**Paper to download**

# A review of current routing protocols for ad hoc mobile wireless networks IEEE Personal Comm (OK) 1999 (Very Old) UCSB (Good)

# A tutorial survey on vehicular ad hoc networks IEEE Communications (Good) 2008 (Old) Germany (OK)

# Vehicular Ad Hoc Networks (VANETs): Challenges and Perspectives ITS Telecommunications (Unknown), 2006 (Old), Iran (Bad)

# Broadcast communication in Vehicular Ad-Hoc Network safety applications IEEE CCNC (Normal) 2011 (OK) France (OK)

# Routing in vehicular ad hoc networks: A survey Journal (Unknown) 2007 (Old), Univ North Carolina (Good)

# Vehicle-to-Vehicle Communications: Readiness of V2V Technology for Application Government document (good to read, but may be not academic), 2014 (Good) Recommend fast reads

# Mobility models for vehicular ad hoc networks: a survey and taxonomy Journal (IEEE Communication Good), 2009 (Old), Germany (OK)

# A Review of Information Dissemination Protocols for Vehicular Ad Hoc Networks Journal (IEEE Communication Good), 2012 (OK), Thailand University AP, but get PhD from CMU (OK)。Recommend

# A survey and comparative study of simulators for vehicular ad hoc networks (VANETs) Conference IWCMC (Known), 2009 (Old), Spain & UHK (OK),

# A survey and challenges in routing and data dissemination in vehicular ad-hoc networks

# Conference (Vehicular Electronics ... Unknown), 2008 Old, Company (Telcordia Unknown)

# Surveys worth thorough reading:

# 1. A Review of Information Dissemination Protocols for Vehicular Ad Hoc Networks

# http://ieeexplore.ieee.org/xpl/abstractAuthors.jsp?tp=&arnumber=760423&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs\_all.jsp%3Farnumber%3D760423

# http://ieeexplore.ieee.org/xpl/abstractCitations.jsp?tp=&arnumber=4539481&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs\_all.jsp%3Farnumber%3D4539481

# <http://ieeexplore.ieee.org/xpl/abstractAuthors.jsp?tp=&arnumber=4068700&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D4068700>

# <http://ieeexplore.ieee.org/xpl/abstractAuthors.jsp?tp=&arnumber=5766513&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D5766513>

# <http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=4450627&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D4450627>

# <http://trid.trb.org/view.aspx?id=1323282>

# <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=5343061&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D5343061>

# <http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=5989903&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D5989903>

# <http://onlinelibrary.wiley.com/doi/10.1002/wcm.859/abstract?systemMessage=Wiley+Online+Library+will+be+unavailable+on+Saturday+27th+February+from+09%3A00-14%3A00+GMT+%2F+04%3A00-09%3A00+EST+%2F+17%3A00-22%3A00+SGT+for+essential+maintenance.++Apologies+for+the+inconvenience.&userIsAuthenticated=false&deniedAccessCustomisedMessage>=

# <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=4640900>

Possibly useful material:

1. Both radio (very high frequency [VHF], micro, and millimeter waves) and infrared waves have been used in experimental V2V systems. Infrared and millimeter waves allow communi- cation only in line of sight;3 VHF and microwaves allow broadcast communications. VHF can provide long links but at low speed; the mainstream is microwaves。
2. The major difference will be that the physical parameter values are doubled in the time domain to decrease the inter-symbol interference caused by the multipath delay spread and the Doppler spread effect. IEEE 802.11p targets a transmission range between 300 m and 1 km. The signal bandwidth thus is reduced from 20 to 10 MHz, and the data throughput ranges from 3 to 27 Mb/s instead of 6 to 54 Mb/s.
3. MAC/PHY Layer: Using the IEEE 802.11 access method and operating in the 5.9-GHz band,6 the dedicated short range communications system (DSRC) [22] was proposed recently. DSRC is a short- to-medium range communications system that supports both safety and user applications in roadside-to-vehicle and vehicle- to-vehicle communication environments. DSRC is now stan- dardized as 802.11p within the IEEE 802.11 working group, and it also is the MAC and PHY layer of the IEEE P1609 standard family.
4. MAC Protocols: TDMA: periodic exchange of control message, bounded delay. Fit following requirements:
   1. frequent topology change
   2. different spatial density
   3. hiden node problem: RTS/CTS partially fix this issue, decrease the throughput, in conjunction with CSMA/CA.
   4. Contention-free protocls: These protocols help avoid the disadvantages of the IEEE 802.11p standard by eliminating the need for a vehicle to listen to the channel before it starts its transmission and by reducing the time to access the channel when node density is high.
5. DSRC: 1) Dedicated Short Range Communication: Dedicated Short-Range Communication (DSRC) [19] was initially coined in USA [20] by the FCC (Federal Communication Commis- sion) [21]. It was developed to support vehicle-to-vehicle and vehicle-to-infrastructure communications. This standard sup- ports vehicle speeds up to 190 km/h, a data rate of 6 Mbps (up to 27 Mbps) and a nominal transmission range of 300 m (up to 1000 m). DSRC is defined in the frequency band of 5.9 GHz on a total bandwidth of 75 MHz (from 5.850 GHz to 5.925 GHz). This band is divided into 7 channels of 10 MHz (see Fig. 2). These channels are divided functionally into one control chan- nel and six service channels. The control channel, CCH, is reserved for the transmission of network management messages (resource reservation, topology management)
6. IEEE 802.11 P: This standard improves QoS by using the Enhanced Distributed Channel Access (EDCA) functionality, derived from the IEEE 802.11e standard [7]. The EDCA allows safety messages which have a higher priority (there are 4 categories) to have a better chance of being transmitted than messages with a lower priority. Prioritization is achieved by varying the Contention Windows (CWs) and the Arbitration Inter-Frame Spaces (AIFS), which increase the probability of successful medium access for real time messages
7. CSMA was adopted by IEEE 802.11, as well as by IEEE 802.11p as the medium access method. IEEE 802.11p most probably will be the default technology for VANETs because it has received backing from industry.
9. QoS: One possibility is to change intelligently the number of vehicles transmitting the emergency messages and the rate at which they are tran不会mit- ting the messages. The second solution is to change the trans- mission range of the emergency messages as the number of affected vehicles increases.
10. QoS 1st example: The transmission rate depends upon the transmission range, maximum speed, and the deceleration capability of the cars and the channel conditions. The messages include the geographical position, speed, acceleration, and direction. The initial rate of transmission is high but then decreases to cater to other cars.
11. Routing protocols: These protocols can be divided into two basic types: reactive and proactive.
    1. Reactive protocols dis- cover the route when there is a data packet to be sent. Gener- ally, a control packet is flooded from the source, and the path of this packet toward the destination node creates the route to the destination. Hence, there is a delay before data can be transmitted.
    2. Proactive protocols, on the other hand, maintain a correct routing table at all times by sending periodic control messages that contain topology information.
    3. Comparison: However, [42] compares the overhead incurred by reactive and proactive protocols given the following parameters: the network graph, the number of active connections, and the mobility of nodes. The length of routes (source-destination) also is compared, and even though it [42] is not devoted specifically to VANETs, this information could be useful for comparing protocols in VANETs.
    4. MDDV:
    5. ferry: Tariq *et al.* [55] propose an interesting scheme, where a spe- cial node called the ferry, facilitates the connectivity in a MANET by ferrying the messages for other nodes. They have carried out many simulations to show that this scheme is fair and provides good performance. Such a system might be interesting in sparse VANETs where network partitioning is a particular problem. For example, the concept could be imple- mented by using traffic police vehicles to act as message fer- ries.
12. Security:
    1. Did not require the identity of the participating parties and, accordingly, supported the goal of appropriately preserving privacy;  (Anonymity & privacy)
    2. Was fast enough to fit within the bandwidth constraints of DSRC and the processing constraints of the V2V on-board equipment;  (fast)
    3. Entailed a number of over-the-air bytes needed for security that fit within the constraints of DSRC bandwidth and size of the BSM in the message payload; and supported non-repudiation.  (efficient )
13. Safety Application：  
    two kinds of safety message in CCH: event driven & periodic.
14. Routing Protocols:
    1. Carry and Forwarding
    2. Geographicial
    3. Trajectory based forwarding: limit data propagation, reduce message overhead
    4. Opportunistic forwarding: end-to-end path cannot be assumed to exist. Copy in original node when forwarding in order to improve reliability.
15. Routing Protocols-Broadcasting:
    1. Multi-hop broadcasting
       1. Delay-based : asically, the vehicle with the shortest waiting delay gets the highest priority in rebroadcasting the packet. In addition, in order to avoid redundancy, the other vehicles abort their waiting process once they know that the packet has already been rebroadcasted. Typically, the delay assigned to each vehicle is a function of the distance between the vehicle and the transmitter. Generally, the farthest vehicle is given the shortest delay and is implicitly selected as the next rebroadcast node, since it maximizes the packet forward progress.
       2. Probabilistic-based: While a different delay is assigned to each vehicle in a delay-based broadcasting protocol, a different rebroadcast probability is assigned to each vehicle in a probabilistic-based protocol. In probabilistic-based broadcasting, each vehicle rebroadcasts a packet according to its assigned rebroadcast probability [29], [30], [31], [32]. Since not all the vehicles will rebroadcast the packet, the number of redundant packets as well as the number of collisions are reduced. One of the main challenges in this type of protocols is in determining an optimal probability assignment function.
       3. Network-coding based multi-hop broadcasting
    2. Single-hop broadcasting: broadcast interval & information to be broadcasted
       1. fixed broadcast interval
       2. adaptive broadcast interval

Models:

Synthetic models may be separated into five classes: *stochastic models* wrapping all models containing purely random motions, *traffic stream models* looking at vehicular mobility as hydrodynamic phenomenon, *Car Following Models*, where the behavior of each driver is modeled according to vehicles ahead, *Queue*

Survey based model: Surveys are an important source of macroscopic mobility information. The major large scale surveys are provided by the US department of Labor, which gathered extensive statistics of US workers’ behaviors, spanning from the commuting time or lunch time, to traveling distance or preferred lunch types. By including such kind of statistics into a mobility model, one is able to develop a generic mobility model able to reproduce the pseudo-random or deterministic behavior observed in the real urban traffic.

Trace based model: a crucial time could be saved by directly extracting generic mobility patterns from movement traces.