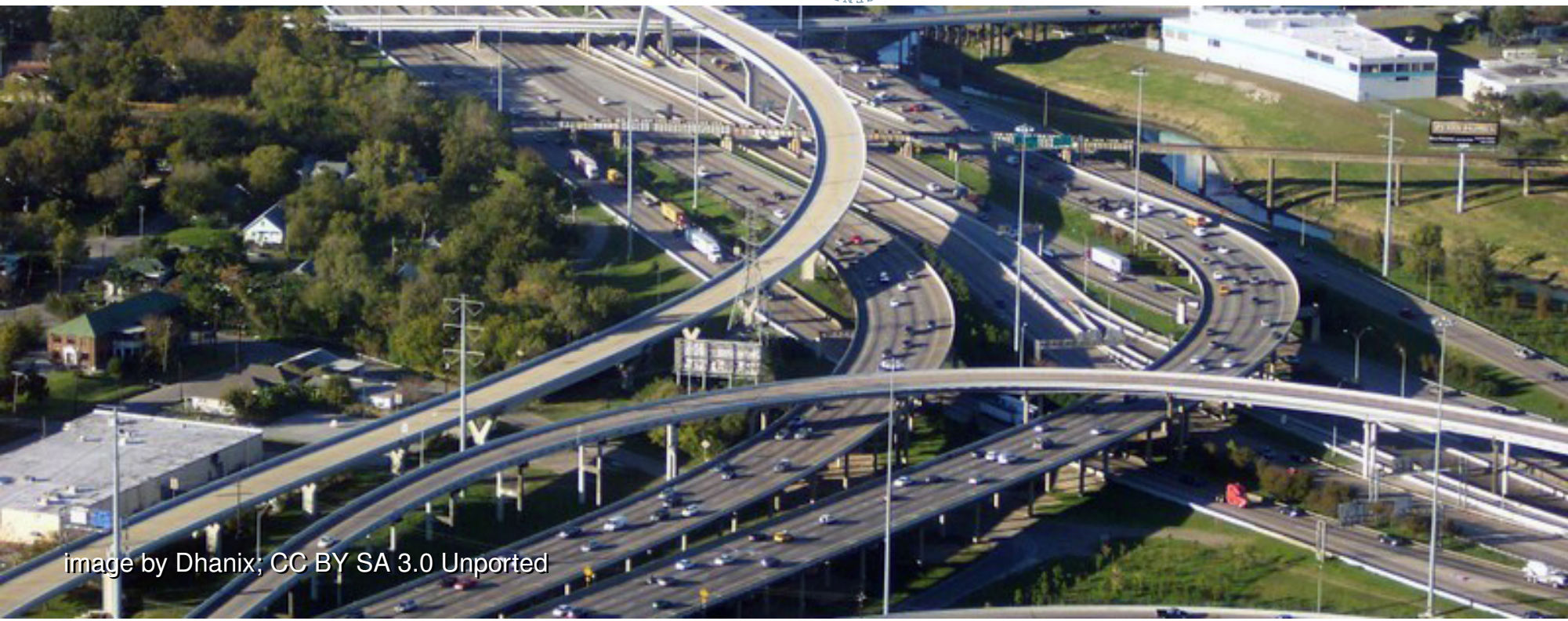


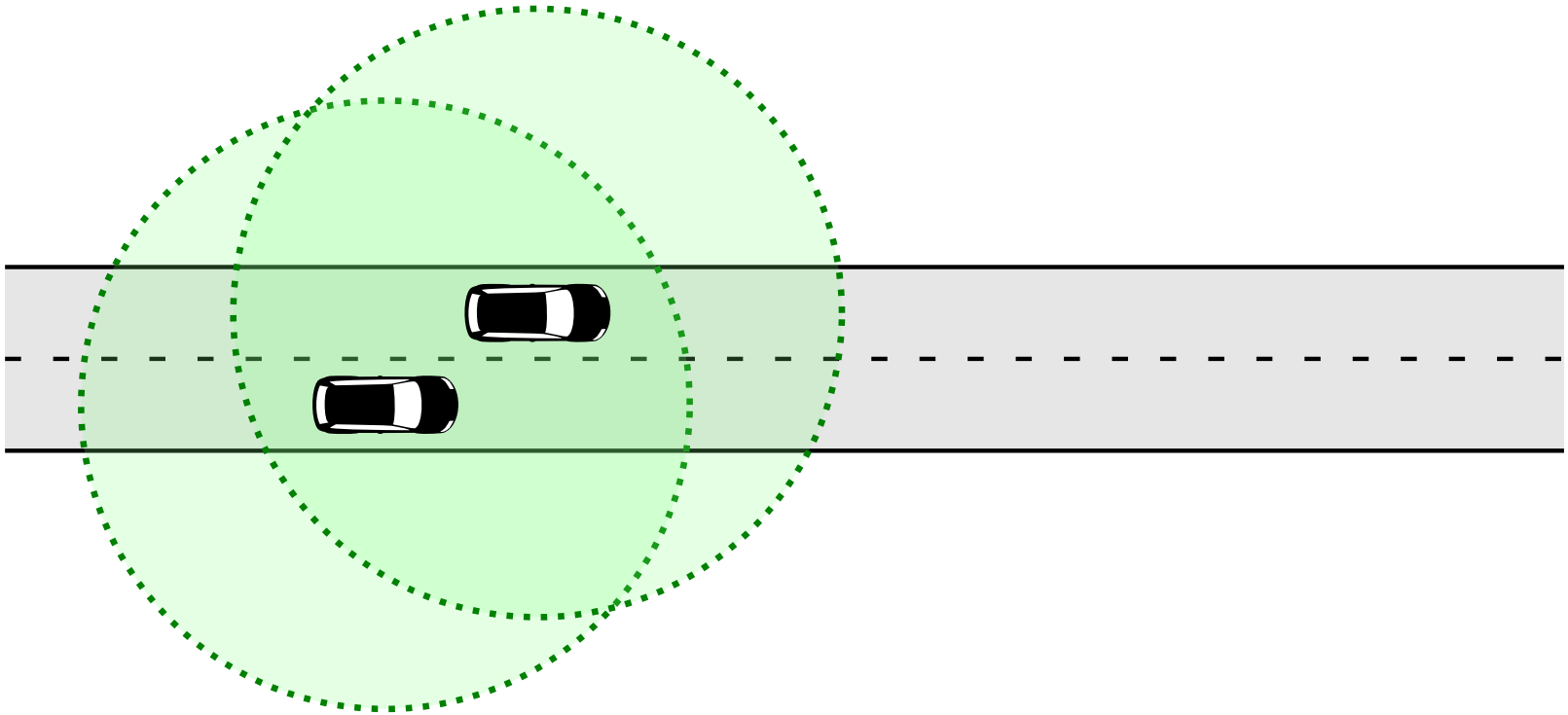
Enhanced Position Verification for VANETs using Subjective Logic

Rens W. van der Heijden, Ala'a Al-Momani, Frank Kargl, Osama M.F. Abu-Sharkh

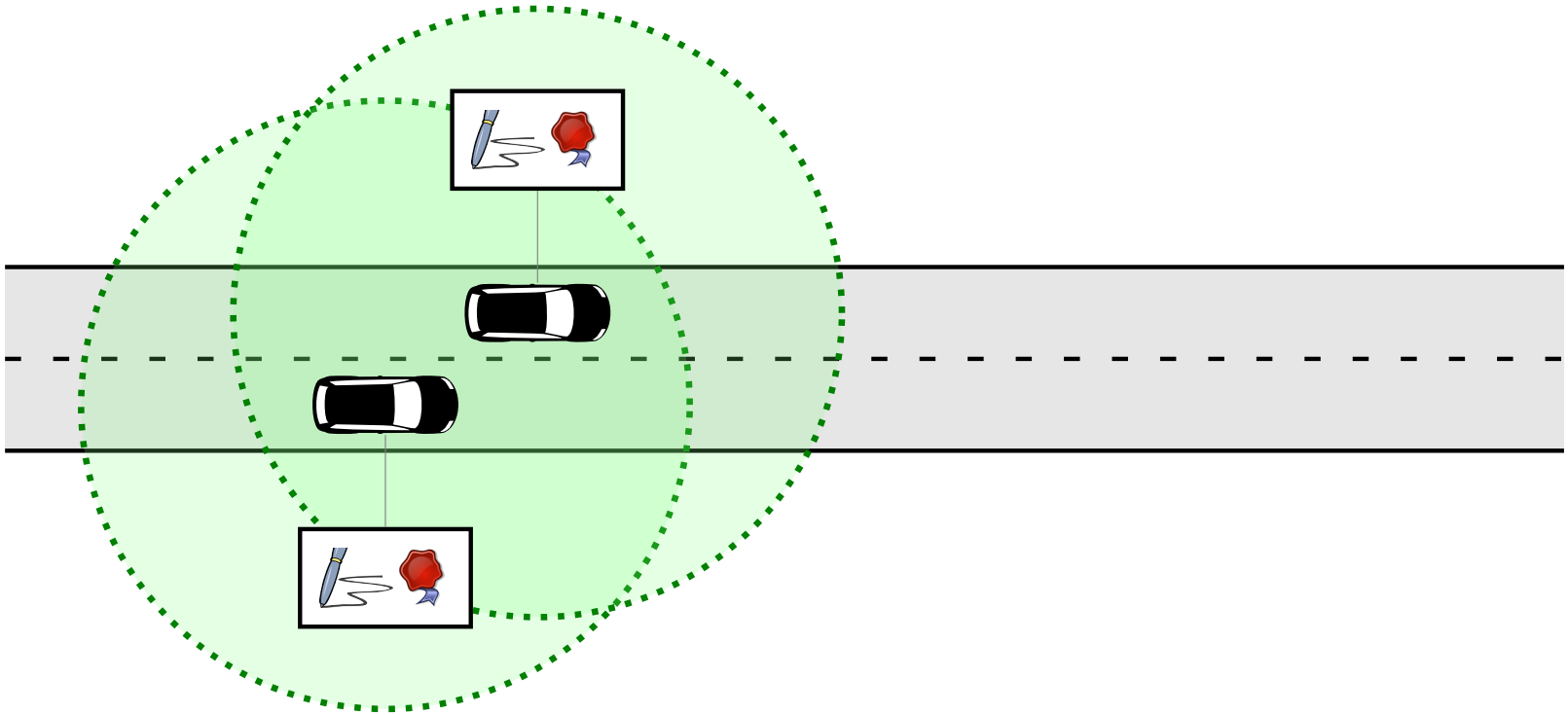
20.09.2016

Vehicular Technology Conference Fall 2016

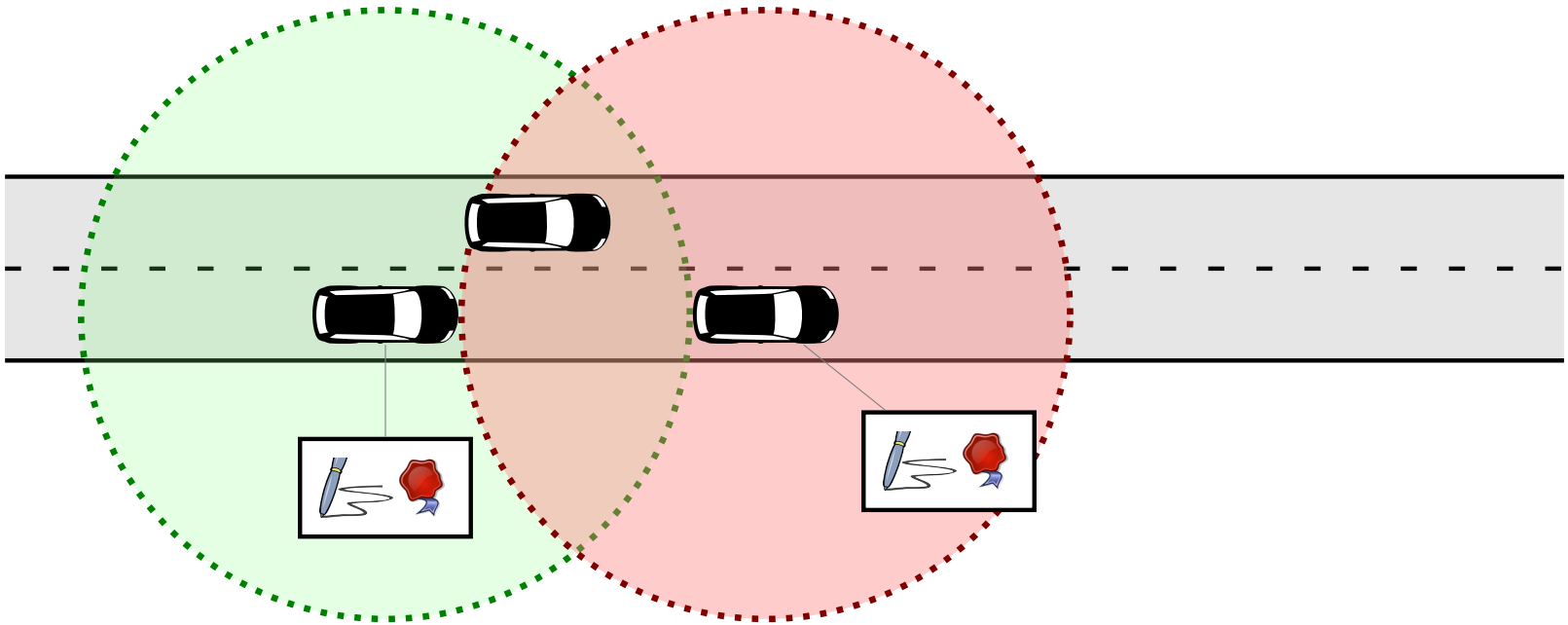
Application scenario



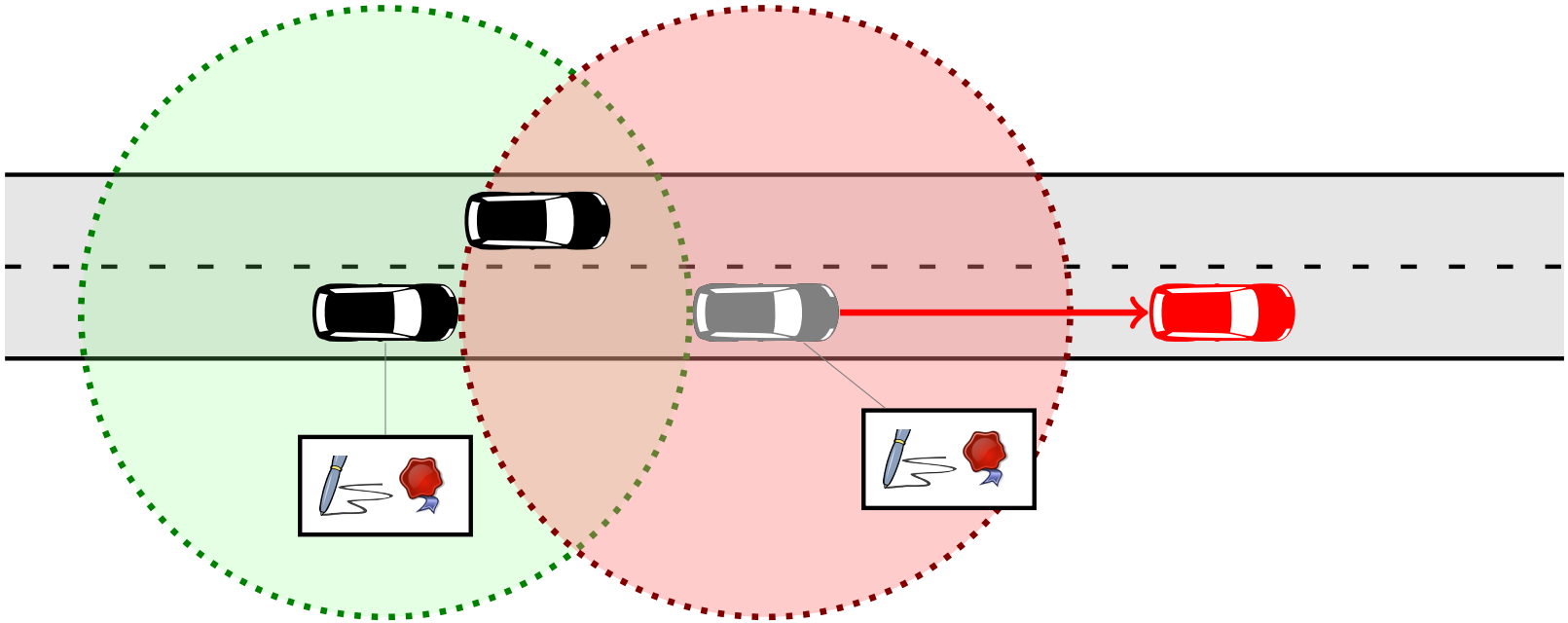
Using signatures



Misbehavior with (valid) keys

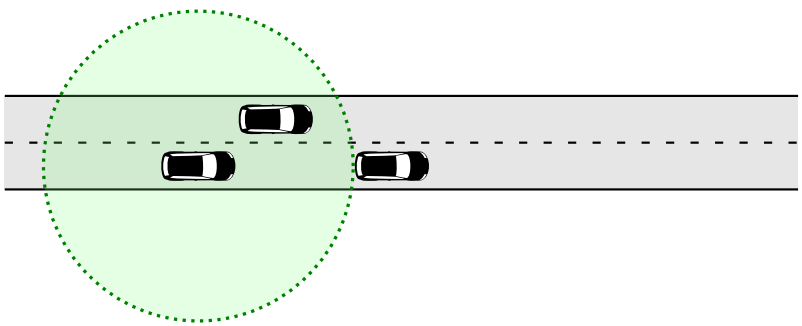


Misbehavior with (valid) keys



Detectors

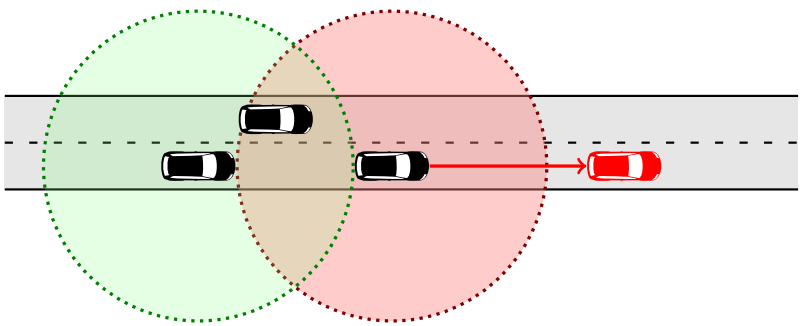
Acceptance Range Threshold[1]



[1] T. Leinmüller, E. Schoch, F. Kargl, and C. Maihöfer, "Decentralized position verification in geographic ad hoc routing," *Security and Communication Networks*, 2008.

Detectors

Acceptance Range Threshold[1]



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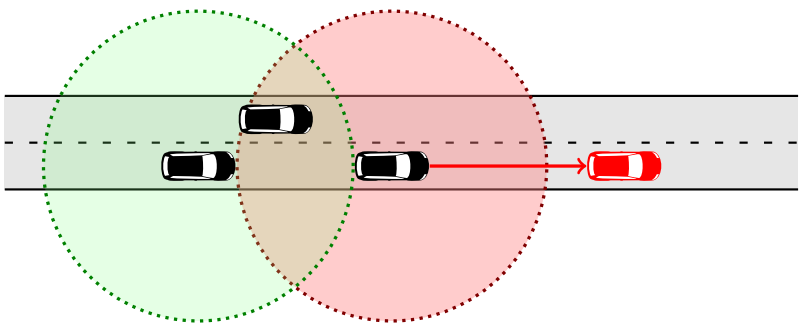
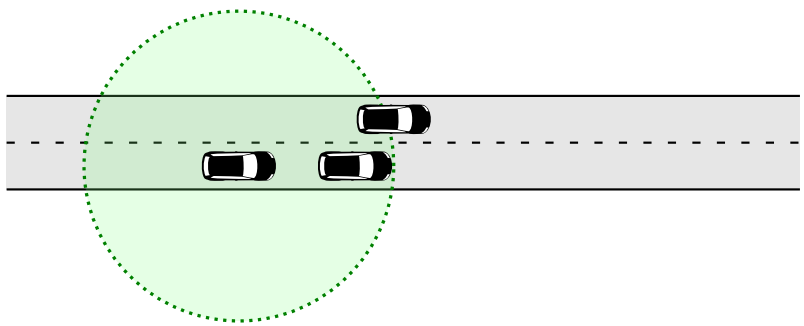


Neighbor Table Exchange[1]



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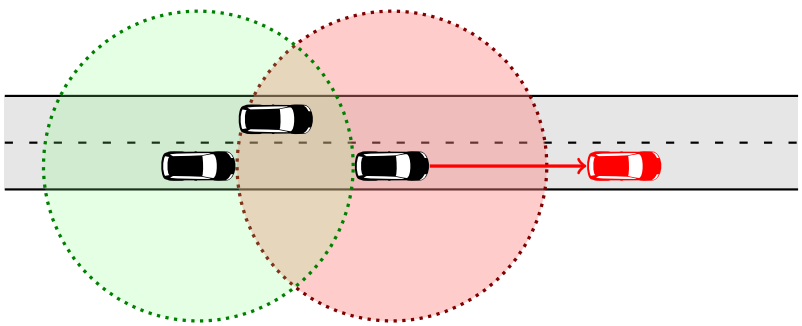

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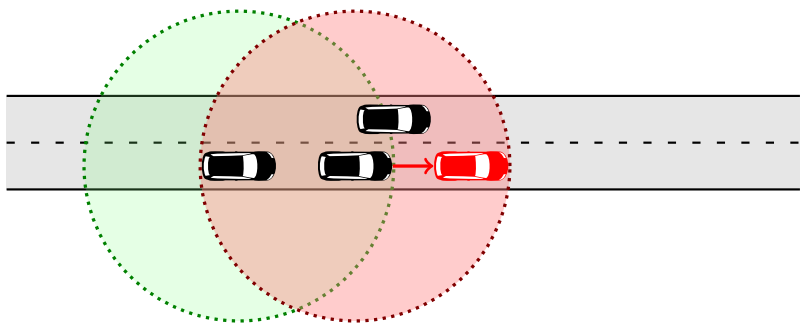

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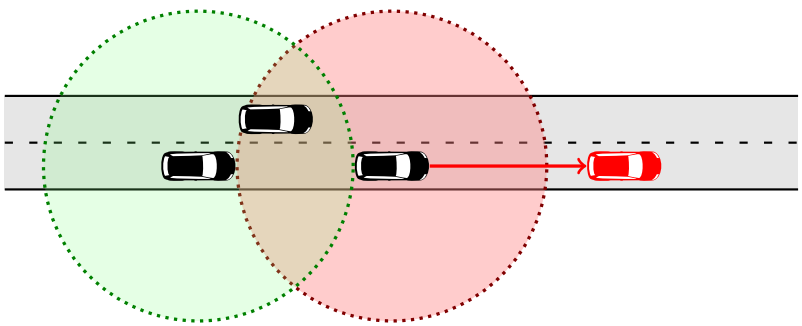

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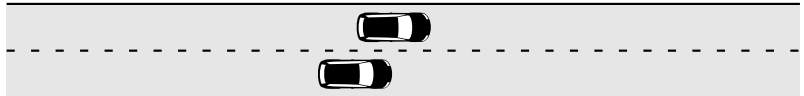

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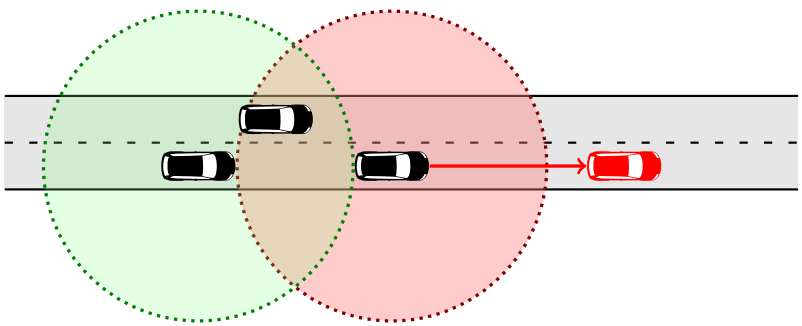

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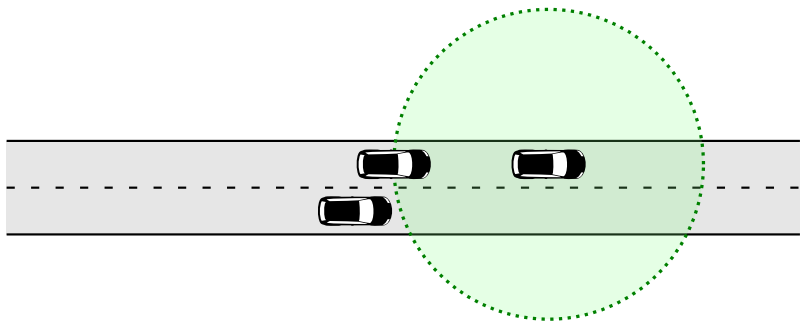

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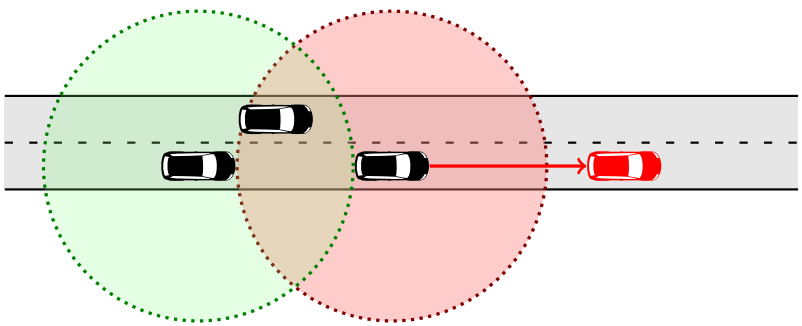

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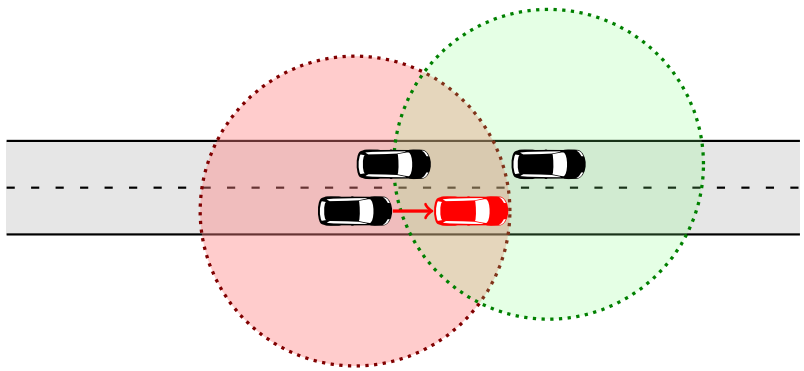

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Subjective logic

$\omega = (\mathit{belief}, \mathit{disbelief}, \mathit{uncertainty})$,
where $\mathit{belief}, \mathit{disbelief}, \mathit{uncertainty} \in [0 \ldots 1]$
and $\mathit{belief} + \mathit{disbelief} + \mathit{uncertainty} = 1$

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Operators:

fusion, transitivity

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Operators:

fusion, transitivity

Decisions:

convert opinion to a result: $\theta > \mathit{belief} + \frac{\mathit{uncertainty}}{2}$, where θ is a configured threshold (0.5 in this work).

Questions addressed in this work

- How can opinions be generated effectively?
- Can fusion improve overall detection performance?

Generating opinions

enhanced Acceptance Range Threshold

$$\omega_{eART} = \left(\frac{\delta}{2\theta} e^{-\frac{|\delta-\theta|^2}{2\sigma}}, \left(1 - \frac{\delta}{2\theta}\right) e^{-\frac{|\delta-\theta|^2}{2\sigma}}, e^{-\frac{|\delta-\theta|^2}{2\sigma}}\right)$$

Generating opinions

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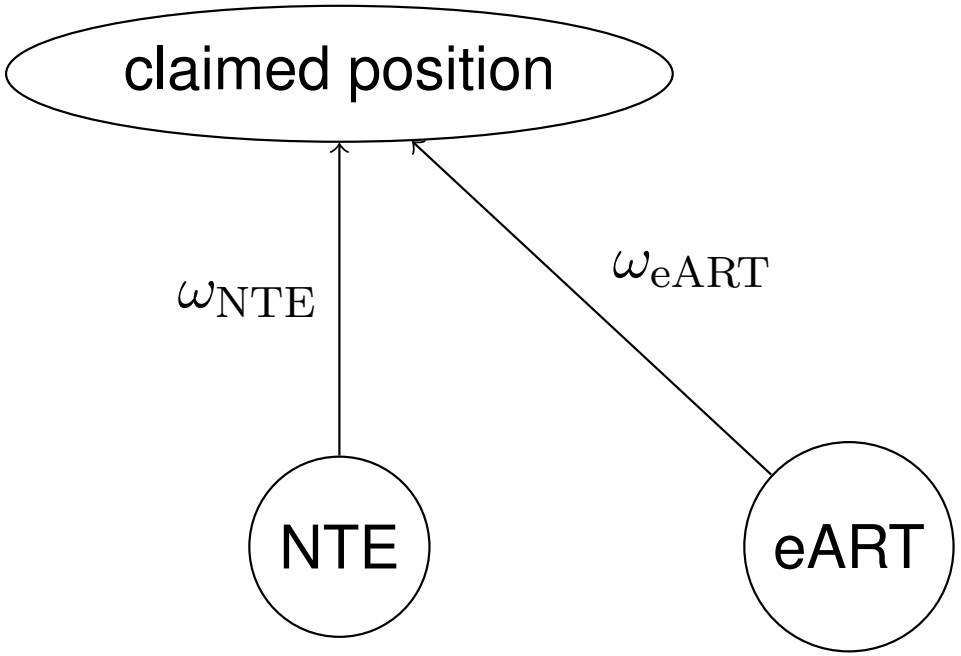
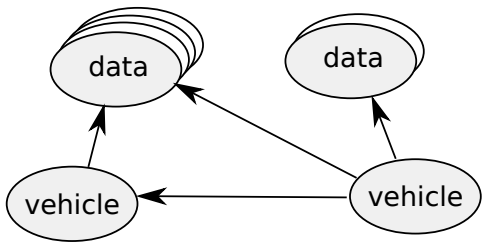
Neighbor Table Exchange

$$\omega_{NTE} = \left(\frac{\beta}{n} e^{-\frac{x}{10}}, \frac{n-\beta}{n} e^{-\frac{x}{10}}, e^{-\frac{x}{10}}\right)$$

Framework based on subjective logic



Maat: a new framework for misbehavior detection



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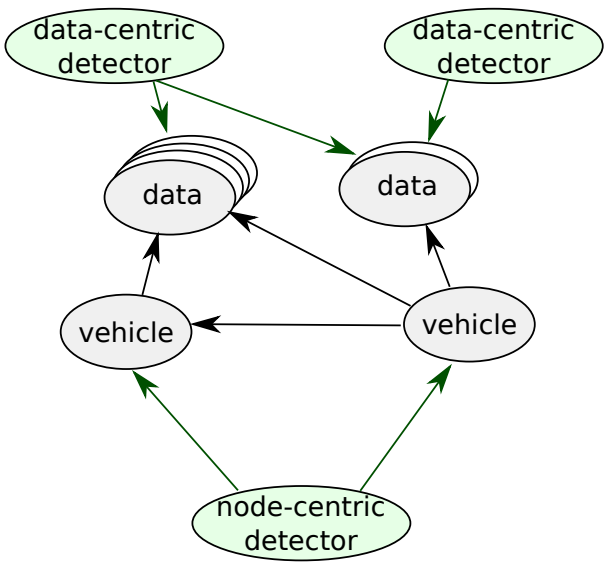

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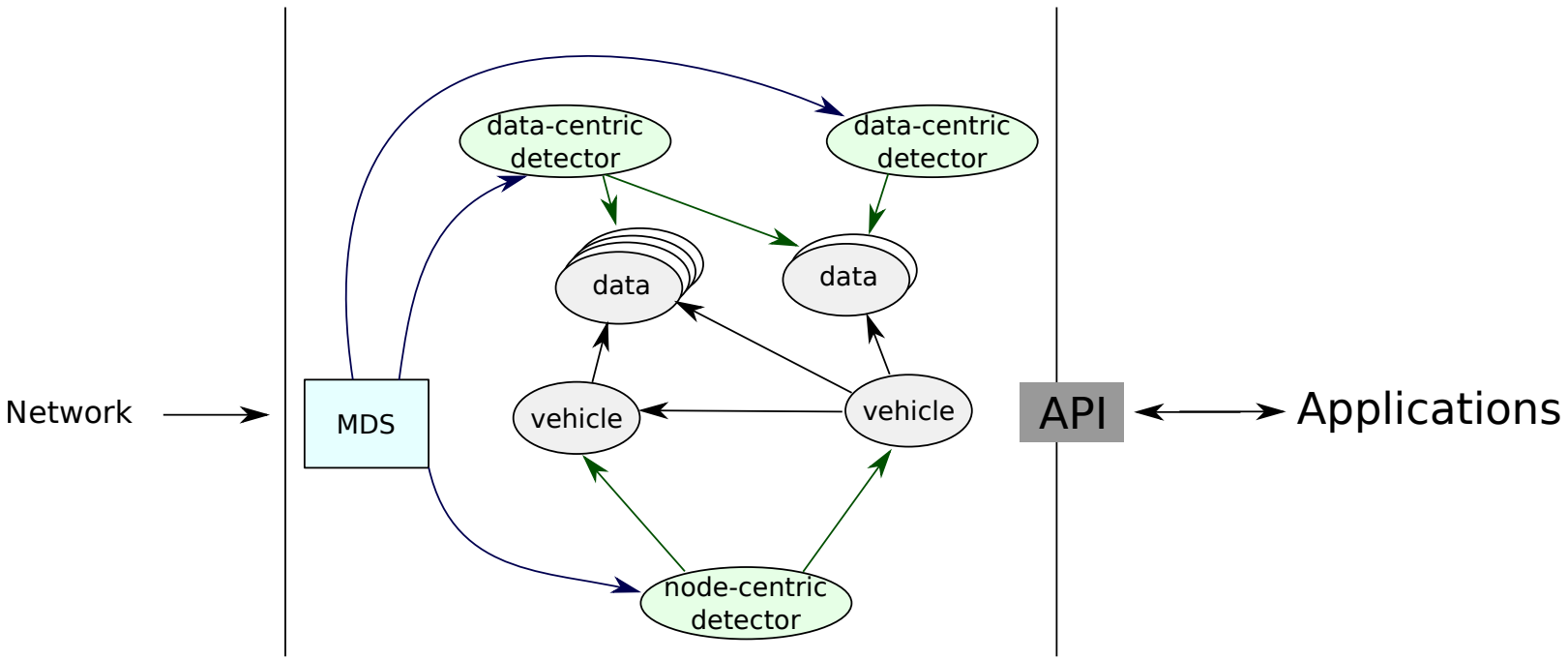
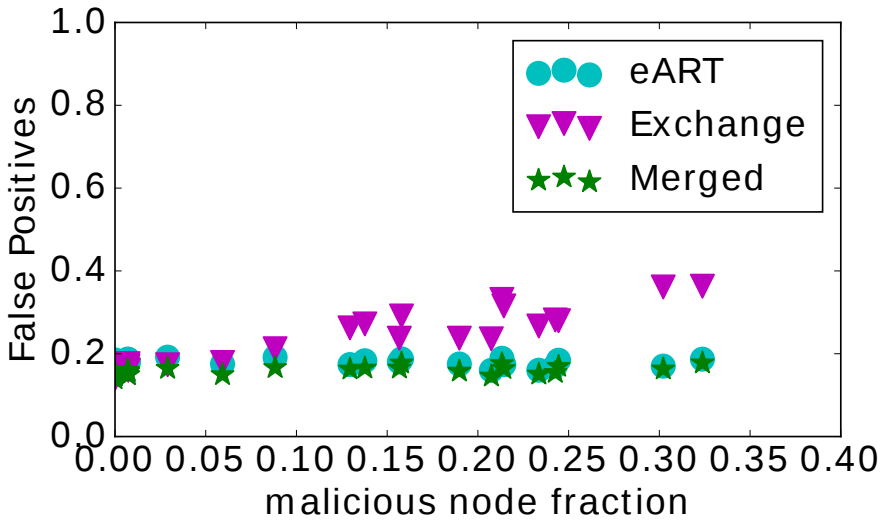
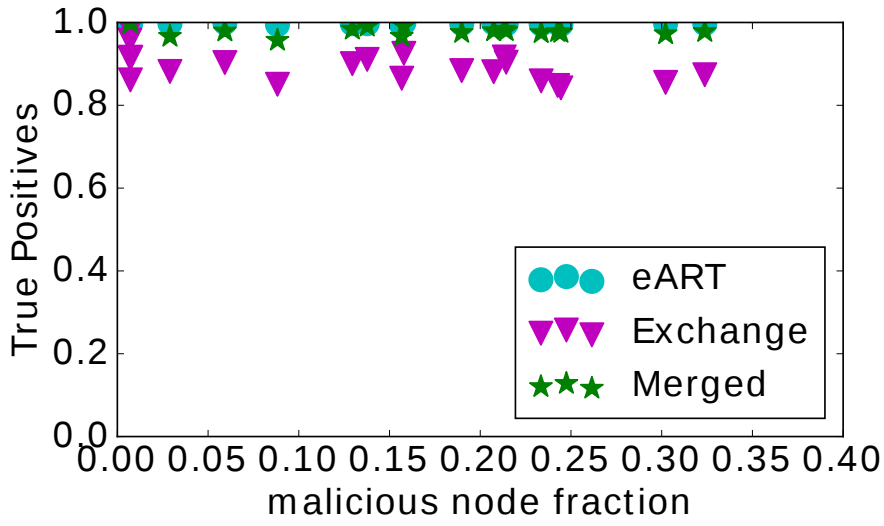


Evaluation: methods

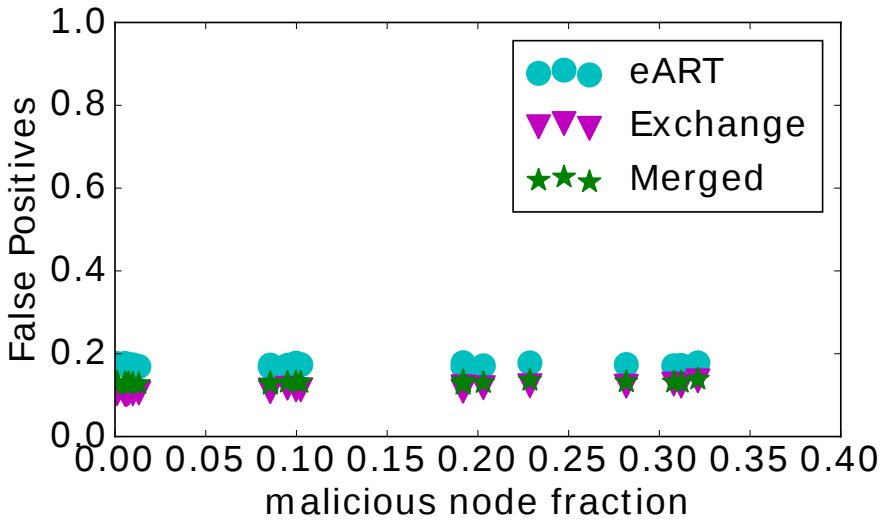
- VEINS simulation
- LuST scenario
- Various attacker models
  - Randomized
  - Randomized Vector
  - Fixed Vector

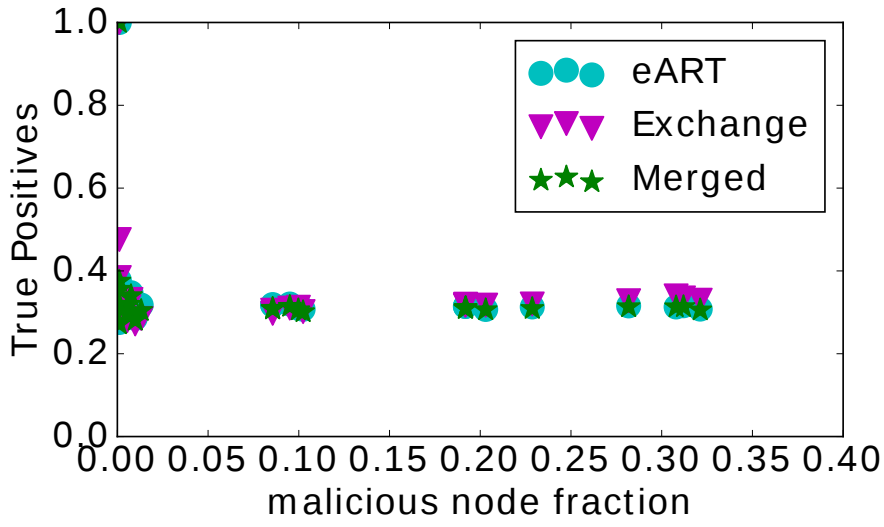
Evaluation: randomized attacker





Evaluation: randomized vector attacker





Conclusion

Contributions:

- show subjective fusion improves results
- opinion conversion
- Improvement of ART
- Stronger attacker model

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Future work:

- Rigorous analysis of fusion approaches
- Scalability
- Detection of misbehaving sensors

Questions?

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E: `rens.vanderheijden@uni-ulm.de`
T: @namnatulco

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