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ERMCB-CRSV: A Framework to Enhance Reactive Mechanism by Reducing Connection Breakage using Client and Remote Storage in VANET

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ABSTRACT

Vehicular Ad hoc Network (VANET) is a network with unique features that the vehicles are considered as nodes in the network. The nodes within the VANET will travel in any direction, speed and distance. In nature, the nodes in the VANET is also categorized by their high node mobility and quick topology changes. Whenever the vehicular node transmits the routing information within the network, the information could succeed or fails before reaching the destination. But, this breakage in the connection can be avoided in the network by using some sort of applications, algorithms and frameworks in terms of security and service oriented. In this research paper a framework is proposed based on reactive routing mechanism and it is implemented using NS-2 to reduce connection breakage using Vehicular Cloud concepts.

Keywords: Reactive Routing Protocol, CBAODV, CS-CBAODV, RS-CBAODV and Vehicular Cloud Computing, VANET Technologies, Client and Server Storage, Cloud Applications, Ad hoc Network, Connection Breakage and NS2.

1. INTRODUCTION

In VANET, the routing protocols can play a vital role in broadcasting the routing information to the vehicular nodes. Data packets reaches the destination with the assistance of routing protocols. Data collision in the network can be avoided by selecting the suitable routing protocols [1]. Routing protocols are of different types like Topology based routing, Position based routing, Geocast based routing, Cluster based routing, Broadcast based routing and Infrastructure based routing [2]. In Topology based routing, the structural arrangement of the vehicular nodes is designed in the network and additionally they are divided into Proactive, Reactive and Hybrid based routing protocols. [3].

This research paper aims at designing the best model for avoiding and solving connection breakage issues in VANET. It also enhances the performance of the routing by storing the routing requests and responses in both Client and Remote storage by including vehicular cloud concepts. Therefore, the objective of this research paper is to design a framework based on Enhanced Reactive Routing Algorithm to reduce Connection Breakage in VANET (CBAODV), Enhanced Reactive Routing Algorithm using Client Storage for VANET to reduce Connection Breakage (CS-CBAODV) and Enhanced Reactive Routing Algorithm using Remote Storage for VANET to reduce Connection Breakage (RS-CBAODV) routing protocols to reduce connection breakage by implementing Vehicular Cloud Computing aspects.

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2. LITERATURE REVIEW

In literature, there are several research models are proposed by various authors to reduce connection breakage in VANET using reactive routing mechanism. Lee et. al. completed a study on local repair routing algorithm based on link duration for urban VANET [4]. Here, the vehicles use movement information to maintain stable routes. The link duration is calculated to prevent link breakage events. To reduce the overall traffic in highly mobile VANETs, a stable link is made by using the values of link duration calculated.

Hu et. al. proposed a model based on link duration for infrastructure aided hybrid vehicular ad hoc networks in highway scenarios [5]. The probability density function is used in infrastructure aided VANET to analyze and drive the link duration. The Monte Carlo methods is used to obtain the numerical based results. Ngo et. al. come up with a concept to predict link quality for location based routing protocols under shadowing and fading effects in VANETs [6]. It uses the forwarding progress distance method and the analysis is done by predicting the transmission success rate and the link quality.

Yadav et. al. introduced a technique to improve routing performance in AODV with link prediction in MANETs. The AODV routing is used to predict the signal strength based on link availability prediction. Here, the nodes estimate the link breakage and further it warns the neighboring nodes [7]. Whaiduzzaman et. al. and Hussain et. al. have composed a survey on vehicular cloud computing. Here, the cloud computing is compared with the mobile and vehicular networks. A replication based storage as a services idea is used to create a cloud formation with fixed infrastructure [9, 10].

3. PROBLEM DEFINITION

Connection Breakage (CB) may happen in the network whenever there is poor quality of the data transmission. The breakage in the network can lead to collision of data packets and data loss. The behavior of the existing routing algorithms for connection breakage is analyzed and the steps are taken to use AODV routing protocol to produce and implement new mechanisms in realistic simulation environment [11]. Further, the storage of frequently accessed routes is also stored in Client and Remote storage by incorporating vehicular cloud concepts with minimum available resources successfully. This mechanism is then analyzed to evaluate its effectiveness and the advantages it can offer.

4. ENHANCED REACTIVE ROUTING MECHANISMS

This section describes the proposed algorithms to reduce connection breakage in Vehicular Ad hoc Networks using cloud computing features. This methodology is systematic, theoretical and performance analysis of the methods applied to a research in Vehicular cloud computing. This section describes the various methodologies followed in this paper.

(A) CBAODV Routing Mechanism

The proposed CBAODV model is designed with the help of AODV reactive protocol which delivers better routing information with RST support for less connection breakage. This RST also acts as temporary backup center like hotspot in the network to store routing information and it reduces the complexity in maintaining the routing information [12]. The breakage may happen during the communication in the vehicular network even when the receiver is in offline or busy mode. The Source Node (SN) generates a request to Destination Node (DN) and it receives the data. The error message is delivered to SN, when there is any link breakage in data transmission. In such case, RST will act as a DN to deliver the updated information to the SN. In this proposed method, the breakage can be prevented before it happens and some steps can be taken at the RST even after there is a breakage.

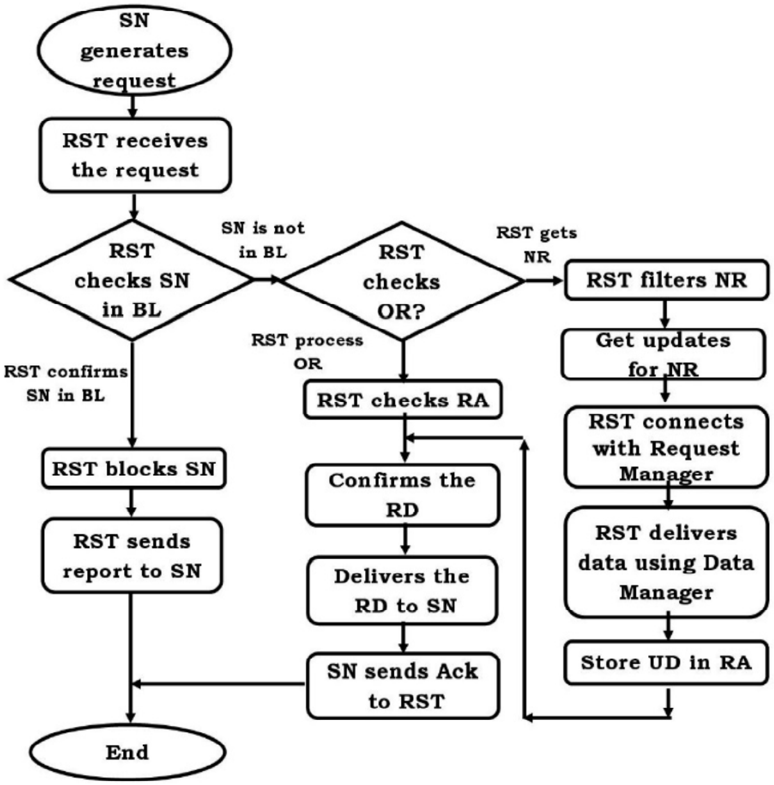

Figure 1: CBAODV Routing Mechanism

The breakage in communication is inspected by transmitting the hello messages periodically to the nearby nodes. When RST receives the unwanted requests, it will treat the request as spam and it adds the SN to the Blocked List (BL). To conflict breakage, the RST maintains the list of frequently received route requests as Request Archive (RA). If the route request is not a new one, it will consider it as Old Request (OR) and RST starts to deliver the Requested Data (RD) itself before updating the information. When RST receives the New Request (NR), it will deliver the Updated Data (UD) after getting the updated information from the server. The flow diagram of CBAODV is given in Figure 1.

(B) CS-CBAODV Routing Mechanism

This proposed CS-CBAODV contribution in Figure 2 uses local storage as Client Storage to back up the frequently accessed routes in RSTs permanently. Whenever there is a chance for route request, this RST acts as static node to bridge the communication between the vehicular nodes in the VANET. The RST consists of buffers to store the routing information and it performs better than CBAODV protocol. This proposal is used for demanding vehicular node to reduce latency in the network. The Vehicular node submits the route requests to the client storage server. The response generated to the particular request is received from the neighboring node. Also, it sends acknowledgment to the remote server by using the client storage servers like RST [13].

(C) RS-CBAODV Routing Mechanism

The proposed RS-CBAODV contribution is used to store routing information in remote storage concept with the help of client side support by using CS-CBAODV. The flow diagram of RS-CBAODV is given in Figure 3. he Remove storage is also used to back up the routing information whenever there is chance for replaying the client nodes like RST in the network [14]. This RST communicates with both client side backup and also with the server side backup center. The routing information is stored in multiple client

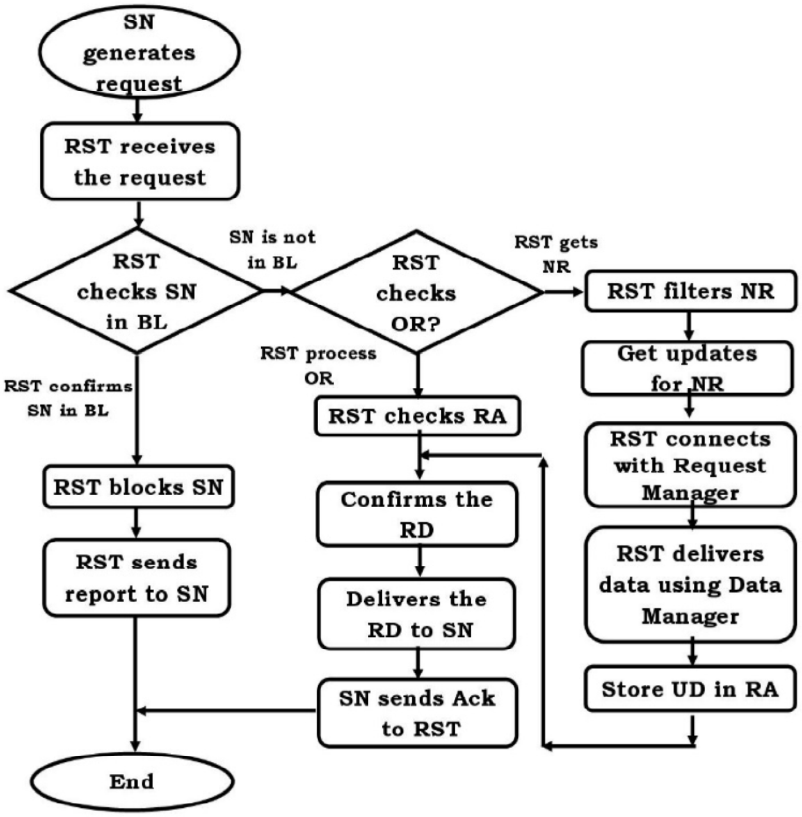

Figure 2: CS-CBAODV Routing Mechanism

storage places [15]. The routing information in the form of new updates will be taken to the remote server after storing the routing information in the RST as a client storage [16].

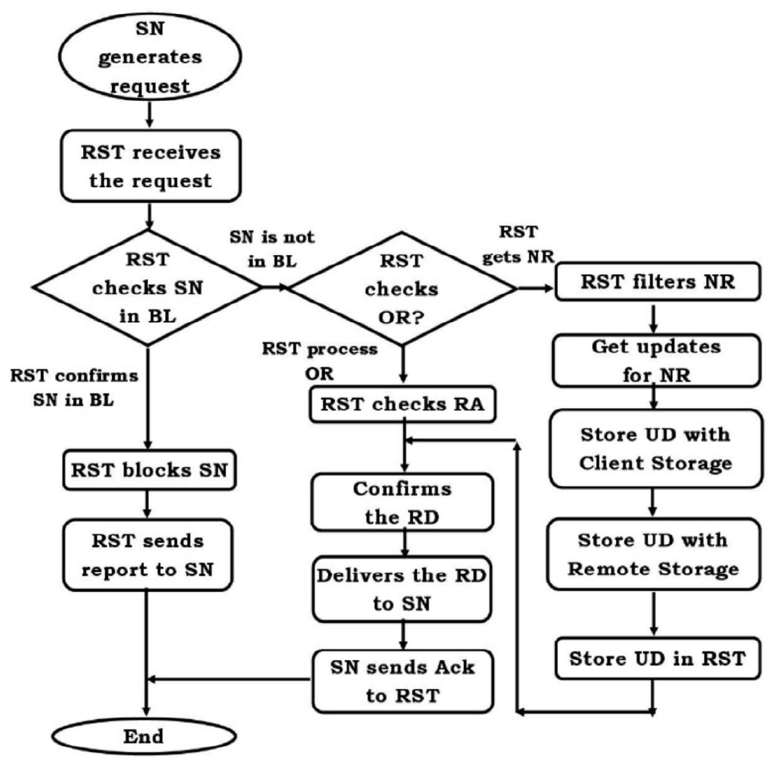

Figure 3: RS-CBAODV Routing Mechanism

5. ERMCB-CRSV FRAMEWORK

A framework is developed to integrate the proposed reactive mechanisms to enhance the performance of VANET. Here, the proposed protocols are taken into consideration to design this framework for reducing connection breakage by storing the routing information effectively in both client and server side storage. In Figure 4, the proposed ERMCB-CRSV framework is systematized as different point of views like User view, VANET view, Protocols view and Services view. In User view, the user may be in static, dynamic and stationary form. The proposed protocols like CBAODV, CS-CBAODV and RS-CBAODV are used to deliver better routing information in Protocols view. The services can be content based, communication based and customized services in the Services view. The mobility and traffic generator is used to set the node movement and also to generate the traffic in the network.

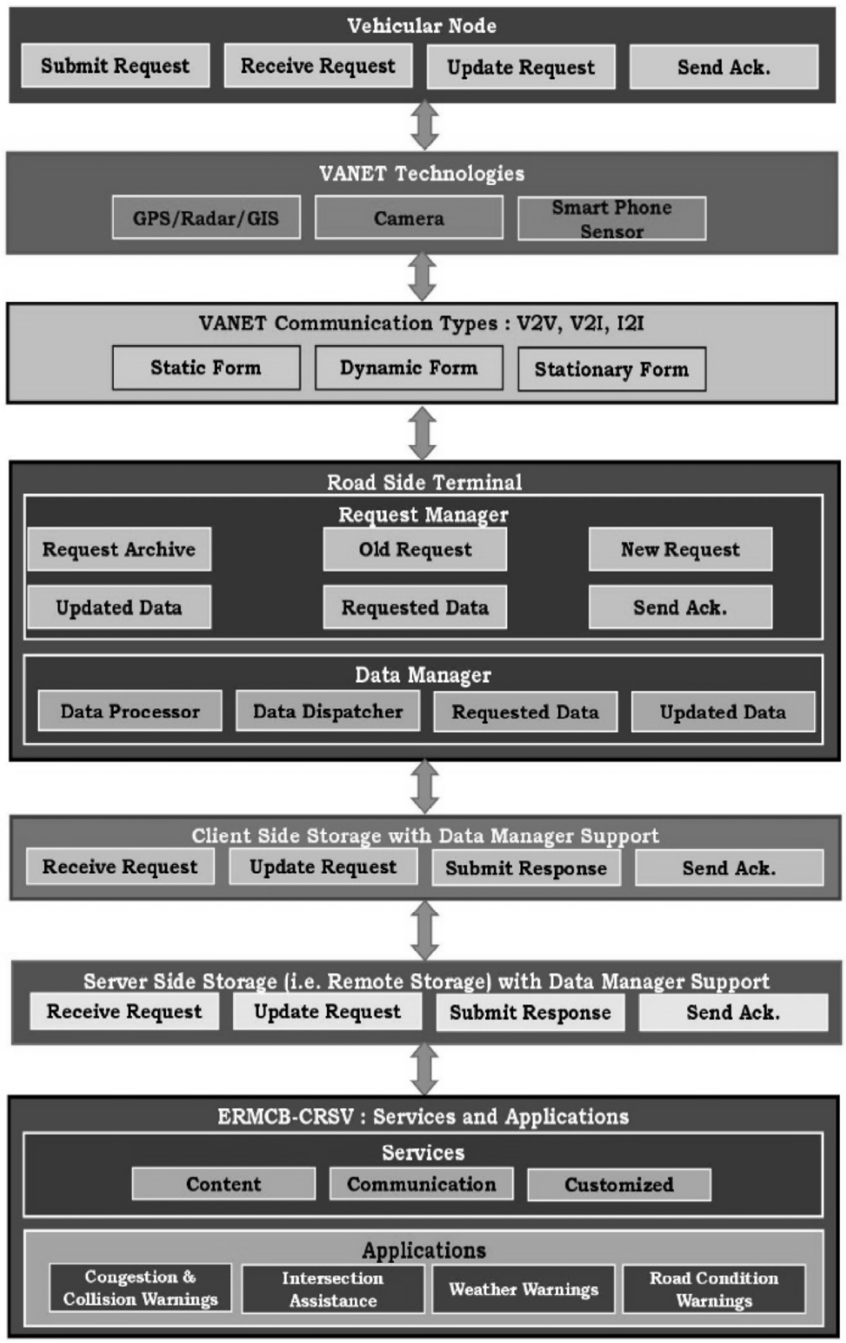

Figure 4: ERMCB-CRSV Framework

This framework has different stages like user, application, computational layer, router/node, client storage and remote storage. The user may be a vehicular node with different technologies like GPS, Radar, Smart Phone Sensor, GIS unit, Camera and Driver assistance. The application is designed to access Traffic, Weather forecast, Roadmap and Road condition by providing proper routing information. The computational layer is designed to support V2V, V2I and I2I communication. The router/node does the Route discovery, Route Maintenance, Connection breakage and Connection repair. The CS-CBAODV acts as a client storage to process data, dispatch data and to store data locally. The RS-CBAODV acts as same as CS-CBAODV but it is used to store data in remote storage server.

6. RESULT AND DISCUSSION

Initially, there are several research challenges are faced to develop this framework like Architectural, functional, operational and policy, safe and secure drive, and congestion. This framework is a best solution for issues like congestion, weather warnings, road conditions, collision warnings and intersection assistance [17].

Table 1
Simulation Parameter

Simulation Parameter	*Value*
Tool	NS2 – 2.34 and MOVE
Time	300s
Network Boundary	670m x 670m
Nodes	10, 20, 30, 40 and 50
Frequency	100m
Data Packet	512 bytes
Movement	Random
Routing Protocol	AODV, CBAODV, CS-AODV and RS-AODV
Antenna Model	Omni Antenna
Radio Propagation	Two Way Ground

Simulation: The simulation values are given in Table 1 and the NS2 simulation environment is given in Figure 5. The output of proposed reactive routing mechanism is simulated using NS2 and the results are compared with the traditional AODV routing algorithm based on varying number of nodes (Table 2).

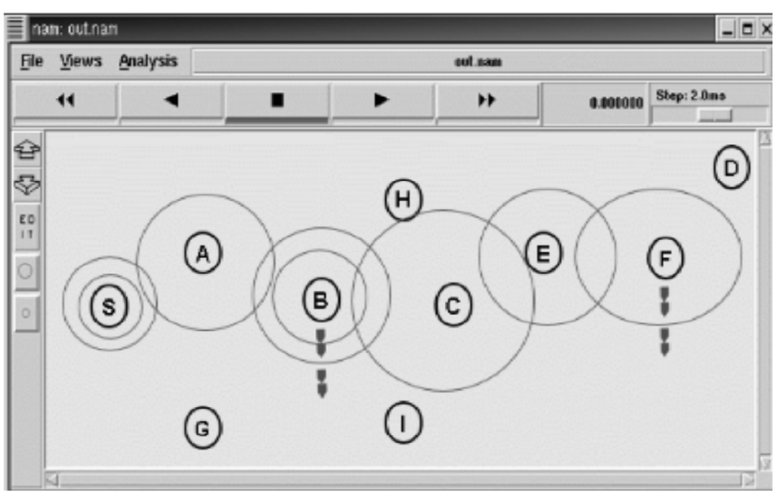

Figure 5: NS2 Simulation

The following are the impact of the proposed reactive routing mechanisms:

CBAODV: In CBAODV, the RST is made as a static vehicular node and placed in the network to support the dynamic vehicular nodes. This RST will bridge the connection between the vehicles by delivering the right routing information to the requests received. As a result, data loss can be reduced and it strengthens the network and the connection breakage is improved when it is compared to the AODV protocol.

CS-CBAODV: In this mechanism, the routing information is stored permanently in the client side to reduce the connection breakage between the vehicles. To carry out this, RSTs are used as a static vehicular node with storage option. The performance analysis shows that CS-CBAODV increases the quality of the network and decrease in the data loss when it is compared with CBAODV protocol.

RS-CBAODV: In RS-CBAODV, RST will support only to the nearby vehicles to deliver the stored client side routing information. But, when the complete network is taken to Remote storage means it will have the complete control to deliver the routing information to all the RSTs. To store data in remote side, the remote storage concept is used to deliver the routing information to all the RSTs. Then, the RST will act as client storage to deliver the routing information to the nearby vehicles. In this mechanism, the transmission of routing information using remote storage increases the data delivery and reduces the data loss when it is compared with CS-CBAODV protocol.

ERMCB-CRSV: This framework is developed to integrate all the proposed algorithms to reduce connection breakage in the VANET with vehicular cloud characteristics. As an outcome of this research paper, this framework reduces connection breakage in the cloud based vehicular network by providing real time routing information to all the vehicular nodes with the help of proposed algorithms.

Table 2
Varying number of nodes

Nodes	*Packet Delivery Ratio*				*End to End Delay*				*Throughput*				*Control Overhead*			
	AODV	*CBAODV*	*CS-CBAODV*	*RS-CBAODV*	*AODV*	*CBAODV*	*CS-CBAODV*	*RS-CBAODV*	*AODV*	*CBAODV*	*CS-CBAODV*	*RS-CBAODV*	*AODV*	*CBAODV*	*CS-CBAODV*	*RS-CBAODV*
10	89.56	92.36	94.58	98.14	0.18	0.17	0.12	0.08	42819	53159	61897	84562	69	65	59	48
20	79.64	82.27	86.39	89.64	0.27	0.21	0.19	0.13	36921	49354	58529	74935	62	59	52	48
30	62.81	67.48	69.79	73.91	0.42	0.38	0.32	0.28	32154	39473	48694	62491	54	51	47	42
40	57.92	59.31	63.19	68.54	0.61	0.58	0.52	0.49	39795	49321	51936	58327	38	34	29	24
50	54.74	57.28	62.11	64.23	0.76	0.72	0.64	0.58	37632	41592	49965	51963	41	37	31	28

7. CONCLUSION

Reactive Routing mechanisms developed in this research paper are scalable and reduces connection breakage in VANET using client and server storage concepts. The proposed scheme utilizes the concept of AODV algorithm to resolve the connection breakage both locally and remotely. The source vehicular node searches the destination node with the help of RST. Therefore, this RST acts as static node to support client storage concept and it is used to back up the frequently requested routing information locally. In the absence of destination node, the RST will bridge the connection between the vehicular nodes. The remote storage is used to backup and monitors the routing information from various client storage servers. The simulated result gives better delivery of routing information to the destination, throughput and reduces overhead and delays on the network when compared to traditional mechanisms. The proposed mechanisms developed effectively by considering vehicular cloud concepts. In future, this ERMCB-CRSV framework could be implemented in the real time scenario.

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