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VANETS-CLOUD: A COLLABORATIVE FRAMEWORK TO PREDICT AND ESTABLISH RELIABLE PATH IN CLUSTER BASED VEHICULAR AD HOC NETWORKS

Abhilash Kumar Manchu[*1] & Rama Mohan Reddy Ambati[2]

[*1]Research Scholar ,CSE Dept. Sri Venkateswara University College of Engineering

[2]Professor, Computer Science and Engineering, Dept, sri Venkateswara University College of Engineering

ABSTRACT

The fascinating innovations in wireless communications and the current expansions in Vehicular Ad hoc Networks are the driving forces to collaborate Vanets and Cloud computing technologies. In existing Vehicle-Cloud models used to share information between vehicles, Network as a service (NaaS), Data as a service (DaaS) and everything as a service (XaaS). We proposed Vehi-Cloud paradigm used to store, process and identify optimal nodes for establishing reliable end to end path for cluster based vehicular ad hoc networks. Establishing reliable end to end path is crucial in dynamic Vanets because of frequent link disruptions protocols, all exiting protocols are purely based on ad hoc but our idea is to foreseen and locks nodes in neighbour clusters for fast path construction. Ubiquitous nature of cloud computing at a stretch could able connect and collects information from group of clusters. Comprehensive analysis shows that proposed method reduces end to end delay and improves network performance.

Keywords*: Vanets, cloud computing, prediction routing, cluster, path reliability, QOS.*

I. INTRODUCTION

A significant amount research has been carried out over few decades to pool Vehicular Ad hoc networks and cloud computing technologies [1] because due to increased usage of internet through driving and ubiquitous nature of cloud computing leverages to develop new vehicle-cloud computing paradigm. More over on board computation, communication and storage resources are not utilized as expected in vanets. So it forces to swift from traditional vanets to vanets–cloud framework. The major goal of intelligent transport system is to provide precise traffic information to drivers to avoid congestion and road accidents moreover to control pollution, as per statistics large amount fuel wasted because of traffic jams and also increases pollution. Due to lack of proper information propagating process between vehicles, road accidents increased drastically. To address aforementioned issues a new revolutionary framework came into picture called vehicular technology.

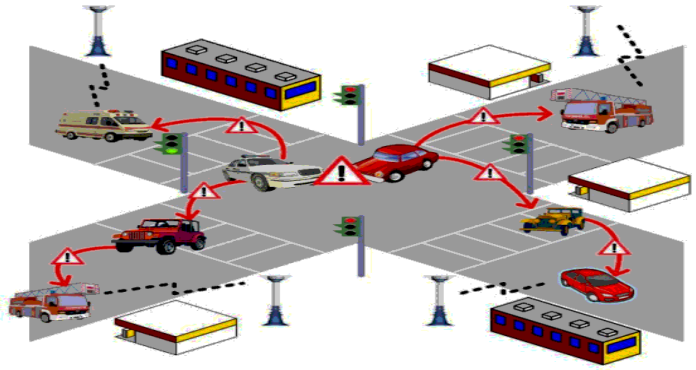

Fig .1 Examples of Vanets

In Vanetsvehicles are equipped with GPS, on-board units and sensors to establish communication between near-by vehicles and road side units. Federal communication commission has given 5.8 -5.9GHz band for sending and receiving signals also called Dedicated Short Range Communication (DSRC).

Cloud computing [2] emerged as ray in the information technology providing facilities like data storing and processing with rapid delivery rate. Ubiquitous computing creates a new revolution in today's internet world, generally cloud set up with processing unit and storage unit providing basic services like infrastructure as service (IaaS), platform as service (PaaS) and Software as service (SaaS) with minimum processing cost, ease access of resources from data storage centers, ability to expand services based on situation demands almost business risks and maintenance cost .This interesting features leverages industries like Google, Microsoft, face book and amazon to integrate new cloud framework to strengthen their business.

In Cloud computing Virtualization [3] plays a key role in cloud computing, it abstracts lower level hardware details and affords various resources for top level applications. Virtualization in cloud forms resource groups from various server groups and based on demand is allot jobs dynamically. Cloud computing is devised to act as taking self-decisions based on comprehensive observations without human interference.

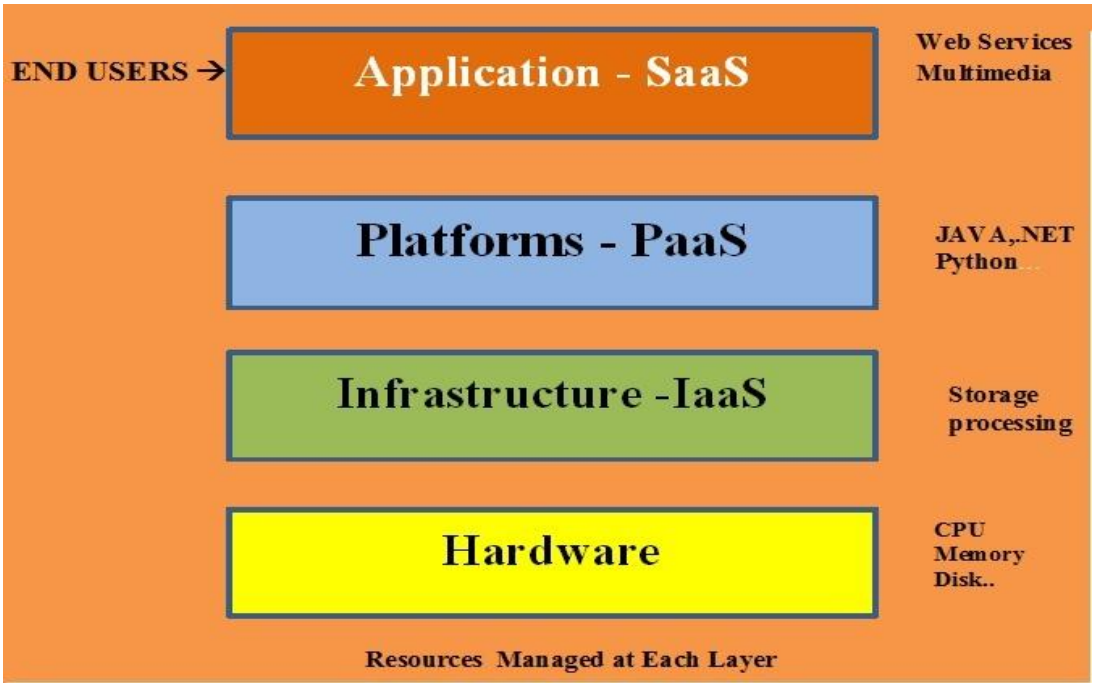

Fig .2 Basic Cloud Frameworks

I. LITERATURE SURVEY

In research[3] V-Cloud framework uses the concept of cyber-physical system, vanets and cloud computing to support vanets applications. Vehicles are grouped and allowed to share information with each other also smart phone embedded sensors used to analyze driver's mood to improve safety.

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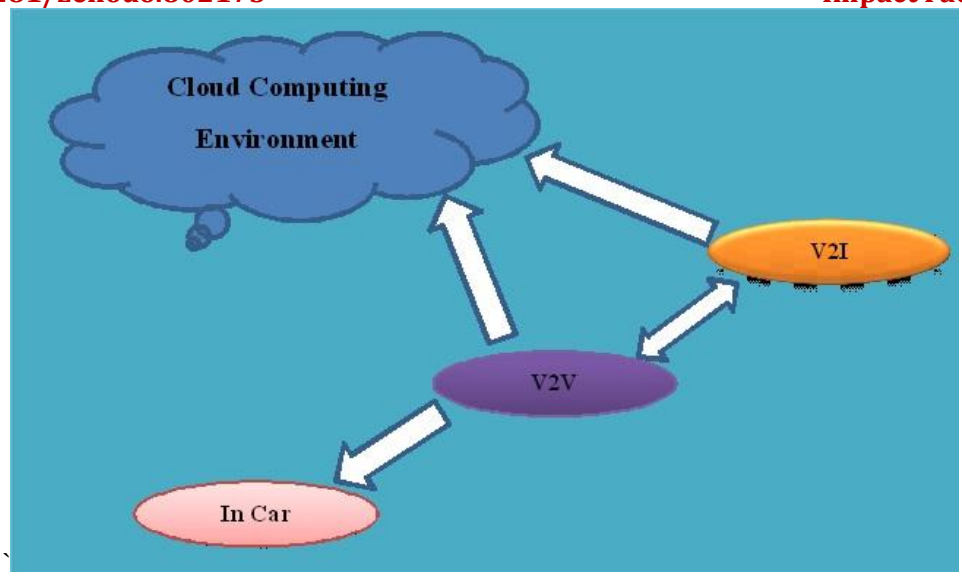

Fig .3 V-Cloud Architecture.

In research[4] Discover ring and consuming services with in vehicular clouds "CROWN" , in this research cloud computing capabilities are hosted by vehicles because they contain resources like CPU, storage and communication processing elements to act as mobile-cloud-servers. Author intention is use of the idle resources efficiently because smart vehicles inbuilt with adequate storage and high computing processors this features makes cloud computing to integrate with vanets. Services provided by vehicular cloud are Network as service (NaaS), storage as service, **Data as service (DaaS).**

In research [5] author termed cloud computing as everything as service (XaaS) why because it provides services like business, scientific applications, education, what not almost all areas. Similarly another side vanets as an emerging research area for developing intelligent transport system. Public and private clouds framework provides to support VCR (Vehicular cloud for road side scenarios).

In research [6] author used an elastic vehicle-to-cloud architecture mitigating a new service called Network as a service (NaaS), which would be used to provide on demand networking functionalities to improve throughput performance , reduce delay and interoperability complexity. Cloud provided infotainment allows vehicle to get multimedia, video conferencing and distribution through cloud infrastructure provider. Cloud navigation model provides congestion information to vehicles so that user could select best route.

In research [7] RSU based cloud avoids frequent updates in RSU because delay created due to several data exchanges between vehicles ,neighbour RSU's and cellular towers which would degrades network services. Mininet used to reduce reconfiguration overhead

In research [8] author developed framework called Vehi-cloud to address routing Issue in Vanets. Objective is to provide reliable routing service by selecting optimal paths where less end to end delay and high packet delivery ratio using predicted future positions of vehicles. Time space link graph model generates network topology and captures changes immediately rely on the present information routing decisions also varied dynamically. TSLG maintains Ad hoc links carry-forward links and the internet setup, way points describes present and future positions, timings.

In research [9] VANET-CLOUD extends usage of vehicle resources like OBU to the other vehicle users, road side units and mobiles in virtualized fashion which results in efficient usage computing resources with faultless and less cost. Here two models were used one is permanent Vanets-Cloud which focuses on processing, storage , and

bandwidth allotment and another temporary Vanets-Cloud consists of computational elements and users device information.

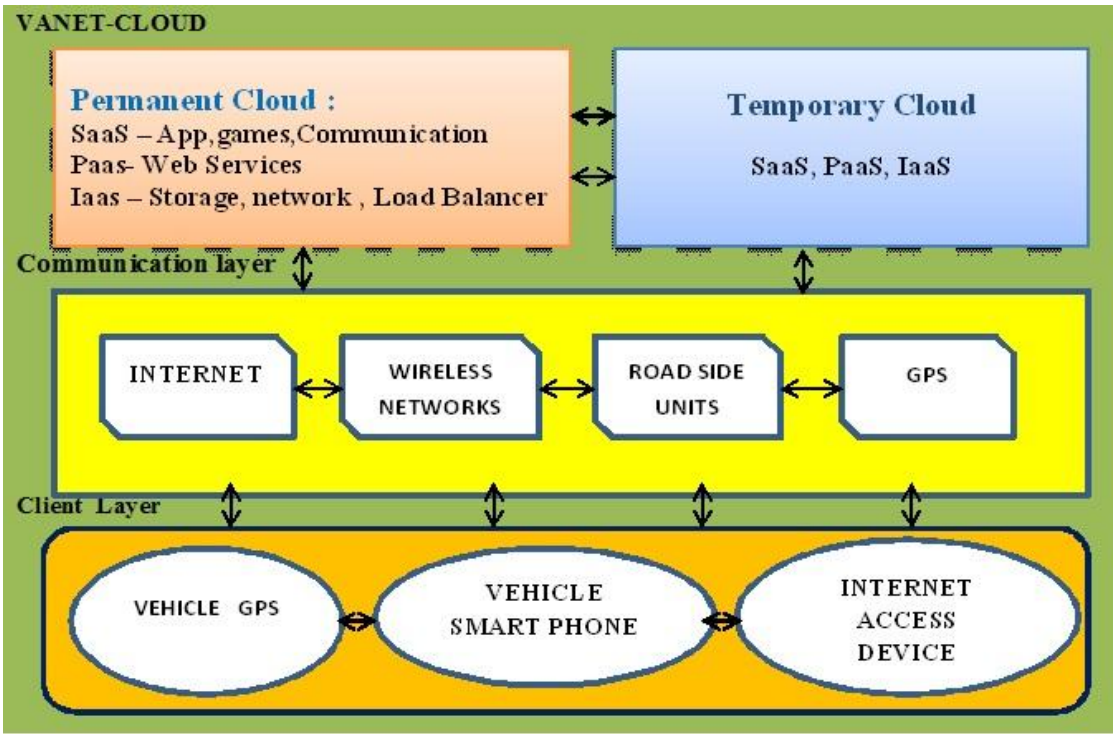

Fig .4 VANET-CLOUD Virtualized Architecture

In research [10] Vehicle cloud networking main goal network is created by sharing resources among vehicles temporally, where as in internet-cloud resources are maintained by cloud service provider. Resources in vehicles used in many ways like data storage, computing elements and sensors used to detect status of neighbour vehicles; VCN aims to provide a virtual processing environment and it contains several modules as cloud formation, content sharing and publishing, task assignment, network analysis, maintenance etc.

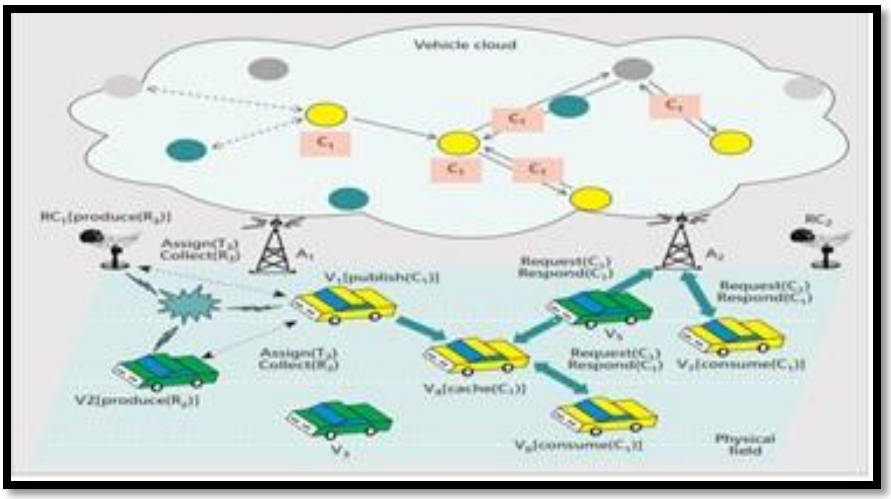

Fig .5 Network created by cloud to share resources

In research [11] used Block based routing protocol to identify more reliable paths by predicting the existence of candidate relay nodes when the link expiration time (LET) passes. If the vehicle cannot identify a candidate relay node, then the data is rerouted to a different block .That means "If a node break occurs, it does not attempt to create new route from the source vehicle instead re-routes the packet to a different block

In research [12] author used LET (link expiration time) for node selection in order to construct reliable path between source and destination. Here node maximum link expiration is selected. Each node maintains a table in which all neighbor's like position, velocity and movement direction informationis stored and updated regularly by sending hello messages to nearby nodes.

II. PROPOSED FRAMEWORK

In existing Cluster based vehicular ad hoc networks [13] one vehicle is selected as Cluster Head (CH) and is responsible for storing neighbor's information like position, distance, direction, link quality and speed in table. Constantly CH updates information whenever changes occurred, because in Vanets network topology changes are very often due to rapid movements of vehicles. As soon as CH moves out cluster region, the total table information must push into newly selected cluster head node.

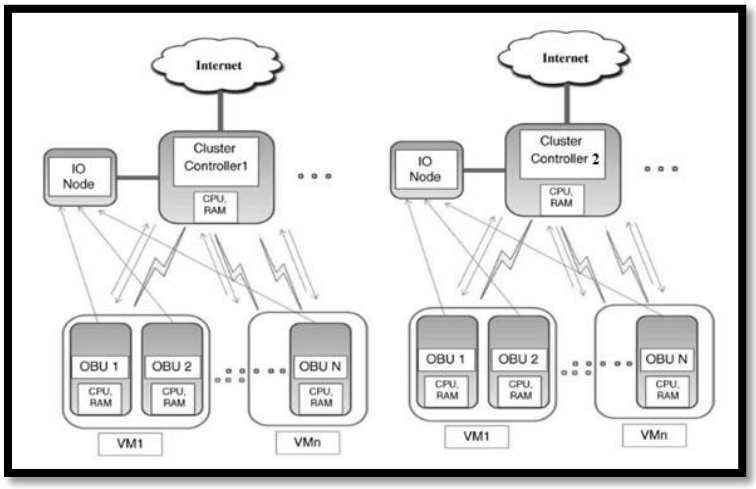

Fig .6 Basic Vanets- cluster paradigm

Some noteworthy Issues to be considered while choosing Cluster Head:

1. In Vanets cluster head selection process is difficult because in short span CH moves to another cluster so again network would have to select new node as CH, here we are emphasizing on significant amount of time wasted by network for selecting CH and moving information instead of routing process because it is not one time process very often network encounters similar problems. So it would be efficient if routing process and CH selection process is isolated and handled by two different entities.
2. If selected node fails while updating information, aforesaid process has to be repeated this consumes network precious time and reduces packet delivery ratio in turn affects delay sensitive Vanets applications like safety, emergency and spreading traffic information to other vehicles

NIST (The National institute of standards and Technology) definition of cloud computing: "Cloud computing is a model for convenient, on demand network access to a shared pool of configurable computing resources (e.g. Networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

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III. PROPOSED FRAMEWORK MODULES

1. Cluster head maintenance

In proposed group of clusters are connected to cloud environment here cloud maintains whole clusters information. Thisframework fetches solution to aforementioned difficulties.

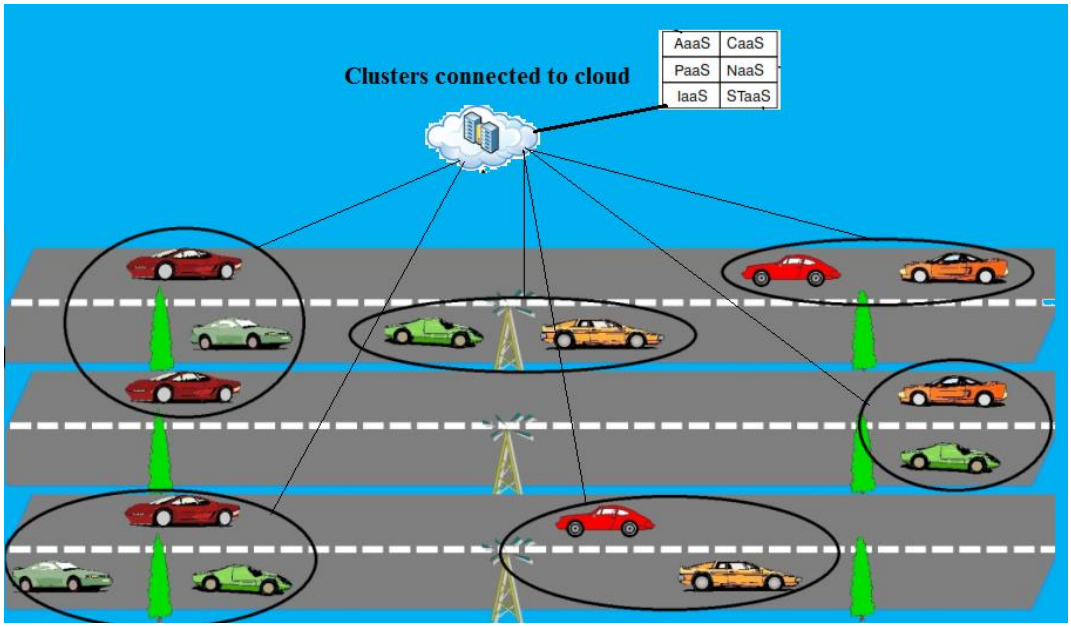

Fig .7 Clusters under control of Cloud

In city environments, we have ample availability of cloud resources so information maintained by cluster head, now moved to cloud storage this makes task easeto push current information table into any vehiclewithout delay. Here main intent is to update new CH node immediately whenever existing CH failure, so that ongoing communication would not distributed moreover it simplifies CH selection process

2. End to End reliable path

To establish reliable communication between source and destination path must contains nodes with high link stability otherwise frequent disconnections degrades network performance. Earlier a lot of methods were used to find stable nodes like calculatingLinkexpiration time (LET)[], Expected transmission time(ETX)[], Expected one transmission advance (EOA)[] these techniques are limited to particular region and same process continued in all regions. Still there is scope to improve total end to end path reliability using cloud features.

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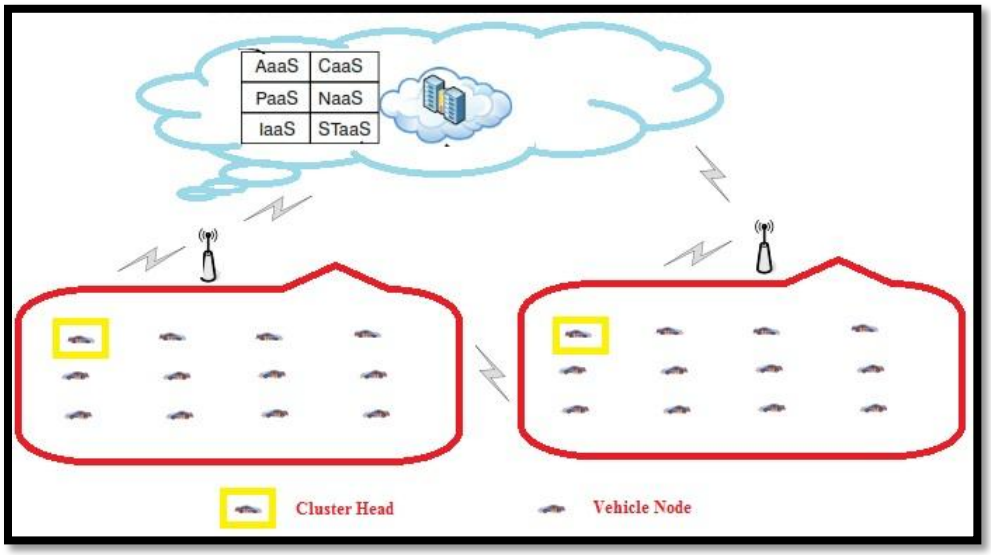

Fig .8 Proposed Vanets Framework

In our proposed cloud connected clusters, cloud constantly collects stores and updates clusters information from cluster heads including nodes status, positions, and directions in every cluster. Cloud maintains isolated table to store information about high link stability nodes for emergency applications from all cluster as shown in Fig .9 Table values are dynamically changed w.r.t changes in network.

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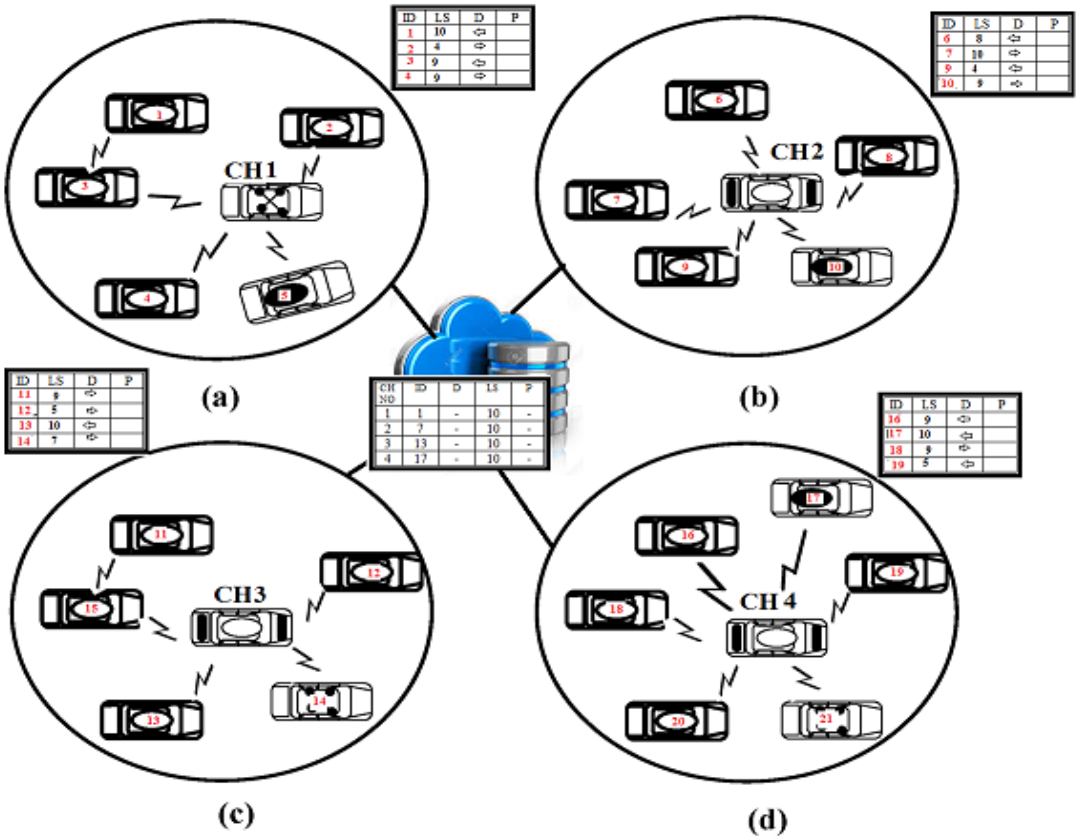

Fig .9 Informationtable maintained by cloud.

3. Inter-operatabilty and portability

The very basic capability of cloud computing is interoperability in Vanets lifetime of node is limited so exchange of data between vehicles and cloud happens often, during this process compatibility problems arises due to different architectures. Cloud interoperability supports efficient communication between heterogeneous operating systems to share and work collectively and also it ensures there would be no conflicts among table formats.

4. Sharing resources

Allocation and sharing of resources in between Vanets clusters, road side units, users and cloud infrastructure is crucial, due to high mobility of vehicles it is little bit tough to allocate and reallocate resources spontaneously. Significant amount of storage and processing elements in cloud computing environment helps to monitor and share resources efficiently.

IV. PROPOSED METHODOLGY\

Process to establish end to end path

1. Cloud initiated and gathered clusters information along the path

In this process cloud environment and vanets environment together collects Clusters information i.e. no of clusters and nodes in each cluster and updates table accordingly .CH frequently probes signals to neighbour nodes and collects status, at backend same information sent to cloud storage.

2. Updates cloud storage with cluster heads table information

Proposed system ensures that if changes happened in cluster will also reflect in cloud, so that chances to get conflicts are minimized i.e. in vanets vehicles move in and out of clusters due to this links will not remain same as assigned and in some cases link failures might occur, all this changes must updated to cloud otherwise conflicts may arise which degrades network performance

3. Initially process begins with Cluster-I

CH selects nodes with maximum link stability as cooperative nodes and assigns task.

// Procedure to pre-select next cluster nodes

If$_1$ link between all selected nodes are good enough to forward packets

If$_2$ the position of packets just before end of cluster

Then Cloud requests Cluster-II CH to update max stability nodes.

Immediately assigns ready nodes to carry and forward packets.

Else

Forwards packets to neighbour nodes

End if$_2$

This process repeats with all clusters until packets reach destination.

End If$_1$.

V. CONCLUSION

In this paper we proposed a new Vanets-Cloud paradigm to enhance routing efficiency usingPre-lock approach for safety and emergency applications in Vanets. This model is applicablefor cluster based vehicular ad hoc networks in which vehicles are grouped as cluster undercontrol of cluster head. To improve network throughput our proposed model integrates cloud environment with Vanets where cloudused to foreseen and locks the nodes in neighbour clusters whenever needed and those nodes will acts as cooperative nodes to forward data towards destination.

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BIBLIOGRAPHY

M.Abhilash Kumar Received hisB.Tech and M.Tech degrees in Computer Science and Engineering at present pursuing PhD in Computer Science and Engineering at Sri Venkateswara University College of Engineering, Tirupati, where he is doing research on Vehicular Ad hoc Networks. His research interests include Vehicular Ad hoc networks, Cloud Computing, Mobile Computing, and Internet of Things.

Dr. A. Rama Mohan Reddy Received his PhD degree in Computer Science Engineering and at present working as a Professor in Department of Computer Science and Engineering, Sri Venkateswara University College of Engineering. His areas of interest include Software Architecture, mobile computing, cloud computing and data mining. He has more than 27 years of experience in teaching and research.