



# A review of broadcasting protocols in vehicle communication for highway and urban areas

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## Overview

- VANETs
- Safety application challenges
- Reliability in Medium Access Control layer
- Broadcast storm problem and the proposed solutions
- VANETs reliability in different environments
- Broadcast storm detection
- Conclusion





# VANETS

**VANETS (Vehicular Ad-hoc NETWORKs)** a subclass of **Mobile Ad-hoc Networks (MANETS)**

- Higher speed, to compare with MANETS
- Relatively predictable movement
- Communication between vehicles
- Improving the awareness of the drivers
- Improving traffic condition and road safety

## Safety Applications

- Pre-crash sensing
- Lane-change warning
- Intersection collision warning
- Emergency vehicle approach warning

## Non-safety applications

- Multimedia and internet connectivity facilities
- Automatic payment for parking
- Toll collection



## *Safety application challenges*

- **Broadcasting for safety messages**
  - Safety messages Lifetime
  - Multi-hop transmission is needed
  - Broadcasting is only one hop transmission
- **Broadcast storm**
  - A physical location can be covered by different broadcasting nodes
  - Packet redundancy
  - Increasing packet loss ratio
  - Network density and broadcast storm problem



## *Safety application challenges*

- **Broadcast storm and hidden node problem**
  - No handshaking for broadcasting
  - Increases contention and collision
  - More serious in a dense network
- **Scalability**

Ability of the network to handle the additional objects without a noticeable loss in performance of whole network



# *Reliability in Medium Access Control Layer*

## **Broadcasting in DSRC**

- No Ack and therefore no error detection and retransmission
- No Exponential back off (adaptive Contention Window size)
- No priority based transmission

## **Proposed solutions from literature**

- **Relevance-based cross layer protocol [1]**
  - Performing prioritisation
  - Reorganizing each node queue
  - A dynamic adaption of the CW
- **Adaptively adjusting the CW size based on received messages sequence number [2]**
  - Estimating the density of the network
  - Adjust the size of CW



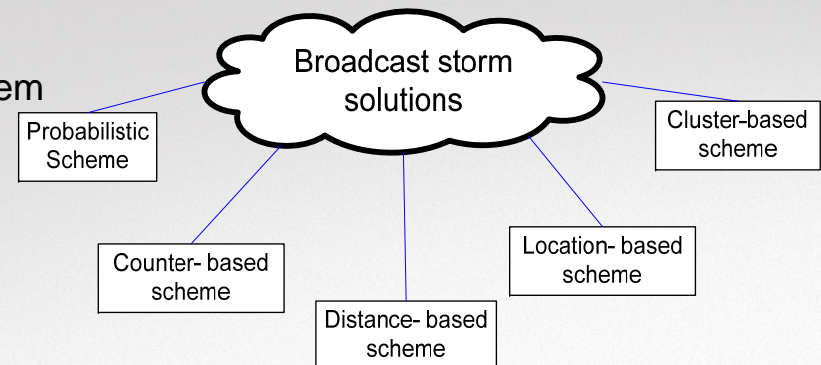
# *VANETs reliability in different environments*

- **Highway environment**

- High mobility of the nodes
- Continuous topology changes
- Network fragmentation
- Node density

- **Urban environment**

- High density of nodes and broadcast storm problem
- Multipath interference
- Lack of line-of-sight
- Intersections



**The five main schemes to address broadcast storm problem in MANETs [3]**



# *VANETs reliability in different environments*

- **Highway environment**

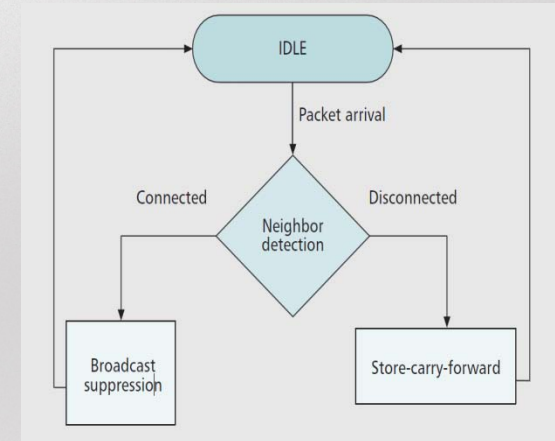
- **DV-CAST [4]**

- Robust against both sparse and dense traffics
- Ability to work in three different courses of well connected, sparsely connected and totally disconnected
- Switching between different techniques in different situation

- **Urban environment**

- **Enhanced Intersection mode Data Dissemination (EIDD) [5]**

- Broadcast storm problem
- Hidden node problem
- Scalability
- keeping the emergency message in the intersection long enough to ensure the message is forwarded to all the intersecting road segments





## *Broadcast storm detection*

### **Broadcast storm detection**

- One-hop topology information
  - In case of broadcast storm, the beacon messages might not be received
  - In dense networks, extra transmission could worsen the situation
  - Adaptive beacon control methods dynamically adjust the number of transmitted beacons
- Analysing the Packet Delivery Ratio (PDR)
  - It is only possible in simulation
  - Lack of Ack, PDR is not available for the transmitting node

### **Possible solution**

- Getting valid and useful information from physical layer
- Estimating network density based on the noise of the channel
- Considering the noise of the environment



## *Conclusion*

### ***Enhancing reliability of the network by***

- Using the collected data from physical layer to adjust the higher layer variables
- Using an adaptive protocol (such as DV-CAST) to improve broadcast reception
- Using one of the methods which provide QoS and adaptive CW size
- Combining number of approaches together, considering different traffic conditions



**Thank you for your attention**



## References

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- [2] N. Balon and J. Guo, "Increasing broadcast reliability in vehicular ad hoc networks," presented at the Proceedings of the 3rd international workshop on Vehicular ad hoc networks, Los Angeles, CA, USA, 2006.
- [3] Y.-C. Tseng, *et al.*, "The broadcast storm problem in a mobile ad hoc network," *Wirel. Netw.*, vol. 8, pp. 153-167, 2002.
- [4] O. K. Tonguz, et al., "DV-CAST: A distributed vehicular broadcast protocol for vehicular ad hoc networks," *Wireless Communications, IEEE*, vol. 17, pp. 47-57, 2010.
- [5] K. Shafiee and V. C. M. Leung, "A Reliable Robust Fully Ad Hoc Data Dissemination Mechanism for Vehicular Networks," in *Future Generation Communication and Networking, 2008. FGCN '08. Second International Conference on*, 2008, pp. 369-373.