

## **VANET Simulation in Diffrent Indian City Scenario**

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### **Abstract**

One emerging, new type of ad-hoc network is the Vehicular Ad-Hoc Network (VANET), in which vehicles constitute the mobile nodes in the network. Due to the prohibitive cost of deploying and implementing such a system in real world, most research in VANET relies on simulations for evaluation. This paper presents a comparative test of various mobility scenarios of Vehicular Ad-hoc Network in three well-known Indian Metros. The AODV routing protocol have been used for the simulation. In order to make the comparisons three well known performance parameters have been considered these are packet-drop, throughput and total time taken by the simulator to simulate the given network. To carry out the simulation process an open source simulator tool is used for this study namely-NCTUns-6.0. With suitable simulation set-up the simulation has been performed. Based on the simulation result of the above mentioned protocol, the output have been compared for different mobility patters for three Indian Metros(Kolkata, Chennai and Mumbai).

**Keywords:** VANET; Ad- hoc network; Performance; Throughput; Packet Drop; Packet Collision; NCTUns6.0 network simulator.

### **1. Introduction**

Vehicular Ad-Hoc Network (VANET) communication has recently become an increasingly popular research topic in the area of wireless networking as well as the

automotive industries. The goal of VANET research is to develop a vehicular communication system to enable quick and cost efficient distribution of data for the benefit of passengers' safety and comfort.

The real life scenario on VANET on the basis of running has been performed in the references(1-6). Here we have observed that those real life simulation on VANET is done on the basis of routing. Therefore, we attempt to find out the result on the over populated scenario like Indian scenario.

We try to find out the best performance of VANET on scenarios on the basis of Ad-hoc routing. The only precondition is that all vehicles should be equipped with mobile communicating device and sensor device and those are much cheaper than agent based or infrastructure based VANET.

#### 1.1 ROUTING PROTOCOL

AODV maintains and uses an efficient method of routing that reduces network load by broadcasting route discovery mechanism and by dynamically updating routing information at each intermediate node. Route discovery in AODV can be done by sending RREQ (Route Request) from a node when it requires a route to send the data to a particular destination. After sending RREQ, node then waits for the RREP (Route Reply) and if it does not receive any RREP within a given time period.

## 2. Research Methodology Used

To complete out the experiment discussed in this paper NCTUns-6.0 simulation tool is used. The scenarios used for analysis, simulation setup, performance metrics used for making various comparisons are discussed in this section.

### 2.1 Simulation Tool Used

In order to complete a simulation work for vehicular networks we need two basic simulator types are required namely-network and traffic simulator. But in this study we use a hybrid simulator is used which provides an integration of both network and traffic simulator.

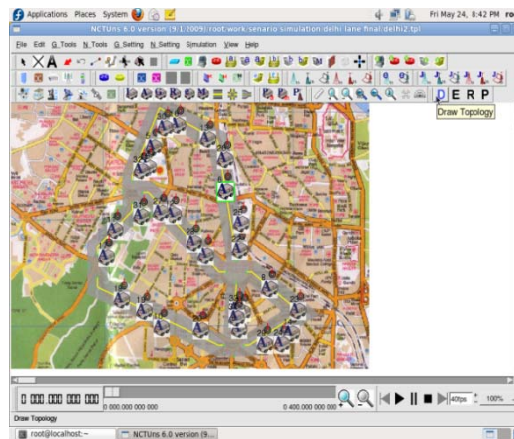
The hybrid simulator used is NCTUns-6.0(National Chiao Tung University Network Simulator) whose core technology is based on the novel kernel re-entering methodology invented by Prof. S.Y. Wang [9]. The wide range of various features of VANET supported by NCTUns-6.0 makes it an obvious choice for this study.

The first step for simulation setup is to create Vehicular Ad Hoc Network. We designed two different networks for evaluation of routing protocols. Network is created by using blank project workspace that is provided by NCTUns6.0 network simulator. For simulation setup for VANET we followed following mentioned steps [7][8]:

#### 1) Draw Topology

In Figure 1 the step we designed roads networks and select the total number of nodes. First we designed the roads by selecting the appropriate icons for road design

that is provided by NCTUns6.0 network simulator. Total length of the roads network also defined in this step. These nodes are highly mobile and we have selected vehicular nodes as it is required by the network. Roads are designed according to real situation for the movement of vehicular nodes .



**Figure 1:** Snap shot of the simulator on draw mode of Delhi Traffic scenario.

## 2) Edit properties

It is the most important step for our simulation setup. In this step we assigned different values in each parameter of vehicular nodes and configured each parameter that is provided by NCTUns6.0 network simulator. Besides these node settings other important settings for simulation and communication among various nodes such that defining the total simulation time, signal selection, implementation of routing protocols for communication, communication type etc.

## 3) Simulation

After making necessary changes in vehicular nodes, network environment and tools we run the simulation to generate the results.

# 3. Proposed Analysys

## 3.1 Performance metrics

Different performance metrics are used to check the performance of routing protocols in various network environments. In our study we have selected throughput and packet drop to check the performance of VANET routing protocols against each other. The reason for the selection of these performance metrics is to check the performance of routing protocols in highly mobile environment of VANET. Moreover, these performance metrics are used to check the effectiveness of VANET routing protocols i.e. how well the protocol deliver packets and how well the algorithm for a routing

protocol performs in order to discover the route towards destination. The selected metrics for routing protocols evaluation are as follows[6][9].

### 3.1.1 Throughput

Throughput is the average number of successfully delivered data packets on a communication network or network node. In other words throughput describes as the total number of received packets at the destination out of total transmitted packets [6]. Throughput is calculated in bytes/sec or data packets per second. The simulation result for throughput in NCTUns6.0 shows the total received packets at destination in KB/Sec, mathematically throughput is shown as follows:

$$\text{Throughput (bytes/sec)} = \frac{\text{Total number of received packets at destination} * \text{packet size}}{\text{Total simulation time}} \text{ kb/sec}$$

### 3.1.2 Packet Drop

Packet drop shows total number of data packets that could not reach destination successfully. The reason for packet drop may arise due to congestion, faulty hardware and queue overflow etc. Packet drop affects the network performance by consuming time and more bandwidth to resend a packet. Lower packet drop rate shows higher protocol performance.

### 3.1.3 Collision

The Collision of data packet is the number of packets collides to each other due to congestion. It affects the performance directly on the bandwidth. Lower packet collision rate shows higher protocol performance.

## 4. Testing and Results

### 4.1 Scenario

We have considered three different congested City map(Figure 2-4) of India from website[11] and we draw the two lane road on the map on the simulator. Next we place the 30car on each scenario map.

#### 1) Senario:1



Figure 2: Kolkata Scenario.

## 2) Senario:2



**Figure 3:** Delhi Scenario.

## 3) Senario:3



**Figure 4:** Mumbai Scenario.

## 4.2 Simulation Setup

In this simulation study we selected the following table[1] network parameters and tools for vehicular nodes and communication among them and Radio obstacles are set for the interruption of signals in city scenario.

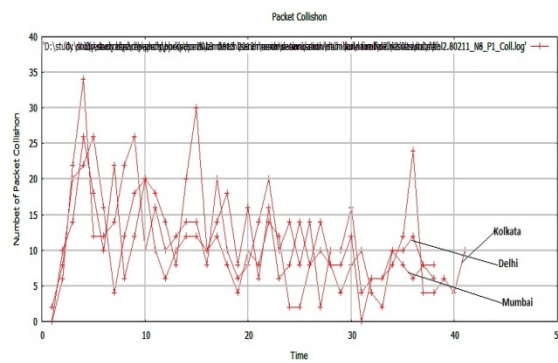
We adopted the AODV Ad-hoc routing protocol as it is believed to be the best routing protocol for VANET scenario. It is adaptive along with distance vector based in nature based on traffic density and scenario.

**Table 1:** Input parameter for three different city scenario.

| Parameter         | Settings  |
|-------------------|-----------|
| Transmission mode | TCP/IP    |
| Lane Width        | 20m       |
| Simulation time   | 40sec     |
| RTS threshold     | 3000bytes |

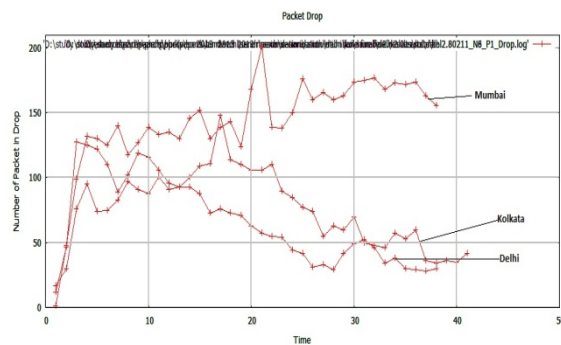
|                                                 |                                        |
|-------------------------------------------------|----------------------------------------|
| The car profile (Taken five)                    | 18km/H, 36km/H, 50km/H, 60km/H, 80km/H |
| Number of lane                                  | 2                                      |
| The protocol                                    | AODV                                   |
| standard used for each vehicular node           | IEEE802.11b                            |
| cars are selected for three different scenarios | 30                                     |
| Transmission power used                         | 15dbm                                  |

### 4.3 Results



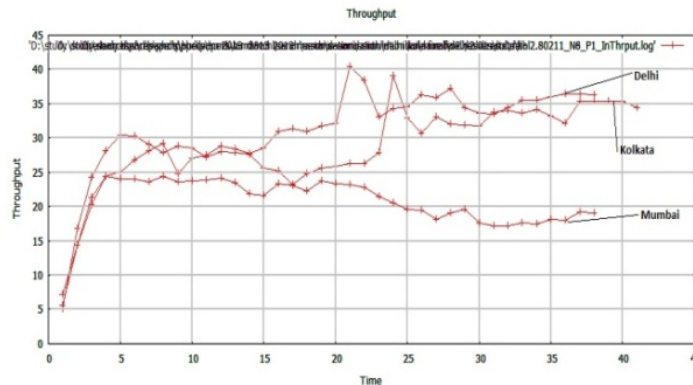
**Figure 5:** Number of packet collision vs time.

In Figure5 we got a packet collision variation against time in second. We got highest packet collision in Mumbai scenario. It is around 30pkt/sec on average. The packet collision rate is much lower in other two scenario (Delhi and Kolkata). Therefore it clearly indicates that dance traffic situation have less collision due to inter vehicle distance is less.



**Figure.6:** Number of Packet drop vs time.

In Figure6 we got highest packet drop is in Mumbai compared to Kolkata and Delhi. As we Mumbai traffic scenario is more scattered and less congested, more mobility ; compared to other two scenario, it is expected that the packet drop will be more.



**Figure 7:** Throughput vs time.

In Figure 7 we got highest throughput in kb/sec in Delhi scenario compared to other two scenario as it expected according to previous two figure (5,6).

#### 4.2 Observation

The Figures above show the performance of AODV protocol in respect of chosen performance metrics. The Figure 5 represents the number of packet collision vs time it is found that there is some variation in the packet collision during the simulation time and this variation remain almost same for the mobility scenarios of VANET. Where in Figure 6 number of packet drop vs time is shown for all three different scenarios. Here we found that packet drop is much high in Mumbai scenario as the vehicles are much scattered in Mumbai scenario in comparison to Delhi and Kolkata. The packet drop will be more as the distance will increase in between different cars at Mumbai scenario. Finally we have observed that the throughput [Figure 7] is best at Dellhi scenario than Kolkata and Mumbai as the number of packet drop is less in Dellhi due to more mesh structure, than Mumbai, Kolkata.

Therefore we have got better result in Kolkata and Delhi than Mumbai. Even Delhi have highest throughput. Here we got more mesh structure of traffic scenario at Kolkata and Delhi than Mumbai, therefore we got better result as we run Ad-hoc protocol(AODV), which works better in close distance and mesh type network.

### 5. Conclution and Future Work

It is found that low packet Collision in Delhi and Mumbai compared to Kolkata and the packet drop performance in metro scenarios with AODV protocol Mumbai

outperforms Delhi and Kolkata. With increasing speed the packet drop rate increases compared. In city scenario the throughput performance Kolkata and Delhi remains high in comparison to Mumbai. With the increasing speed of the vehicles the throughput remains unaltered

We try to simulate other routing protocols (ADV, DSR, ADV) to study the mobility VANET scenarios in various metros to have a comparative picture for them.

## 6. Acknowledgement

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