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# Cluster Based Data Dissemination Protocol In VANET

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***Abstract*- Vehicular Ad-hoc Network (VANET) in the recent years have emerged as a most attractive topic for researchers and automotive industries due to their tremendous potential to improve traffic safety, efficiency and other added services.The routing in VANET is the most challenging part of research.. Research in the field of Vehicular ad-hoc network technology has provided us with a new chapter in the world of wireless communication. In this paper we are propose a cluster based routing approach for VANET and compare its performance with existing routing protocols. This new approach will have an aim to minimize end to end delay and increase the overall network throughput. NS2 is used to conduct simulation.**

***Keywords*- Vehicular Ad Hoc Network (VANET), Road Side Units (RSUs),GPS, Clustering, AODV, DSR.**

## I. INTRODUCTION

VANET stands for vehicular Ad-hoc network. In VANET vehicles are considered as mobile nodes. There are several cases that made many researchers interested in vehicular ad-hoc networks. As the deployment of these networks is useful in several areas, such as wars to monitor the movement of enemies and their numbers and position, and in the field of research will help us in the work of several statistics such as knowing the amount of air pressure, speed and position.[1] It also helps us in carrying out operations in inaccessible areas.

Successful operation among the vehicles is mainly achieved with the implementation of the Cluster-based data dissemination protocol like any other shared medium. In general, there could be some chances where two or more interfacing vehicles act on a single communication attribute and cause the collision due to the single time dissemination of data at network level.[2]

Vehicle-to-Infrastructure communication works on infrastructure networks wherever vehicles move with the Road-Side Units (RSUs) that square measure the Access points placed at the margin. RSUs offer information like margin recognition, parking a vehicle, control, lane keeping help etc. Figure 1 shows the situation of V2I communication.

Vehicular networks are networks established between vehicles. These networks are short lived and self-organizing. In vehicular Networks vehicles are equipped with wireless communication devices (OBUs) and each vehicle act as a node in the network[3].

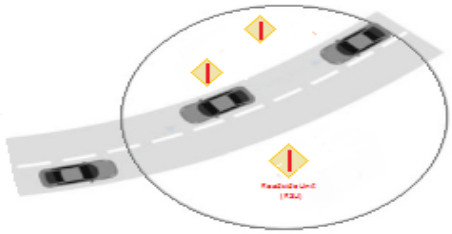


Figure 1 Vehicle-to-Infrastructure communication

## II. LITERATURE SURVEY

In infrastructure network vehicles communicate with road side units (RSUs) and in infrastructure less network vehicles communicate with totally different vehicle's onboard unit. Vehicles frequently change their positions and exchange information and communicate with each other. It works on Dedicated Short Range Communication (DSRC). It act as a medium of communication. DSRC stack builds on IEEE 802.11a operating on 4.9 GHz band. WAVE (Wireless Access in Vehicular Environments) builds on IEEE 1609 operating on seven reserved channels in the 5.9 GHz frequency band. Organization is being standardize as IEEE 802.11p for special conveyance communication.[4]

VANET applications focus on the safety of the users and various user requirements. VANETs is used to increase safety on the roads by running several safety applications, e.g., cooperative collision warning, VANETs can also provide several non-safety applications, from notifications of traffic conditions to file sharing. Unfortunately, it has been show that using WAVE VANETs cannot support both safety and non-safety applications with high reliability at high traffic densities. These are bandwidth exigent and require network capability to supply continuous access to the web with a controlled Quality of Service.[5]

## III. ROUTING PROTOCOLS

Here are different routing protocols in vehicular environment to improve its performance and to provide correct and timely data to the drivers [6]. Routing Protocols to be employed in the VANET ought not to be reliable, economical and robust but also must handle network load, and may have low latency.

### *A. Cluster based routing protocols*

In cluster based routing 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. This protocol is proposed for a highway scenario in which vehicles are divided into clusters and a vehicle node is selected as a head of cluster. The cluster-based routing protocol (CBRP) was introduced by Jiang . In CBRP the nodes of a wireless network are divided into several disjoint or overlapping clusters. Each cluster elects one node as the so-called cluster head [7]. These special nodes are responsible for the routing process. Neighbors of cluster heads cannot be cluster heads as well. But cluster heads are able to communicate with each other by using gateway nodes. A gateway is a node that has two or more cluster head as its neighbors or when the clusters are disjoint at least one cluster head and another gateway node. The routing process itself is performed as source routing by flooding the network with a route request message.

## EXISTING APPROACHES

The followings are the various described cluster based protocols used to design a new algorithm for VANET.

Y. Gunter. B. Wiegel, and H.P. Grossmann [8] presents a Cluster-based medium access control protocol for vehicular ad-hoc networks. The main aim of this approach is to minimize the hidden station problem by introducing the concept of clusters to provide better scalability. Traditionally, clustering is only used for routing protocols to avoid flooding the network. But In this approach a fairer medium is provided to every cluster head (CH) which has the responsibility to assign bandwidth to the members of cluster which leads to increase in the reliability and Quality of Service (QoS) can also be improved. If we follow the same approach of medium access in clustering in different traffic scenario, the problem of overhead clustering can also be reduced.

B. Ramakrishnan, Dr. R. S. Rajesh and R. S. Shaji [9] proposed and create a new cluster model for efficient communication among the VANET nodes on the highway. In our Model a Simple Highway is taken for characterizing the VANET. On a highway vehicles can move freely on either direction. Each vehicle can have a limited radio range. Vehicle within a radio coverage range can communicate directly as against the communication through a fixed roadside unit in the existing model. In this model a very few Fixed roadside units are assumed.

Zaydoun Y. Rawashdeh and Syed Masud Mahmud [10] proposed a hybrid medium access technique for cluster based vehicular ad-hoc networks. This technique integrates the centralization approach of cluster management and the universal way of forwarding data, where the farthest vehicle forwards data in an effort to maximize the opportunity of advanced notification. The concept of grouping vehicles into manageable clusters in VANET is used to avoid flooding the network.

Clustered architecture for data collection is a safety paradigm proposed by Ismail Salhi, Mohamed Oussama Cherif and Sidi Mohammed Senouci [11] for vehicular networks. The main aim of this architecture is to find driver's environment such as speed, acceleration, seats occupation, etc in order to provide a safer, more efficient and comfortable driving architecture. This paper uses Cluster based gathering, dissemination and aggregation protocol which is based on geographical clustering used to gather, distribute and aggregate information in hybrid architecture (V2V and V2I).

Evandro Souza, Ioanis Nikolaidis and Pawel Gburzynski [12] proposed a New Aggregate Local Mobility (ALM) Clustering algorithm for data dissemination in VANET. As describe Clusters are basically a set of nodes which are organized by momentarily selected representative called head. A node is being either in Cluster head (CH), or in the regular cluster member. According to Gunter et al. [8] the basic clustering approaches is based on three techniques: Lowest-ID, Highest-degree, and Beacon-based. The first two are not efficient in VANET but the third approach effectively defines the state of node. Here, clusters contain large number of nodes in the CH state which leads to instability.

In our Model a Simple open scenario is taken for characterizing the VANET. Each vehicle can have a radio range which is limited. Vehicle within a radio coverage range can communicate directly with each other.

### *B. Ad-hoc on Demand Distance Vector routing (AODV)*

Being a reactive routing protocol AODV uses traditional routing tables, one entry per destination and sequence numbers are used to determine whether routing information is up-to-date and to prevent routing loops. It helps in both multicasting and unicasting [13].

AODV makes use of <RREQ, RREP> pair to find the route. The source node broadcast the RREQ i.e. Route Request message to its neighbors to find the route to destination. The RREQ message contains the source and destination address, lifespan of message, sequence numbers of source and destination and request ID as unique identification. Destination Sequence Number is the latest sequence number received in the past by the source for any route towards the destination and Source Sequence Number is the current sequence number to be used in the route entry pointing towards the source of the route request[14].If any node from a list of neighbors is destination or knows the route to destination, it can send RREP message to source.

The main advantage of AODV protocol is that routes from source to destinations are established on demand. The connection setup delay is less. It doesn't require much memory for communication.There are several disadvantages with this protocol like the intermediate nodes

can lead to route inconsistency if the source node sequence number is very old [15].Multiple route reply packets for a single route request packet can lead to Heavy control overhead. It consumes extra bandwidth because of periodic beaconing.

C. ***Dynamic Source routing***

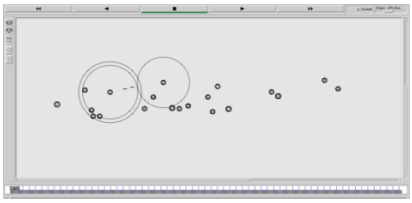
DSR is a reactive routing protocol. It initiates route discovery only on demand like AODV. DSR [15] stores the whole path to destination in its routing table instead of next hop node unlike AODV. The packet header includes the address of all the nodes through which the packet must pass to reach the destination node. This kind of routing is called source routing and that's why the name of protocol is. A pairof <RREQ, RREP> message is used to discover the route similar to AODV. Source node broadcast the RREQ message and the node having route to destination replies with RREP message. If node receiving RREQ message doesn't have information regarding destination node it rebroadcast the RREQ message after adding its address to source address.

## IV. INVESTIGATED MODEL

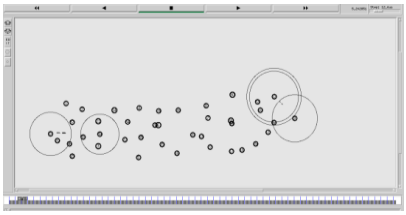
Cluster based routing protocol is new cross layered data gathering, aggregation and dissemination protocol that uses synchronization between vehicles to efficiently and effectively operate over a wide range of traffic loads. . In our Model a open scenario is taken for characterizing the VANET. In which vehicles can move freely. In this protocol, nodes are organized on a set of clusters which can be maintained and controlled by a special node called cluster head. One or more node collects the data in his cluster and sends them after to the next cluster. A cluster head can be elected randomly by random function generator based on trust value of that particular node. Mobility also affects the size of the cluster, low mobility increases the size of the cluster compared to high mobility, leading to increase in the number of clusters. After cluster head election data dissemination between clusters and cluster head takes place depending upon mobility pattern of nodes .Each vehicle can have a limited radio range. Vehicle within a radio coverage range can communicate directly as against the communication through a fixed roadside unit in the existing model. In this model a very few Fixed roadside units are assumed. In this approach our main aim is to reduce end to end delay and improve the throughput and packet delivery ratio.

## V. V.SIMULATION AND IMPLEMENTATION RESULTS

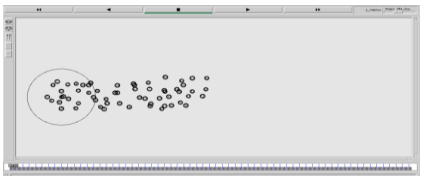
The simulations carried using NS_2.35 simulator for position based routing protocols the CBR, AODV and DSR. We used the new model and compare its performance as well. The simulation carried out for 20, 40 and 60 vehicles. We considered an open traffic scenario where vehicles are moving that are shown below in snapshot of NAM file in figure 2.



***(a ) For 20 nodes***



***(a ) For 40 nodes***



***(a ) For 60 nodes***

Figure 2 Snapshot of NAM file.

We use a 2500m * 800m square area for simulation. Network size is represented by the number of vehicles. Each node having a radius of 250 m.The traffic density is not uniform and it depends on the number of vehicles chosen in the given area. The packet transmission density can be adjusted by setting different CBR rates with a packet size of 1000 bytes. A simulation runs for 150 seconds.

Table 1 Parameter Value

| | |
|---|---|
| Simulation Scene | Open |
| Topology Dimensions | 2500 m * 800 m |
| Number of vehicles | 20,40 & 60 |
| Vehicles speeds | 6-15 m/s |
| Protocols simulated | CBR, AODV, DSR |
| Simulation time | 150 seconds |
| Communication type | Position Based |
| Transmission range | 250m |
| Traffic type | CBR(Constant bit rate) |
| Simulator | NS_2.35 |

## VI. PERFORMANCE MATRICS

Several performance metrics are there according to which performance of a routing protocol is evaluated for network

simulation. we use the average end to end delay, average throughput and packet delivery ratio as performance metrics in our simulation.

### *A. Average End to End Delay*

The delay ratio in VANET specifies how long it takes for a message to travel across the network from one node or endpoint to another. The average end to end delay refers to the ratio of sum of delay experienced by each packet transmitted across the network from source to destination to the total number of packet transmitted.

Average End to End Delay = Sum of delay experienced by each packet/ Total number of packets transmitted

### *B. Packet Delivery Ratio*

Packet Delivery Ratio (PDR) is the quotient resulting from the number of successful delivered packets to those generated by the source within simulation period. It is an important metric which indicates congestion level of the network. Higher PDR implies that the packet loss rate is lower and protocol is more efficient from the perspective of data delivery.

PDR= Total number of packet received at destination/ Total number of packet transmitted by sender

### *C. Average Throughput*

Throughput determines the amount of data that is transmitted from a source to a destination per unit time. It can be measured in Kbps (kilo bits per second) or bps (bits per second)

Average Throughput =

(recvdSize/( S1 –S2))*(8/1000)

S1 is Stop time of simulation
S2 is Start time of simulation

## VII. RESULTS

Following graphs shows the performance of our new cluster based protocol and its comparison with AODV and DSR.

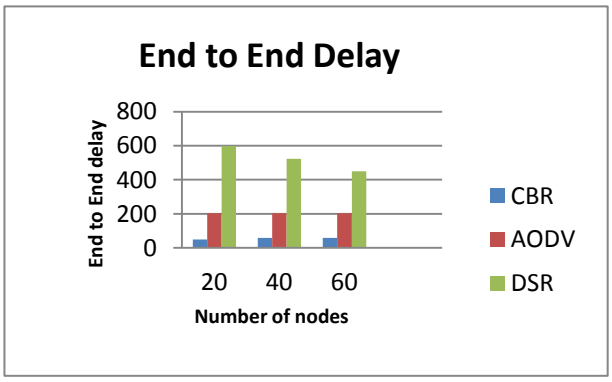



Figure 3 End to end delay analysis.

Above figure3 shows that the performance of our new approach is better then AODV and DSR as end to end delay is low in our new approach.

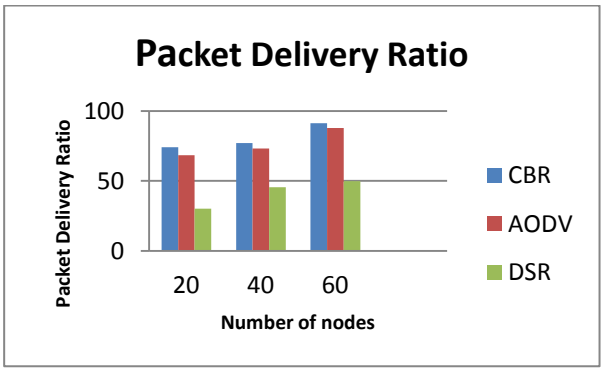



Figure 3 Packet Delivery Ratio analysis.

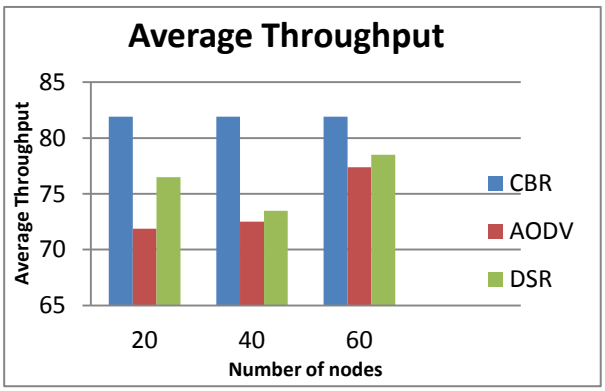



Figure 4 Average throughput

Above figures shows that the packet Delivery ratio as well as average throughput is also more in our new approach then AODV and DSR. However the average throughput of AODV is less as it consumes more bandwidth due to periodic beaconing.

## VIII. CONCLUSION AND FUTURE WORK

When analyzing the survey of protocols, it's found that the cluster based mostly routing has higher performance as a result of there's no creation and maintenance of worldwide route from supply node to goal node. Within the Cluster based routing protocol, all the packets square measure received with small average delay, higher turnout, and effective utilization and together helps to prevent the accidents on the road effectively. In future these protocols also can be used for any analysis in VANET.

Discussion of the cluster based routing protocols are drawn and the conclusion that each routing protocols has its own advantages and disadvantages in particular scenario. Benefits and drawbacks of VANET Routing protocols are mentioned. Cluster Based routing Protocol shows the better results as compared to AODV and DSR in terms of Throughput, End to End Delay and Packet Delivery Ratio.

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