



Study of Various Data Dissemination Types and its Protocols - A Review

Er. Gaganpreet Kaur
Student, M-Tech (CSE) 4th Semester
CSE Department
Global Institute of Management & Emerging
Technologies, Amritsar (PUNJAB)

Dr. Sandeep Singh Kang
Professor & Head
CSE Department
Global Institute of Management & Emerging
Technologies, Amritsar (PUNJAB)

Abstract- Vehicular plays an important role in day-to-day world in the field of automobiles. VANETs are the subclass of mobile ad-hoc Networks which have no central infrastructure. Nodes are highly mobile in VANET. VANET is distinguished from MANET by their features, design and applications. A Vehicular Ad-Hoc Network or VANET is a sub form of Mobile Ad-Hoc Network or MANET that provides communication between vehicles and between vehicles and road-side base stations with an aim of providing efficient and safe transportation. A vehicle in VANET is considered to be an intelligent mobile node capable of communicating with its neighbors and other vehicles in the network. VANET introduces more challenges aspects as compare to MANET because of high mobility of nodes and fast topology changes in VANET. In this paper, VANET basics structure, its architecture, challenges, applications are discussed. Data dissemination is a challenging task because by utilizing limited bandwidth, maximum data has to disseminate over the vehicular network. Many researchers have provided several techniques to disseminate data so that the data can be accessed more efficiently. Major stress is given to this topic where data dissemination types and its protocols are compared.

1. INTRODUCTION

Mobile Ad-hoc network (MANET) is emerging globally as a communication mechanism. A MANET is generally defined as a network that has many free or autonomous nodes often composed of mobile devices or other mobile pieces that can arrange themselves in various ways and operate without strict top-down network administration. Mobile Ad-Hoc Networks is integrated with wireless nodes that can communicate anywhere. MANET are categorized into three types: VANET, InVANET and iMANET. Vehicular Ad Hoc Networks (VANETs) is technology that integrates the capabilities of

new generation wireless networks to vehicles. VANET build a robust Ad-Hoc network between mobile vehicles and roadside units. It is a form of MANET that establishes communication among nearby vehicles and adjacent fixed apparatus, usually described as roadside apparatus. VANET can achieve affective communication between moving node by using different ad-hoc networking tools such as Wif IEEE 802.11 b/g, WiMAX IEEE 802.10, Bluetooth, IRA.[3]

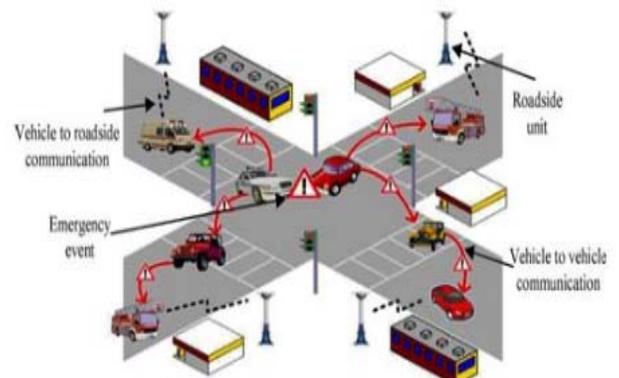


Fig. 1- Basic structure of VANET [1]

Vehicular ad hoc networks (VANETs) have come forward as one of the most successful commercial applications of mobile ad hoc networks. One major aspiration of VANET deployment is to boost road safety and moving efficiency. Mainly VANET research has resolute on analyzing routing algorithms in a highly dark network topology under the over easy assumption that a classic vehicular network is well allied in nature. Another phenomenon that could lead to network disintegration in VANET is the low breach ratio of the DSRC technology at the first stages. This case implies that, even during hasten hours; the number of cars that are capable with DSRC radios could be extremely little due to the low incursion ratio of the DSRC expertise. This disconnected network problem poses a fundamental research confront for embryonic a reliable

efficient routing protocol that can hold up safety applications in extremely diverse VANET topologies. [2]

2. VANET ARCHITECTURE

Data dissemination in VANET depends upon three architectures:

V2V

This is vehicle to vehicle architecture where vehicles act as both consumers and producers as vehicles receive information from other vehicles in the network and distribute that information to other vehicles in the network. So, both collection and distribution of data are done within the network for faster delivery of messages.

V2I

This is vehicle to infrastructure wireless architecture in which infrastructure is used to collect information from vehicles and provide that information to other vehicles when necessary.

Hybrid

This is combination of both V2V and V2I architectures.

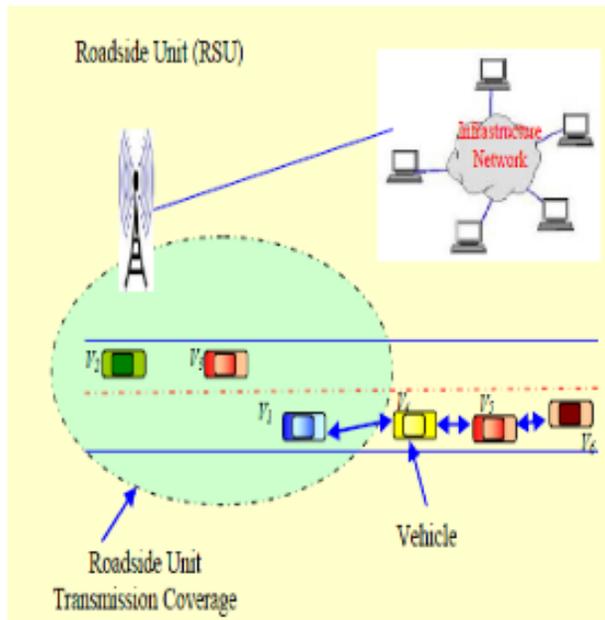


Fig. 2- VANET Architecture [5]

Every node i.e., a vehicle or RSU communicates with other nodes in single hop or multi hop. VANETs are designed with the goals of enhancing driving safety and providing passenger comfort.

In VANETs, the types of communication are the following:

- Vehicle-to-Vehicular (V-V) or Inter-Vehicular Communication.
- Vehicle-to-Infrastructure (V-I) or Vehicle-to- Roadside Communication.
- Inter Roadside Communication

3. CHALLENGES IN VANETS

- a) Multi-hop data delivery is challenging task as frequent disconnections and high mobility is there in VANETs.
- b) Gathering of information like accident, speed limit, obstacle information, and traffic conditions etc. for safety and entertainment convenience purpose.
- c) Vehicles should be chosen for data delivery in such a way that packets will be transmitted with minimum delay to destination.

4. APPLICATIONS OF VANET

There are three main applications of VANETs that are given below:

Safety Applications

Safety applications are one of the most important applications types which is primarily focused on to reduce the chances of road accidents and the loss of life of the occupants of vehicles. A large number of accidents that happen in all parts of the world are associated with vehicle collisions. This class of applications mainly provides active road safety to avoid collisions by assisting the drivers with timely information. Information is shared among vehicles and road side units which is further used to predict vehicle collisions.

Traffic Monitoring and Management Applications

This category primarily focuses on improving the vehicle traffic flow, traffic coordination and traffic assistance. It is responsible for providing updated local information, maps and relevant messages bounded in space and/or time.

Infotainment Applications

Infotainment applications provide convenience and comfort to drivers and passengers. The idea of infotainment applications intend to provide all kind of messages that offer entertainment and useful messages to the driver and passenger. Finding the nearest coffee shop, cinema, mall, fuel station which offers the best price in that area, or available parking spot are the few examples of infotainment applications.

5. CHARACTERISTICS OF VANETs

In addition to the similarities to ad hoc networks, VANETs possess unique network characteristics that distinguish it from other kinds of ad hoc networks and influence research in this area. Few important characteristics of VANETs are as follows:

- Somewhat predictable but Highly Dynamic Topology.
- Mobility Modeling and Predication.
- Geographical Type of Communication.
- Different Communication Environments.
- Adequate Storage and Energy.
- Frequent Network Disconnection.

6. CHALLENGES IN DATA DISSEMINATION

Data dissemination is a process of spreading data or information over distributed networks. So, data dissemination in VANETs improves the efficiency of traffic system. It also improves the quality of driving. Though this process seems to be very simple but in reality it is tough for vehicles to communicate among themselves due to large number of vehicles on road. So, it becomes very challenging task for vehicles to transmit information over the network. Some of the main issues during dissemination of data are:

a) High Mobility and Frequent Disconnections:

The big challenge in VANETs is the high mobility and frequently disconnected topology at different regions of the city. The traffic density is low during the night and in suburban areas, but network node density is very high in urban areas and especially during the peak hours in day time, which causes frequently network disconnection. There is no simple 'one-for-all' solution for disseminate data to all recipients spreading across the city

b) Data Transmission in presence of Disconnection

The second main challenge in VANETs how to disseminate data over the network with less delay and before occurring the disconnections among vehicles. When target vehicle moves closer to the roadside unit and placed in densely area, disconnection is less concern. But the major problem is when different vehicles those are in radio range of one another requesting the same data at the same time and sharing the wireless media then utilization of bandwidth is the key issue. When a vehicle reaches within the one- hop range of the road side units, data can be transmitted to the vehicle at the highest throughput. Thus a

vehicle passes by the roadside unit, it is most desirable to extend the connection time between the vehicle and road side unit so as to spread more data.

c) Data Distribute over the Mesh Nodes

For efficient data dissemination, many roadside units are connected together to form an infrastructure like mesh network and cooperatively disseminate data to the vehicles.

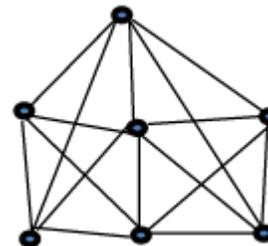


Fig. 3- Mesh Network

7. TYPES OF DATA DISSEMINATION

Data Dissemination is a process of spreading data or information over distributed wireless networks. Aim of data dissemination is the optimum use of network resources to serve the data needs of all users.

Different types of data dissemination used in VANETs are:

- V2I/I2V Dissemination (Vehicle to infrastructure or RSU).
- V2V Dissemination (Vehicle to vehicle).
- Opportunistic Dissemination.
- Peer-to-peer Dissemination.
- Cluster Based Dissemination.

A) V2I/I2V Dissemination

It consists of two types of mechanisms: Push based and pull based. In Push based data dissemination, data pouring and buffering concepts are used. With data pouring concept, road is selected having high mobile vehicles and data center broadcast the data to the vehicles on the same road as well as on crossing roads. Data center is a computer having wireless interface that collects the data from outside world and deliver it to the vehicles. And buffers are placed at intersection points to store the data and from these buffers data will be transmitted to moving vehicles [3]. So, in push based data dissemination, data is efficiently delivered from the moving vehicles or RSUs (Road Side Units) to another vehicle [1]. While pull based data dissemination scheme is used by vehicles if they want to get some information from data center or from some other vehicles. This scheme is mainly used by vehicles for making queries and receiving response.

B) V2V Dissemination

In vehicle to vehicle data dissemination flooding and relaying mechanisms are used [1]. In flooding, data is broadcasted to all nodes that participate in data dissemination. One to all communication is done here. In the relay type of data dissemination, relay node is selected and this node forward the data to next relay hop and so on. Relay approach is generally preferred for congested networks.

C) Opportunistic dissemination

In opportunistic data dissemination, messages are stored at each intermediate node and forwarded to every encountered node till the destination is reached.

D) Peer-to peer Dissemination

In P2P dissemination, the source node stores the data in its storage device and sends the data in the network only when it is demanded by another node.

E) Cluster Based Dissemination

In order to reduce broadcast storms and for providing better delivery ratio, a data packet has to be relayed by a minimum of intermediate nodes to the destination. To do so, nodes are arranged in a set of clusters in which one node or more collects data in its cluster and send them after to the next cluster.

Dissemination Type	Dissemination Approach	Pros	Cons
V2I/I2V	Push based	Suitable for popular data	Unsuitable for non-popular data
	Pull based	Suitable for non-popular data, user specific data	cross traffic incurs heavy interferences and collisions
V2V	Flooding	Data distribution is done quickly and reliability	Not suitable for dense networks
	Relaying	Works well in dense networks and in congested networks	Selecting next best hop and reliability is difficult
Opportunistic	Store and forward	Routes are built Dynamically	It is data centric architecture in which applications are not concerned with transporting data to the right place
P2P	Store and forward on asking	Works well in delay tolerant applications	Messages are not sent in the network
Cluster based dissemination	Clusters are generated	It provides high Delivery ratio and delay is less	It does not allow all nodes to broadcast messages

Table 1- Comparison of Data Dissemination types

8. FEATURES OF DATA DISSEMINATION

There are some characteristics or features that data dissemination protocols must possess and these features are given below:

- Scalability.
- Effectiveness.
- Efficiency.
- Dissemination delay.
- Robustness.

- Reliability.
- **UMB**- Urban Multi- hop Broadcast protocol.
- **AMB**- Ad-hoc Multi-hop Broadcast.
- **ABSM**- Acknowledged Broadcast from Static to highly Mobile.
- **BEAM**- Bandwidth Efficient Acknowledgement based Multicasting protocol.
- **UGAD**- Urban Geocast based on Adaptive delay.

Existing Protocol Name	Mechanism used	Pros	Cons	Urban	Highways
UMB	Broadcast	Saves bandwidth and reduce redundancy by choosing one vehicle for forwarding the packet	Cost incurred on installing repeaters that are used to forward packets at intersections	Yes	Yes
AMB	Broadcast	Saves cost as repeaters are not used at intersections	wastage of time in finding the vehicle closest to intersection	Yes	Yes
ABSM	Broadcast	It resolves propagation at intersection without recognizing intersections	Protocol overhead is high when there are multiple simultaneous broadcasting tasks	Yes	Yes
BEAM	Multicast	Bandwidth is utilized efficiently during an emergency situation and vehicles decide themselves whether to receive the message or not	Maintenance of Multicast group is difficult.	Yes	Yes
UGAD	Geocast	Reduce redundant rebroadcast and increases packet arrival ratio	There is no method for assuring that message has been reached to destination or not	Yes	Yes

Table 2- Comparison of data dissemination protocols

9. CONCLUSION

In recent years VANETs becomes broadly used dissemination technology. This paper included the VANET architecture and its types. The challenges to VANET are also discussed in this paper. As VANET is turning to be an imperative part of technology, it has many applications as well. This paper also presented various challenges to VANET along with its characteristics. Data dissemination requirements (delay, reliability, coverage, etc.) may be different from one application to another. Secure data dissemination in VANETs is of vital importance in ITS. Without security, minimizing the delay and maximizing the reliability could not be attained. Intelligent transport applications aim at providing faster

delivery of traffic information, and improving the accuracy and efficiency of traffic detection At last comparison is done on behalf of data dissemination and its various protocols.

REFERENCES

- [1] N.Gayathri, S.Rakesh Kumar, “Critical Analysis of Various Routing Protocols in VANET”, International Journal of Advanced Research in Computer Science and Software Engineering, 2015.
- [2] Er. Gulshan Rana, Er.Mahesh Kumar, “A Review on: Routing Protocol for Vehicular Ad-hoc Networks

(VANETs)“,International Journal of Advanced Research in Computer Science and Software Engineering, 2015.

- [3] Divya Chadha, Reena, “Vehicular Ad hoc Network (VANETs): A Review”, International Journal of Innovative Research in Computer and Communication Engineering, 2013.
- [4] Maria Elsa Mathew and Arun Raj Kumar P., “Threat Analysis and Defence Mechanisms in VANET“, International Journal of Advanced Research in Computer Science and Software Engineering, 2013.
- [5] Navneet Kaur, Amarpreet Singh, A Survey on Data Dissemination Protocols used in VANETs”,I nternational Journal of Computer Applications, 2015.
- [6] C.Kiruthika, Ms.N.Gugha Priya, “A survey on Security based data dissemination for VANETs“, International Journal of Advanced Research in Computer and Communication Engineering, 2015.
- [7] R.Maheswari, Dr.T.V.U.Kiran Kumar, “Efficient Way of Emergency Message Dissemination and Reliable Broadcast in Vehicular Ad-Hoc Network”, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 2015.