Broadcast Communication in Vehicular Ad-Hoc Network Safety Applications

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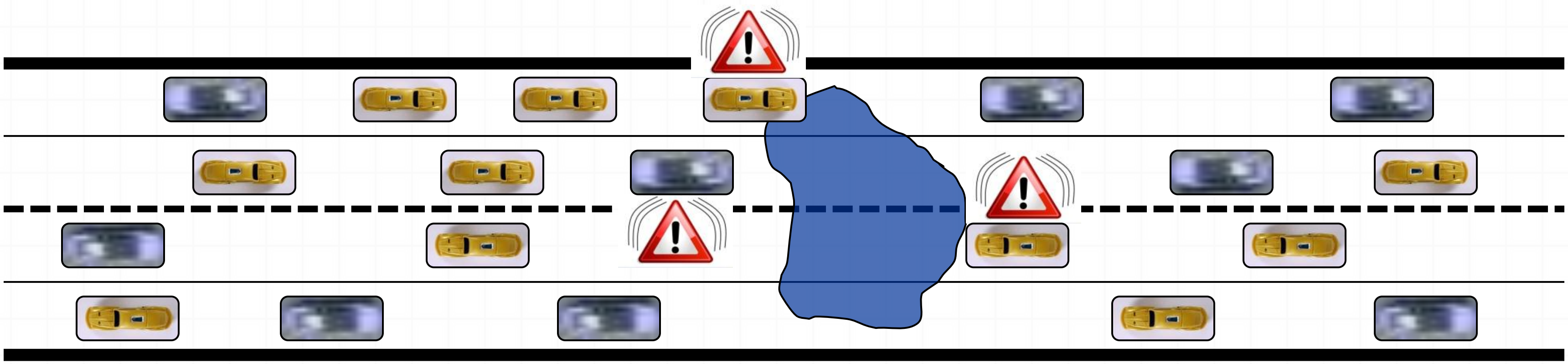
- ❑ Broadcast Scalability in IEEE 802.11
- ❑ Influence of the Minimum Contention Window
- ❑ Adaptive Contention Window
- ❑ Conclusion

VANET objective: Building an accurate image of the exterior world



❑ **Broadcast communication (beaconing, event notification) using IEEE 802.11p**

Congestion Control

- ❑ Reduce Beaconing Frequency

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  - **Strict requirements from applications**

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  - Strict requirements from applications
- ❑ Decrease Transmission Power
  - Minimal coverage area
- ❑ Increase Data Rate
  - Reduced reception probability

Contention Window in unicast IEEE 802.11

- If channel free – send directly
- If channel busy – back off for n idle slots
- n= random (0, CW)
- Initially CW= CW_{min}
- If collision – CW= CW*2

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Bianchi et al. (1996):

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WLAN size ~ 10 nodes

- $T_{idle} = T_{col}$

RTS/CTS handshake

VANET control channel 100% broadcast

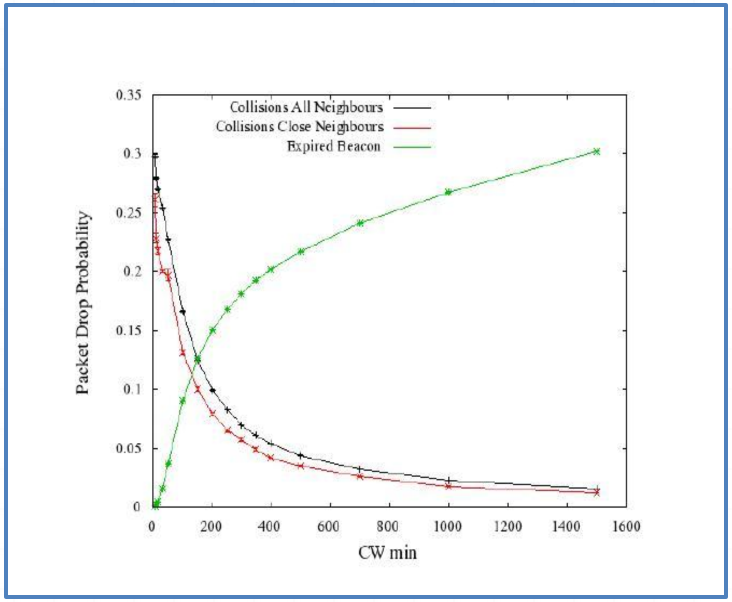
- Cooperative Awareness Message (beaconing)
- Decentralized Environment Notification
- No RTS/CTS
- No ACK – No collision detection
- $CW = CW_{min}$

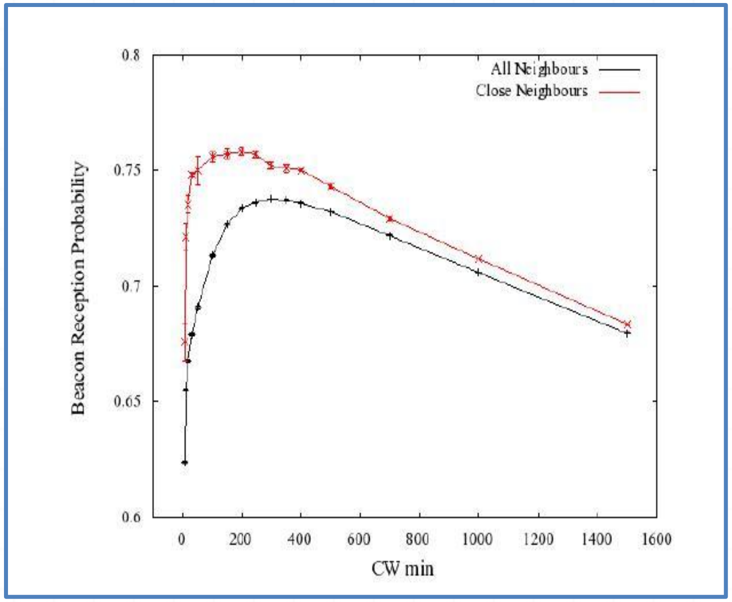
Simulation scenario

- JiST/SWANS framework
- Street Random Waypoint Mobility Model
- Beaconing frequency 10 Hz (beacons can expire)
- Road Topology: Intersection

Fully connected network

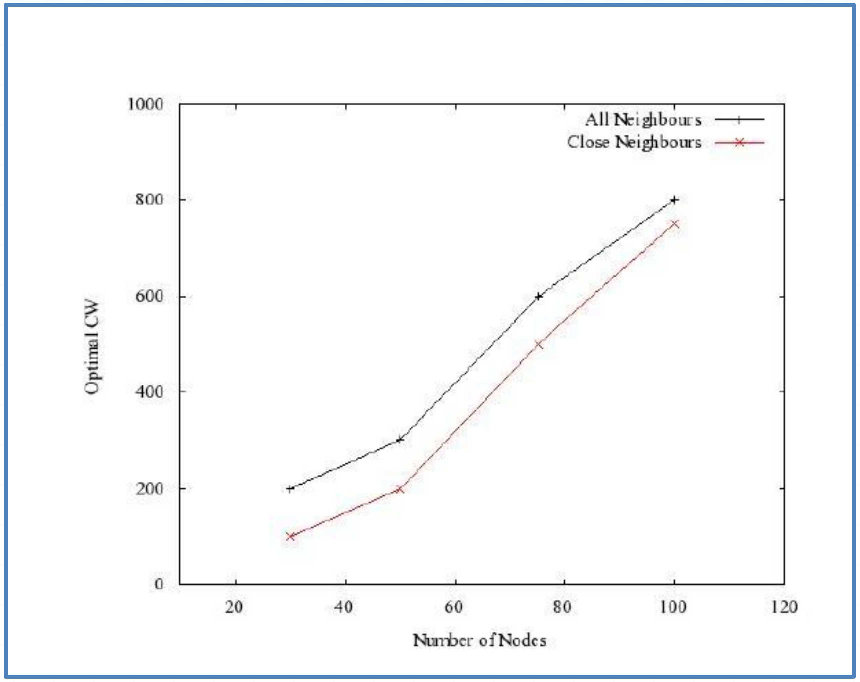
- 50 static nodes (12.5 cars/lane/km)
- Free Space radio propagation model





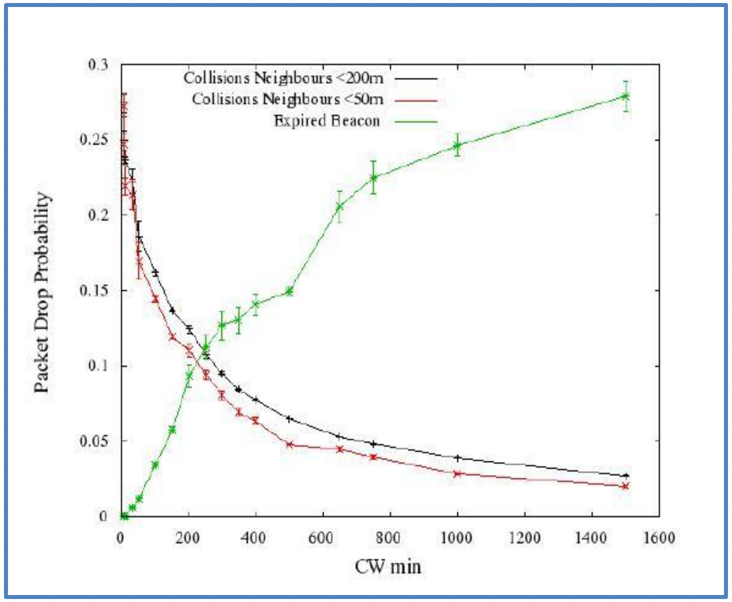
Scalability | Minimum CW | Optimal CW

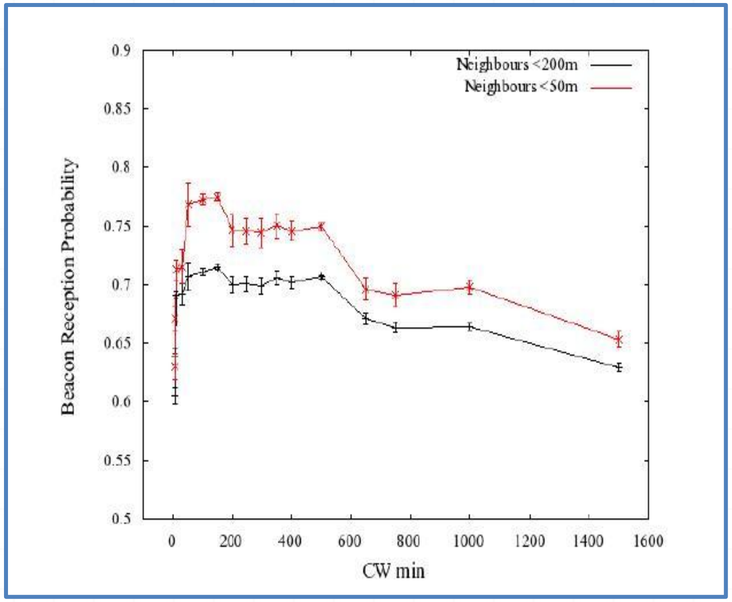
Fully connected network



Large mobile network

- 12.5 cars/lane/km
- Probabilistic Radio Propagation with Shadowing





Scalability | Minimum CW | Optimal CW

Local Density Estimation

- Native method to estimate local density in VANET: beaconing
- CW = λ*Ň
- Ň – estimation of the number of neighbors in the last T seconds
- Ex: Intersection scenario, 25 veh/lane/km, 10 beacons/s

CW	P_{rec50}	P_{rec200}
7 (fixed)	67.07	63.85
λ=2 (adaptive)	79.89	73.05

Conclusions

- Contention window: very important in IEEE 802.11
- IEEE 802.11p – many amendments at the physical layer
- MAC layer (IEEE 802.11e) – good for multimedia applications in WLAN
- VANET safety applications should be considered

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