CDVCN : AN ADVANCED DATA DESSIMINATION STRATEGY EXPLOITING RSU BASED BROADCASTING IN VANET

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Abstract

Vehicular Ad-hoc network is a field of computer network wherein the vehicles act as node and communicate with each other forming a network. In vehicular Ad-hoc Network (VANET) we have two approaches first one is vehicle to vehicle (V2V) communication and the other is vehicle to infrastructure (V2I) communication. The data can be effectively disseminated by broadcasting the messages within the network. This will cause the network to be flooded with messages which results in Broadcast storm problem. This paper proposes a solution to the problem based on Hybrid Vehicular Cloud Network Architecture. The architecture is best understood as a hierarchy of networks wherein the first level network is a network formed by clouds, the second level is formed by RSAPs and the last level is formed by vehicles as the nodes.We conclude by proposing a approach which involves the clustering of RSUs and maintaining the details related to data dessimination.

Keywords: Vehicular Ad-Hoc Network-VANET, Road Side Access Point-RSAP, Vehicle to Vehicle-V2V, Vehicle to Infrastructure-V2I, Vehicluar cloud computing

Introduction

As VANET comes under the category of Ad-Hoc Network which is a very powerful means of communication during floods, earthquakes or any other disaster, it became a field of research. Vehicular network helps in intelligent transport system which presents applications like traffic information, congested routes discovery etc.

There are different categories of application in VANETS such as safety application, public service, improved driving etc.The applications presented here are gathered from several sources. A large collection of applications was formed in a report (Yen-Wen 2011) by the Vehicle Safety communication Project. The potential application can be safety and entertainment services.

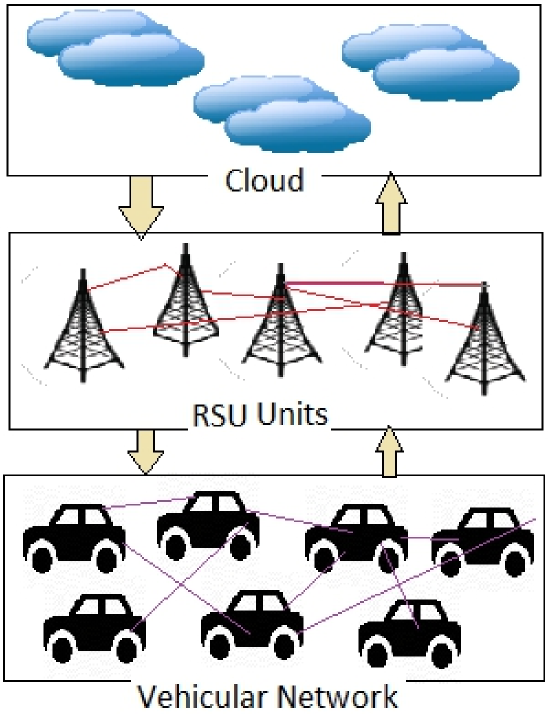

Figure 1: Logical view of Vehicular cloud network model

In clouds we have different type of services such as Infrastructure as a service, Network as a service, software as a service etc. Auto-mobile industry are working on integrating the on board units within the vehicles to the cloud platform to provide different services, this is known as Infrastructure as a service. The different architectures in VANET are

1.**Centralised architecture:** In this architecture individual vehicle is independently managed at the back-end cloud by a service provider.

2. **Distributed architecture**: In this architecture the cloud is entirely managed by vehicles.

3. **Hybrid architecture**: In this architecture vehicular cloud management is assisted by vehicular nodes and managed at the cloud level by service provider.

The different architecture is shown in fig 2

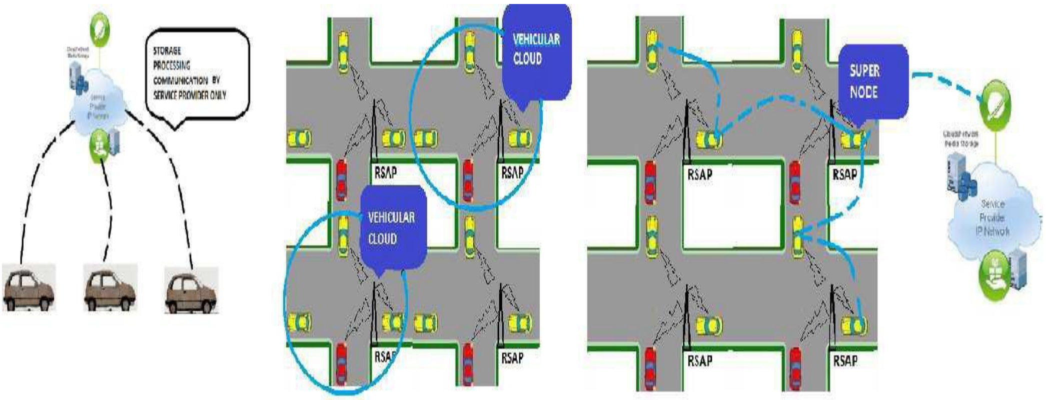

Figure 2: Architectures For Centralized, Distributed And Hybrid Vehicular Cloud Network Management Systems

Related Work

Worked done by different authors is presented here that address the need for a Cloud enabled VANET. In[1] authors introduced a cloud based server which act as gateway in transmission of data. (Yen-Wen 2011) Put forward a new service which is discovery of gateway which can be called as Discovery as a service. (Barghi 2009) presents a new mechanism to reduce the overhead of gateway discovery for VANETs using the most stable route to perform seamless hand-over and considers the packet lifetime as a metric.(Kchiche 2008) Explains the use of roadside units for file sharing through a peer-to-peer network of VANET nodes and proposes a protocol based on Chord, a P2P overlay protocol. It is based on distributed strategy rather then centralized strategy. (Teng-Wen Chang 2010) Presents a VANET management system based on Android/OSGi for determining the functionality of telemetric applications installed in test-bed nodes that represent vehicles.(Alazawi 2011)Introduces a Disaster management system based on cloud enabled Vanets.

Most of the works listed above make use of services for VANET nodes through (Road-Side Unit) RSU or (Road-Side Access Point) RSAP but only a few describe their deployment in detail.

As we see the challenges and limitations in the VANET many of the services need to be re-engineered to be implemented in VANETS. Important limitations include constrained coverage areas of internet access and high mobility of the nodes of these networks. Challenges include manageability of heterogeneous technologies, integration of VANETs and existing backbone networks, integration of VANETs and future service platforms.

Proposed System

In VANET the effective way to communication is through broadcasting which results in broadcast storm problem. The communication involves sending and receiving messages, notifications and other application services. Therefore the messages can be classified as emergency messages such as road blocks, accidents etc, and service messages like parking lot space, entertainment, mobile service etc.As we have seen emergency messages are like the messages which need to be communicated as soon as they are generated. The service messages can be communicated on request

V2V is the most effective way of passing the emergency messages as it involves low overhead and delay. Therefore the emergency messages are communicated over V2V communication. (By making use of best possible techniques proposed).This communication is over V2V network which does not involve any RSAP and Cloud. The proposed system removes the burden of broadcasting of other service messages and hence by decreasing the load on the network.

The service messages are not important or not required by every vehicle so, this message can be sent on request. We have cloud network which is responsible for collecting the information from different clouds processing it and forwarding it to the RSAPs on request. The RSAP network is responsible for accepting the request from vehicles and responding to the request by providing the requested service . The communication between vehicles to RSAP is pull based and between RSAP and Cloud is push based.

The push based mechanism can be implemented as broadcast between RSAPs and cloud. The broadcast can be of two types such as, a broadcast in which the information is disseminated to the whole network and the other one in which a broadcast is created for each individual RSAP.The former method of broadcasting is used in disseminating the information required for the network of RSAPs, this minimizes the broadcast storm problem by reducing the number of broadcasts required for data dissemination. The later method involves broadcasting of specific information requested by vehicles. The RSAPs are grouped into clusters depending upon Number of vehicles, demand of data and vehicles movement pattern as shown in fig 3. This approach reduces the broadcast storm problem of repeated subscribing and downloading of information. For example there is a vehicle requested for service presently being in one RSAP range, while the data is still downloading it moves to the other RSAPs range then their it has to subscribe again and request for data and start downloading from 0.But with the help of cluster of RSAP method the data can be downloaded from the point where it has stopped

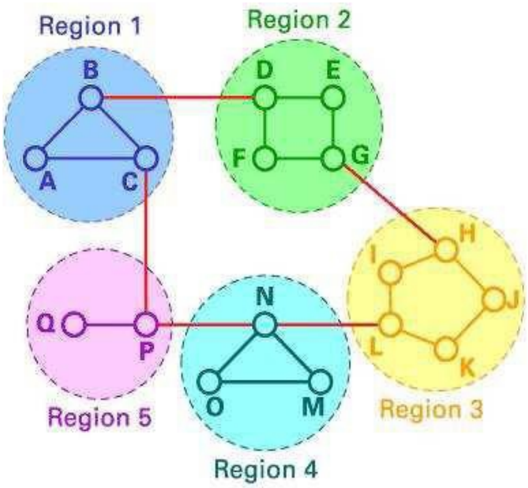

Figure 3: An example of cluster formation.

An Algorithm presenting the proposed strategy for **Content Downloading using Vehicular Cloud Network.**

As discussed earlier the Service Provider has got prior knowledge of the RSAPs deployment.

1. Vehicles need to register themselves with the cloud service provider to get updates while on the move.
2. When the vehicle request for a service, the Service Provider determines the list of available RSAPs in the cluster(region) where the vehicle is currently moving using (1) and (2)
3. The vehicle uses the GPS data to connect to a particular RSAP while moving through a cluster. As a particular RSAP ESSID is mapped IP address is assigned to the vehicle and the content gets updated at the vehicle automatically.
4. In case the vehicle leaves the RSAP the downloading starts from the point where it has stopped.

The proposed solution can be explained with the help of figure shown in figure 4. The vehicle shown in black colour request for a resource from RSU1 and RSU1 starts transmitting the information. As vehicle is moving it will leave the range of the RSU1,let us suppose that at this point vehicle has received some amount of data. After reaching in the vicinity of RSU2 it will again request for information from RSU2,intead of starting from the beginning, the RSU transmit the data from the point where it has stopped. This is possible because of RSU1, RSU2 and RSU3 are clustered by same cloud.

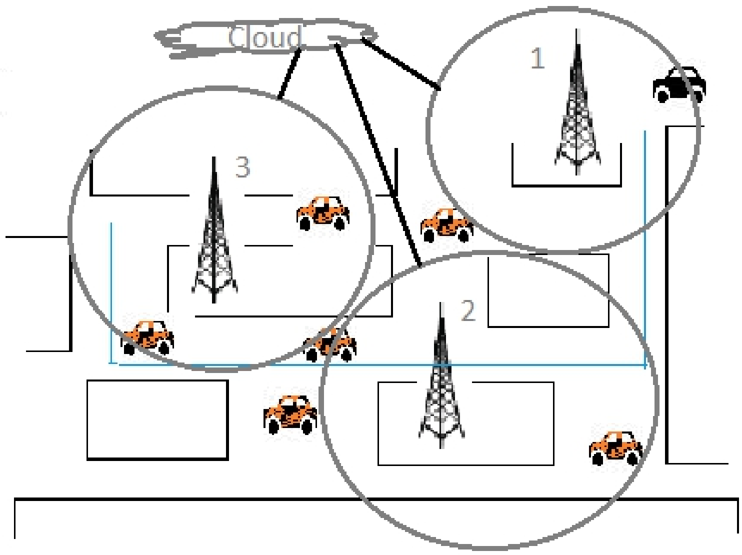

Figure 4:System Architecture

We can consider the cost involved in this process as cumulative of cost involved in connection,servicing and handoff.Connection is established by sending and receiving beacons which can be neglected. Vehicle requests services from RSU when driving through RSU, and it can get the service profit from RSUs, while it also incurs a cost in requesting for RSU, where the cost can be the price that vehicles spend on RSUs' bandwidth, buffer size, and other resource. Besides, when vehicles drive from an RSU to another, the vehicles have to pay for the handoff cost. The cost involved in servicing can be calculated as the data transmitted by the time taken to transmit the data,which is nothing but the bandwidth.The payoff can be calculated as

Payoff P = Throughtput(TP) – Resource Cost(RC) – Transmission Rate(TR)

P = TPi^j – RCi^j – TRi^j

Where TP is Throughtput of vehicle i In RSU j

RC Resource Utilised by vehicle i In RSU j

TR is Transmission Rate of vehicle i In RSU j

Hi^j is the handoff cost

Ω * Rf *Dv

Where Rf is the request files that have finished and Dv is the distance that vehicles have driven in RSU's coverage.

Transmission Rate can be calculated as

TR = Amount of data sent / Time taken.

TR = Ad/Tt

Date rate is also responsible for delay,which is given by the formula

DT = N/R
DT:Transmission Delay
N:Nummber of bits
R:Rate of transmission

Our proposed solution makes efficient use of data by reducing the data loss.Reduces delay by not allowing repeated downloading and also efficient use os bandwidth.

Analysis and results

The proposed idea is implemented in Omnet+. Retransmission of data chunks is reduced by clustering the RSUs into clusters,Which keeps the account of data transmitted and the details of requested vehicle during transmission.Retransmission of data inturn reduces the delay in data delivery,number of messages transmitted and broadcast count.It utilizes the bandwidth efficiently.

The metrics used to evaluate our proposed system are delay,number of transmitted messages and broadcast count. Estimation is calculated with respect to the vehicle density. End to end Delay is defined as the average time taken by a data packet to reach the destination. It also includes delays caused by various other factors during transmission. The data packets that are successfully delivered to the destination are counted.

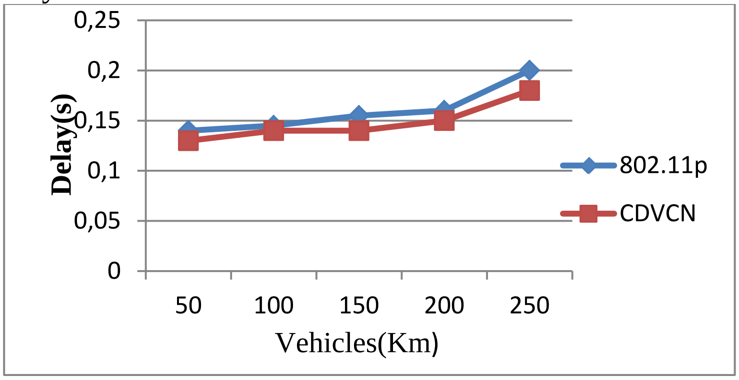

Figure 5: Compairision of delay for CDCVN and 802.11p Scheme

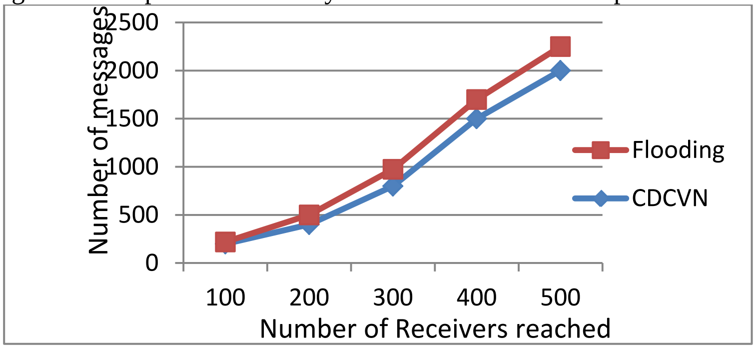

Figure 6: Compairsion of number of messages transmitted and received

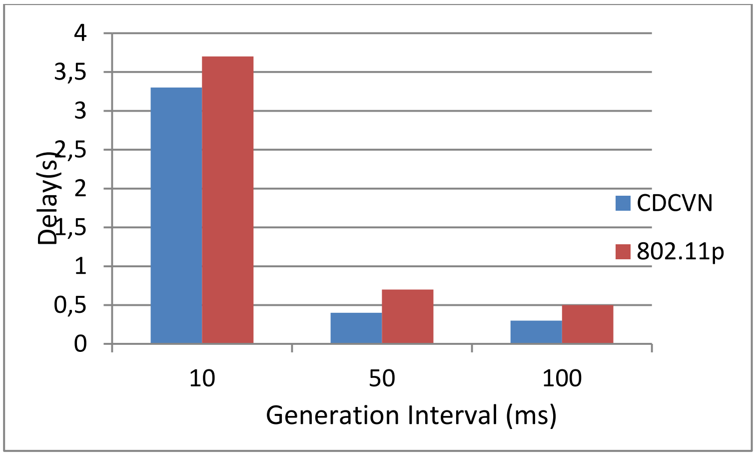

Figure 7: Compairision of delay in generation interval

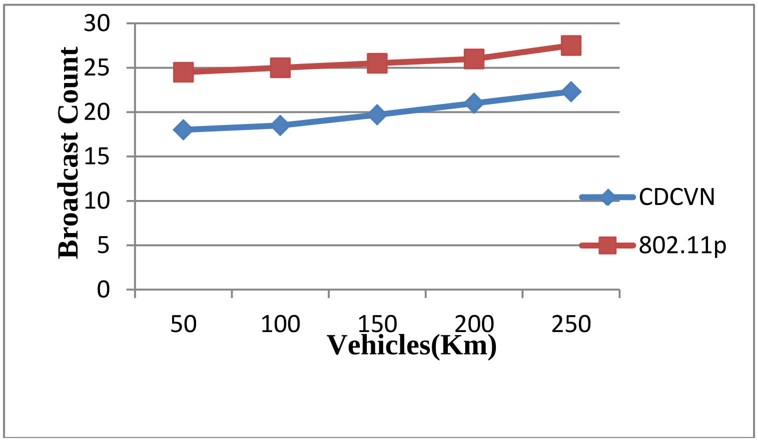

Figure 8: Broadcast in proportion with speed

Conclusion

We have proposed a solution to minimize the broadcast storm problem based on Hybrid cloud architecture. This system consist of forming clusters of RSUs,which are maintained by cloud.Whenever a service is requested,cloud maintains the data related to that session of request acceptance and data transmission. It reduces the broadcast storm problem by avoiding the repeated transmission of requested data.

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