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Throughput and Control Overhead Analysis using CBAODV Algorithm for Link Breakage in VANET

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ABSTRACT

Vehicular Ad hoc Networking (VANET) is a network that helps a vehicle to send information to neighboring vehicles, and data packets are transmitted from one vehicle to another vehicle. In VANET, Connection Breakage is an important issue in the existing routing protocols like Ad hoc On-demand Distance Vector (AODV), DSR, DSDV. In this paper, an analysis of Throughput and Control Overhead is done using our proposed CBAODV Algorithm. The CBAODV allows route discovery and route maintenance and it also reduces the connection breakage. The experimental results are very promising as the proposed algorithm exhibits superior performance with respect to traditional AODV routing algorithm in terms of QoS metrics like Throughput and Control Overhead. NS2 and MOVE tools are used as simulator to simulate the network and to prove the effectiveness of the research work.

Keywords: *VANET, Routing Protocol, AODV, Connection/Link Breakage, NS2, Move.*

1. INTRODUCTION

In VANET, each vehicle can act as a sender, receiver, and also as a router for data dissemination. It is a technology that is becoming a very interesting domain for research in computer science. The steps are taken to improve the quality of the data transmission and to reduce the risk in Connection Breakage (CB) or Link Failure (LF) or Link Breakage (LB) in VANET. This breakage in connection is also referred as link death. The breakage can happen when a vehicle is communicating with other vehicle or when a vehicle is communicating with the infrastructure like Road Side Terminals (RST). If there is any failure, the sender has to reuse the Route Discovery mechanism to find a route to the destination to deliver messages. Then the route has to be maintained without any breakage till the communication ends [1].

The structure of this research paper is organized as follows: The Related Work and a detailed explanation of AODV (Ad hoc On-demand Distance Vector) protocol is examined in Section II. Section III introduces the proposed Algorithm CBAODV. In Section IV the proposed model is simulated and the results are analyzed with QoS parameters to prove the effectiveness of the proposed work.

2. RELATED WORK

The traditional routing algorithms are insufficient to deliver the messages due to draft changes in the mobility, traffic patterns, density of the vehicles, and limitation of the nodes. Routing protocols are classified as Proactive, Reactive and Hybrid. The Proactive Protocols are like table driven which uses periodic updates about the routing information in the network. Eg. FSR, DSDV and OLSR. Reactive Protocols are like On Demand or Source initiated protocol which searches for the shortest path in the network to reach the destination. Eg. AODV, DSR and TORA. Hybrid protocols are used to decrease the control overhead of Proactive Protocols and also it will reduce the initial route discovery delay in Reactive Protocols. Eg. ZHLS, ZRP and HARP. [2, 3].

Ad hoc On-demand Distance Vector (AODV) routing protocol is used to find the path on an On-demand basis when a node wants to communicate with other node. The Source Node (SN) broadcasts a Route Requests (RREQs) to the nearby nodes. The Destination Node (DN) unicast a Route Replies (RREPs) to send the response and sets available to receive the data. When there is any Route Error (REER) to the source node. This protocol can support for large network and it also helps to solve the connection breakage problem [4].

Srinivasan et al. proposed an enhanced route maintenance mechanism in Route Stability and Energy Aware Routing (RSEA-AODV) protocol that accounts for both stability and energy metrics during route discovery, through cross layer approach for mobile ad hoc networks [5]. Shin et al.

proposed and compared Local Repair scheme in AODV-based Ad-Hoc networks. In case of link breakage, the route is managed by finding the next-to-next node to deliver the data [6]. Sarkar et al. proposed an AODV-based technique for quick and secure local recovery from link failures in MANETs. These techniques will also help to collect and manage the mobility information by extending current AOMDV [7].

3. PROPOSED METHOD

The breakage may happen during the communication 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 [8]. In such case, Road Side Terminals (RST) will act as a DN to deliver the updated information to the SN.

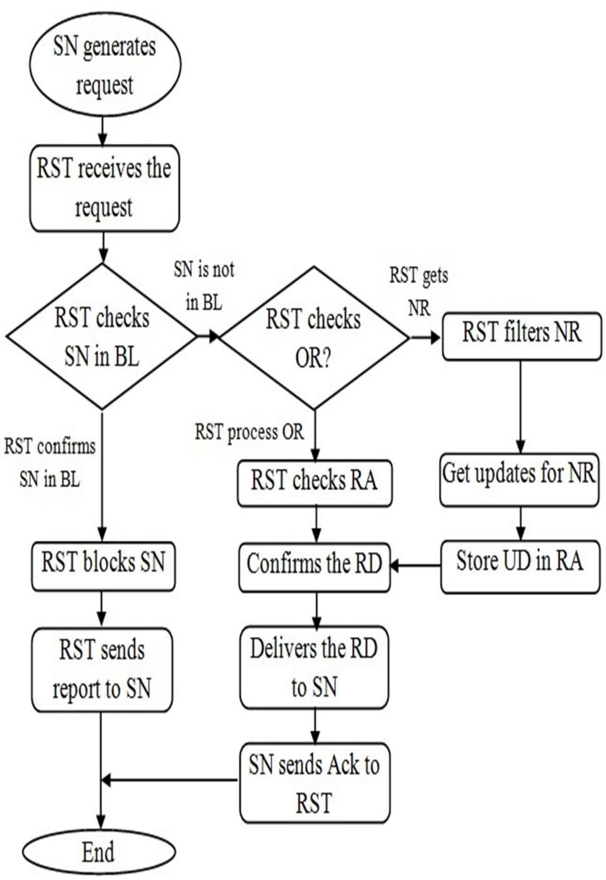

Fig. 1 CBAODV Flowchart

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. The breakage in communication is inspected by transmitting the hello messages periodically to the nearby nodes [9]. When RST receives the unwanted requests, it will treat the request as Spam and it is add the SN to the Blocked List (BL). To conflict breakage, the RST maintains the list of frequently received requests as Request Archive (RA). If the request is not new one means, 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 proposed CBAODV flowchart is represented in Fig.1 and the CBAODV algorithm is given below:-

Step 1: RST receives the request

Step 2: Classify request as Old Request (OR) and New Request (NR)

Step 3: Filter the requests and maintains Blocked List (BL)

Step 4: Maintains the frequent requests in Request Archive (RA)

```
if(OR)
{   RST will deliver the Requested Data (RD);
    SN sends ACK to RST;
}
else if(NR)
{   RST will deliver the Updated Data (UD);
    SN sends ACK to RST;
}
else
{   continue searching RST for data;
}
```

Step 5: Confirms the data deliver by receiving Acknowledgement (Ack).

4. IMPLEMENTATION AND ANALYSIS

The AODV protocol mechanism is selected for the implementation because it maintains the sequence number at the DN to determine the sender and to avoid breakage [10, 11]. It uses Time To Live (TTL) to find the destination node. This value is incremented when the search option begins with ring search method. The TTL values increases until the threshold value is reached. After implementing CBAODV, it gets the number of hops, sequence number and TTL to transfer the data. The different functions in AODV like Hello-Message i.e. AODV::sendHello(), Send Request and Forwarding Request are taken into consideration to implement the proposed model in VANET [12, 13]. The proposed algorithm CBAODV is compared with the existing AODV with respect to QoS parameters End-End Delay and Packet Delivery Ratio.

The simulation parameters are mentioned in Ta-ble 1 and topology for VANET simulation is represented in Fig. 2.

Table 1: Simulation Parameters

Simulation Parameter	Value
Tool	NS2 – 2.34 and MOVE
Time	300s
Pause Time	0s, 30s, 90s, 120s, 150s
Network Boundary (sq.m)	200, 400, 600, 800, 1000
Nodes	10,20,30,40,50
Connection Type	CBR/UDP
Frequency	100m
Data Packet	512 bytes
Node Movement	Random
Routing Protocol	AODV & CBAODV
Antenna Model	OmniAntenna
Radio Propagation	TwoWayGround
Type of Network	Mobile

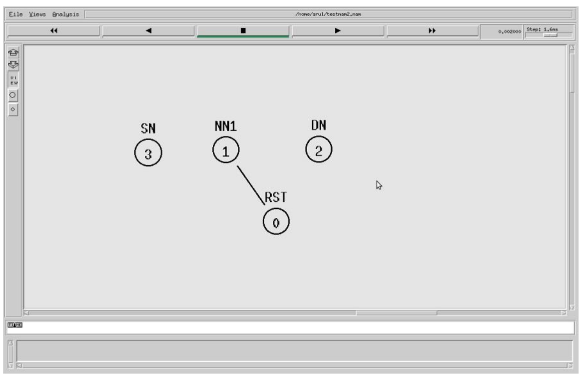

Fig. 2. Topology for VANET simulation using CBAODV in NS2

Throughput: It refers to the average data rate of the successful data or message delivery over a specific communication link [14]. The ratio of the number of packets received by Destination Node to the observation time duration.

Control Overhead: It is ratio of the control information sent to the actual data received at each node in VANET [15]. It also refers to the processing time required to transmit a data by a node, which includes all the supporting functions like node discovery, link maintenance, network size, network latency and data transmission.

4.1 Performance analysis of varying number of nodes

In this performance analysis, the number of nodes varies from 10 to 50. The nodes are incremented and the random scenarios are designed to analysis the output by changing the number of nodes. The proposed CBAODV gives more throughput and it faces only less routing overhead when it is compared with AODV model which is shown in Fig. 3 and 4.

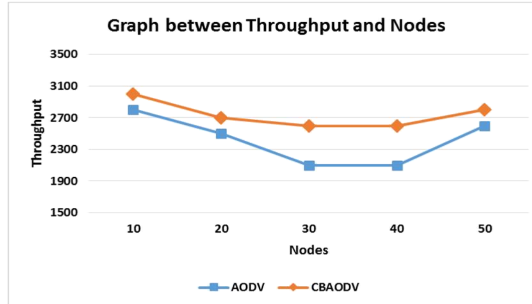

Fig. 3. Graph between Throughput and Nodes

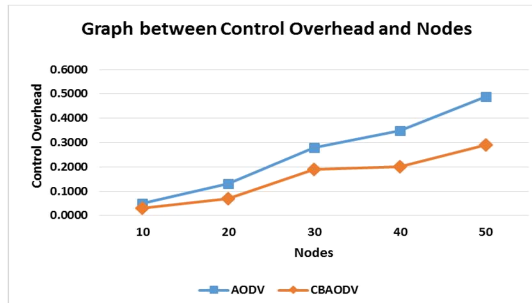

Fig. 4. Graph between Control Overhead and Nodes

4.2 Performance analysis of Varying pause time

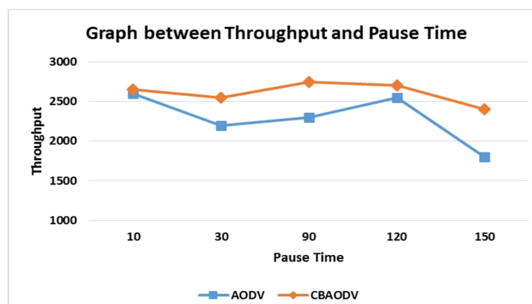

Fig. 5. Graph between Throughput and Pause Time

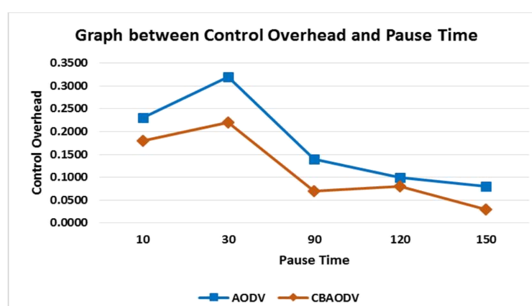

Fig. 6. Graph between Control Overhead and Pause Time

Here, each node in VANET environment has var-ious velocity and direction. The Random model is taken into consideration to create various mobility models. The different pause times like 10s, 30s, 90s, 120s and 150s are used to simulate the vehicular node. In this analysis, CBAODV gives more throughput in various pause time and it takes only less overhead when it is analyzed with AODV which is shown in Fig. 5 and 6.

4.3 Performance analysis of varying network size

In this analysis, the network size is taken in dif-ferent levels like 200X200 sqm, 400X400 sqm, 600X600 sqm, 800X800 sqm and 1000X1000 sqm and keeping the number of nodes fixed. The throughput level of CBAODV reduces when the network size increases but it gives better results when compared with AODV which is shown in Fig. 5.

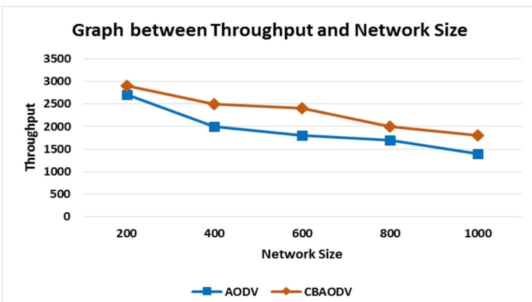

Fig. 7. Graph between Throughput and Network Size

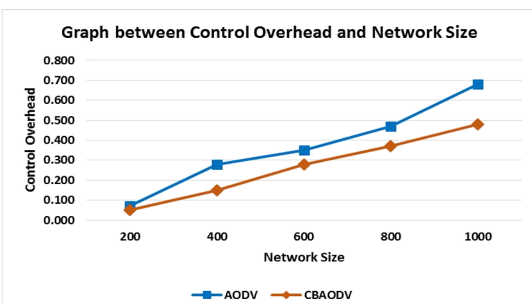

Fig. 8. Graph between Control Overhead and Network Size

4.4 Performance analysis of speed of a node

The speed of the node is changed in different lev-els like 5 m/s, 20 m/s, 40 m/s, 60 m/s and 80 m/s. The CBAODV protocol gives better results when it is compared to AODV. The Control overhead in CBAODV is also less when it is matched with AODV protocol which is shown in Fig. 6.

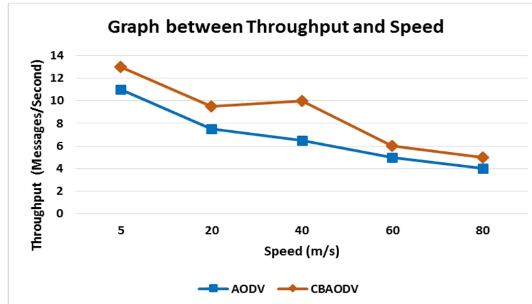

Fig. 9. Graph between Throughput and Speed

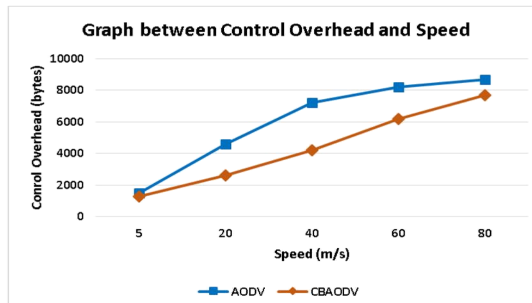

Fig. 10. Graph between Control Overhead and Speed

5. CONCLUSION AND FUTURE WORK

The proposed CBAODV model delivers better data with RST support with less connection breakage. This RST also acts as backup center for data as well as to store routing information and it reduces the complexity in data management. The metrics like Throughput and Control overhead is taken into consideration to analysis the per-formance of the network. The network is analyzed by changing the number of nodes, pause time, network size and speed of a node. Finally, the Result shows that CBAODV algorithm gives better results than the tradition-al AODV algorithm and it trim downs the delay experience in the data delivery. The proposed CBAODV algorithm produces high throughput and faces only less overhead in the network. As a future work, this idea could be combined or expanded with the cache mechanism in RST and with a cloud based server for storing remote data.

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