

A Review of Various Routing Protocols in VANET

Rajashree Dutta, Ranjana Thalore

Department of ECE, CET, Mody University, Lakshmangarh, India

Abstract—Vehicular Ad Hoc Networks (VANET) is a subclass of Mobile ad hoc networks which provides a distinguished approach for Intelligent Transport System (ITS). VANET's provide communication between vehicles moving on the roads. Many protocols have been adopted to serve different topology and scenarios. We introduce and review Position based Routing Protocols, Broadcast based routing protocols, Multicast/Geocast routing protocols, Cluster based routing protocols. The survey of routing protocols in VANET is very essential and necessary for smart ITS. This paper also discusses the advantages / disadvantages and the applications of the above mentioned routing protocols for vehicular ad hoc networks. The challenges and perspectives of routing protocols for VANET's are finally discussed.

Keywords– Delay-bounded routing, MANET, Routing protocols, VANET.

connect mobile devices using wireless channels. It is used to supply each device to ceaselessly maintain the information required to correctly route traffic [1]. Apart from the safety applications, VANET's broadcast valuable, real-time information to the users such as transit systems, weather information, mobile e-commerce, internet access and other multimedia applications. [5][6] Routing in Vehicular Ad hoc Networks is a challenging task due to the unique characteristics of the network such as high mobility of nodes, dynamically changing topology and highly partitioned network. [2] The performance of routing protocols depends on various internal factors such as mobility of nodes and external factors such as road topology and obstacles that block the signal. [3] This demands a highly adaptive approach to deal with the dynamic scenarios by selecting the best routing and forwarding strategies and by using appropriate mobility and propagation models.

I. INTRODUCTION

MANET (mobile ad hoc network) is a network that has no infrastructure and it has the ability to configure itself to

II. ROUTING PROTOCOLS IN VANET

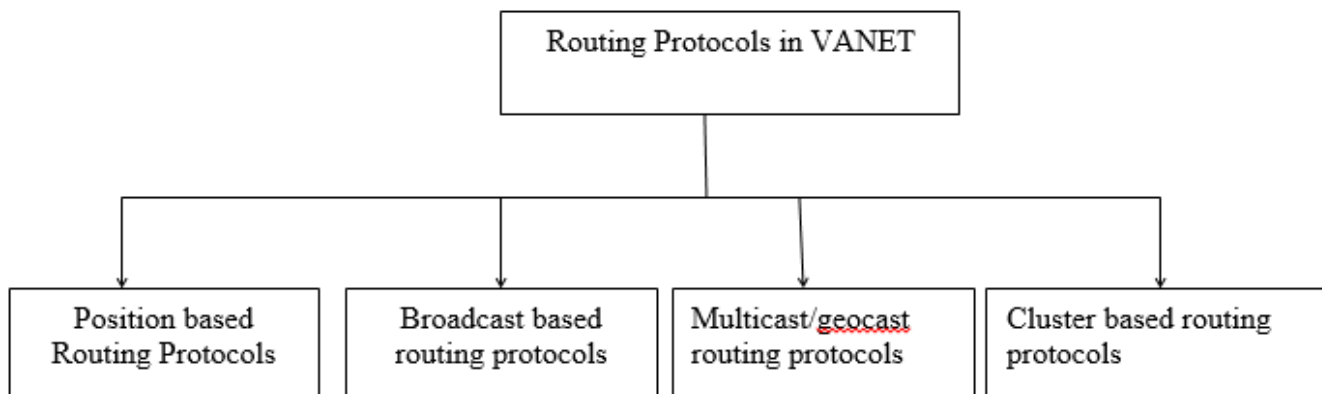


Fig. 1: Routing Protocols in VANET

Vehicle to Vehicle data transfer is one of the main challenges within the design of VANET because it needs to design a dynamic routing protocol. [4] Routing in traditional MANET is different to the VANET routing because of extremely dynamical topologies. Routing in VANET can be classified into following major categories:

1. Position based Routing Protocols

In position based protocols, the routing decisions are based on geographic position of the vehicles. [7][9] This does not require establishment or maintenance of routes, but requires location services to determine the position of the destination. Some of the commonly used location services include Global Position System (GPS), DREAM

Location Services (DLS), Reactive Location Services (RLS) and Simple Location Services (SLS).[1] With the advancement of GPS based location services, position based routing protocols are gaining importance.

PROS:

- Good performance in highway environment
- Need of global route not required.
- With high mobility in environment stability increases.

CONS:

- It needs global positioning system position (GPS).
- GPS device stop working in tunnel.
- Location server sometime goes into deadlock state.

2. Broadcast based routing protocols

This is the most commonly used routing protocol in VANETs, particularly in safety related applications.[7] In broadcast mode, a packet is sent to all (even unknown or unspecified) nodes in the network and in turn each node re-broadcasts the message to other nodes in the network. Flooding is a prominent technique used in broadcast routing protocols. [8] However, blind flooding results in broadcast storm problem. A broadcast storm can overload the limited channel capacity, causing channel congestion that reduces communication reliability.[2] Broadcast routing is frequently used in VANET for sharing, traffic, weather and emergency, road conditions among vehicles and delivering advertisements and announcements.[6] The various Broadcast routing protocols are BROADCAST, UMB, VTRADE, and DV-CAST.

PROS:

- Since packet is delivered via many nodes so the packet transmission is reliable.
- Minimize overhead by occurrence of broadcast storms

CONS:

- Consume the large amount of network bandwidth.

3. Multicast/geocast routing protocols

Multicast routing enables dissemination of messages from single source to a group of starting point nodes of

interest.[5][7] Geocast routing is basically a location based multicast routing, which aims to deliver information from a source node to all other nodes within a specified geographical region called a Zone of Relevance (ZOR). A Zone of Forwarding (ZOF) is demarcated, inside which the packets are directed instead of simply flooding the packets everywhere in the network. In Geocast routing vehicles outside the ZOR are not alerted to avoid unnecessary hasty reaction. [5][6] Geocast is considered as a multicast service within a specific geographic region. It normally defines a forwarding zone where it directs the flooding of packets in order to reduce message overhead and network congestion caused by simply flooding packets everywhere [1].

PROS:

- Reduced network overhead and congestion.
- Reliable packet delivery in highly dynamic topology.

CONS:

- Packet transmission delay due to network disconnection.

4. Cluster based routing protocol

Clustering in vehicular ad hoc network can be defined as the virtual partitioning of the dynamic nodes into various groups. [1][9][10] A group of nodes identify themselves to be part of a cluster. A special node, designated as cluster-head is responsible for routing, relaying of inter cluster traffic, scheduling of intra-cluster traffic and channel assignment for cluster members. Cluster based routing is preferred in clusters. [5] A group of nodes identifies themselves to be a part of cluster and a node is designated as cluster head will broadcast the packet to cluster. Good scalability can be delivered for large networks but network delays and overhead are experienced when forming clusters in highly mobile VANET. In cluster based routing virtual network infrastructure must be created through the clustering of nodes in order to provide scalability [1].

PROS:

- It has good scalability of large networks.
- Delays in highly dynamic networks.

CONS:

- Network overhead is increased.

III. COMPARISON BETWEEN VARIOUS ROUTING PROTOCOLS

Table.1: Comparison of various routing protocols based on different parameters.

Protocols	Position Based Protocols	Broadcast Based Protocols	Geocast Based Protocols	Cluster Based Protocols
Prior Forwarding Method	Heuristic method	Wire less multi hop Forwarding	Wire less multi hop Forwarding	Wireless Multi hop Forwarding
Digital Map Requirement	No	No	No	Yes
Virtual Infrastructure Requirement	No	No	No	Yes
Realistic Traffic Flow	Yes	Yes	Yes	No
Recovery Strategy	Carry & Forward	Carry & Forward	Flooding	Carry & Forward
Scenario	Urban	Highway	Highway	Urban

IV. CONCLUSION

Conniving effective routing protocols for VANET is one of the biggest challenges to be addressed in order to leverage the benefits of the VANET technology in day-to-day life. Performance of routing protocol for VANET's depends drastically on the mobility of nodes, vehicular density and several external factors such as driving environment; [4] But a universal routing solution for all the VANET's application scenarios may not be practical; we need to design specific routing protocol and mobility model to fulfill the specific QoS requirements of each application[1][5].

This paper reviews the literature concerning four most common protocols Position based Routing Protocols, Broadcast based routing protocols, Multicast/geocast routing protocols, Cluster based routing protocols, that are used to route data between communicated vehicles in VANET.[7] This work comes to address how a routing protocol performs in high node density VANET for different mobility models.

Position based routing contains class of routing algorithm. [8][9] They share the property of using geographic positioning information in order to select the next forwarding hops. Broadcast routing is frequently used in VANET for sharing, traffic, weather and emergency etc.[1] Multicast routing enables dissemination of messages from single source to a group of destination nodes of interest. In Geo cast routing vehicles outside the ZOR are not alerted to avoid unnecessary hasty reaction. Cluster based routing is preferred in clusters.

REFERENCES

- [1] Rakesh Kumar, Mayank Dave, "A Comparative Study of Various Routing Protocols in VANET", IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 4, No 1, July 2011 ISSN (Online): 1694-0814, pp 643-648.
- [2] Venkatesh, AIndra, R Murali, "Routing Protocols for Vehicular Adhoc Networks (VANETs): A Review", Journal of Emerging Trends in Computing and Information Sciences Vol. 5, No. 1 January 2014 ISSN 2079-8407, pp 25-43.
- [3] Yun-weilin, Yuh-shyanchen, Sing-ling lee, "Routing protocols in Vehicular Ad Hoc Networks: a Survey and future perspectives", National Science Council of the R.O.C. Under grant nsc-97-2221-e-305-003-my3, pp 02-19.
- [4] Komal Mehta, Dr. L. G. Malik, Dr. Preeti Bajaj, "VANET: Challenges, Issues and Solutions", 2013 Sixth International Conference on Emerging Trends in Engineering and Technology 978-1-4799-2560-5/13 \$31.00 © 2013 IEEE DOI 10.1109/ICETET.2013.18, pp 64-66.
- [5] Surmukh Singh, Poonam Kumari, Sunil Agrawal, "Comparative Analysis of Various Routing Protocols inVANET", 2015 Fifth International Conference on Advanced Computing & Communication Technologies 2327-0659/15 \$31.00 © 2015 IEEE DOI 10.1109/ACCT.2015.113, pp 315-319.
- [6] Surmukh Singh, Sunil Agrawal, "VANET Routing Protocols: Issues and Challenges", Proceedings of 2014 RA ECS UIET Panjab University Chandigarh, 06 – 08 March, 2014 978-1-4799-2291-8/14/\$31.00 ©2014 IEEE, pp 205-210.

- [7] Venkatesh, Indra. A ,Murali. R, “Vehicular AdHoc Networks (VANETs): Issues andApplications”, Journal of Analysis and computation, Vol. 8, No. 1, 2012, pp.31-46.
- [8] A. K. Saha and D. B. Johnson, “Modeling mobility for vehicular ad hoc networks,” ACM International Workshop on Vehicular Ad Hoc Networks (VANET), Oct. 2004, pp.91-92.
- [9] H. Safa, H. Artail, and R. Shibli, “An Interoperability Model for Supporting Reliability and Power-Efficient Routing in MANETs,” International Journal of Ad Hoc and Ubiquitous Computing (IJAHUC), vol. 4, no. 2, 2009, pp.71-83.
- [10] S. Corson, and J. Macker, “Mobile Ad Hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Considerations,” RFC editor, 1999. S. Corson, and J. Macker, “Mobile Ad Hoc Networking (MANET): Routing Protocol Performance Issues andEvaluation Considerations,” RFC editor, 199