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# Handover Enhancement in Vehicular Ad-Hoc Network

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**Abstract:**
*Vehicular ad hoc networks (VANET) have been one of the important areas of research in both automobile industry and academia in many aspects such as information and services, communication infrastructure, broadcasting, security, and routing for over the last decade. An important aspect of VANET which has been overlooked is the "Handover Performance". Vehicles move at a variable high speed, which affects the Handover Quality of Service (QoS) in VANET, this is an ongoing research, seamless and efficient method is yet to be provided to utilise communication channels to reduce packet drop and collision and increase the amount of throughput. For example, when new traffic is introduced into the system, the performance drops. Performance factors such as packet drop, packet collision and throughput have been analysed in this paper in order to enhance the QoS in VANET. Based on the simulations used, a routing protocol (Routing Rule) was used to enhance the performance, finally results are presented and analysed.*

**Keywords:** VANET, QOS, Handover, WAVE, IEEE 802.11p, Dedicated Short-Range Communication (DSRC) Vehicle to Vehicle (V2V), Vehicle to Infrastructure(V2I), Roadside Unit (RSU)

## INTRODUCTION

An emergent development in the Network technology and one of the important academia and automobile industry research for over the last decade is VANET. VANET is an unstructured spontaneous network, using nearby vehicle to vehicle communication and infrastructure, alongside the availability of frequent change of topology because of vehicles with high speed. However, many have been involved in research concerning the issues in VANET, which include Information and Services Communication, Infrastructure, Broadcasting and Security and Routing among others. Hence, little have been done and accomplished in the overlooked Stimulating problem in VANET which is the handover QoS optimization to provide an efficient communication in VANET to reduce or eliminate the total loss/dropping of packets, improvement of packets delay, packets drop, collision and

Variance, enhancement of throughput, packet delivery ratio, bandwidth utilisation and latency of data and ideal channel utilisation. It is unknowingly assumed that handover does not affect the handover performance in VANET [1] [2] The recent fifth-generation cellular system (5G) innovations have enabled VANET a capable paradigm and the likelihood of remote wireless attack on an in-vehicle network [19][12].

VANETs are a subnet of MANETs. They are using the Mobile Ad-Hoc Networks (MANETs) principles, wireless networks created consciously to the domain of vehicles for data exchange in certain coverage.[13] VANET application requires internet therefore the IPV6 stack for application use to attract business investors for infotainment applications. It is essential to provide the ability for vehicles to have efficient and seamless connectivity and channel utilisation while having communication and access to available applications and services [2][9], as Vehicles in the modern transportation era help and play a vital role in some of our daily life activities. It is a necessity for commuters to use vehicles safely, luxuriously and time efficiently.

As the number of vehicles increases, the rate of accidents, traffic, and pollution increases among others are becoming increasingly challenging to the authorities (Road and Traffic Management). Issues during handover occur such as handover delay, end to end delay and the throughput network leads to bottleneck in the network as advanced vehicles are now introduced to the roads of VANETs, [21]

A statistics report by the United State Department of Transportation (USDOT) and National Highway Traffic Safety Administration of the U.S. Department of Transportation, Estimate 20,160 people died in car accidents, an increase of 18.4% from 2020 Motor Vehicle Traffic Fatalities January June of 2021 the biggest six-month increase ever seen in the history of the Fatality Analysis Reporting System. More than 6 million road accidents happen due to congestion, 40% occur at an intersection, negligence, among others claiming over Three million people casualties Two million with permanent accident damage. People waste 40 hours weekly on traffic, more than 8.4 billion gallons' fuel/gas lost [3]. Similarly, a recent study report by National Statistics from the Department of Transportation in the United Kingdom, shows that as the traffic increases by 1.5%, about 185,010 casualties were involved in an accident United State Department of Transportation dropped by 2% in comparison to June 2015. Also, the number of people killed or had permanent/serious injuries in accidents are about 24,620 people. The figures increase by 3% in comparison to the year 2015 [4] With the global warming and environmental challenges today, there is a need to provide a solution to such challenges. The Intelligent Transport System (ITS) is using connected vehicles to help in providing solutions [5][18].

VANET communication is based on the license ITS band transmitting at the rate of 3Mbps-27 Mbps within 1000 Meters (1 Kilometre) range and 161.56 Mph (200Km/h) speed maximum is supported by DSRC [5]. A particularly intriguing problem for vehicular ad hoc networks (VANET) is how to exchange and communicate information among vehicles. For VANET, IEEE802.11p has been recommended for short- to medium-range communication to support the characteristics of vehicle frameworks thus, Established connections experience numerous disruptions by high mobility attributes of the vehicles [21]. During handoff the connection that has been established between the vehicle and the network should remain intact to maintain seamless connectivity. It is also necessary to bring about reduction in packet loss and handover delay. Vehicles move from one network region to another handoff is to be stable and seamless to avoid handover delay and reduce packet loss [20].

The necessities and importance of low latency and high data in the mobile environment are the properties that present challenges to the application design and protocols in VANET. Based on the V2V and V2I communication using the Dedicated Short-Range Communication (DSRC) in equipped VANET vehicles to accomplish the Detection and Collision Avoidance, Traffic Analysis and Vehicle Positioning, these problems are now attracting the attention on the use of VANET to find a suitable solution. Therefore, ISO TC204 and IEEE 1604 working group, ITS Technical committee and IEEE 802.11p task group have been created.

An approach to provide solutions and to enhance and provide seamless and efficient QOS Handovers in the VANET system using the simulation environment and analyse the results is the aim of the research.

With the objectives of: -

- Improving the performance of handover techniques used in VANET and
- Improve the traffic analysis and collision control, enhance Throughput, bandwidth utilisation, and minimise the amount of drop packets in VANET systems.

The rest of this paper is organised as follows. Section II provides a brief overview of the related area and the contribution provided. Section III provides the methodology, implementation, and simulations (scenarios) performed/created, whereas in Section IV the results obtained from the scenarios are presented and discreetly evaluated and discussed in Section V. Section VI presents the conclusion and the suggestion of future work.

## BACKGROUND OF THE RESEARCH

VANET is a new emerging technology with standards used to simplify, develop, help in cost minimisation, guarantee interoperability, interconnectivity and enable the implementation of a new technology to be successful. Therefore, among the standard protocols in VANET relating to Wireless Access in Vehicular Access (WAVE) range from communication protocol, security, interoperability, addressing and routing, and transponder equipment are set: -

- DSRC
- IEEE 1906 – WAVE standard (IEEE 802.11p)

"The capability of a network towards providing a better performance/service over different technologies in selecting network traffic, nevertheless, the overall performance or service which are provided by network specifically those which users can notice or see, the services either guaranteed in advance or enhanced for continuous transmission of network services" [6] can be referred to as QOS which help in providing Traffic prioritisation, resource reservation and allocation, control mechanism to users, data flow [6][14]. The services/performance have various challenges which include Availability, Bit Rate, Channel Estimation, Channel Variation, Error Rate, Frequency Selective Fading, Multipath/Multi Lane Challenges Like Delay Spread, Network Coverage Area, Rayleigh Fading, Transmission Delay, Throughput. The safety application communication will be unsuitable as it requires a rapid and short communication mediums access for scanning and handshake initiation and it will make the handover application unsuited, WAVE mode is used to tackle this issue [7][17]. WAVE network response using high speed and its robust failure to act will disturb life and property and may cause danger. It is an essential network which has challenges on the Physical Layer (PHY), among the challenges include Collision Avoidance between vehicles with high mobility affecting the QOS. The parameters of the PHY have been changed to solve the issue. Since Tight Latency is necessary and allowed 50Ms-100Ms for safety application to communicate, and other application are permitted to use more than 100Ms by as defined by IEEE 802.11p, Orthogonal Frequency Division Multiplexing (OFDM) is very sensitive to the carrier offset and as a result, packets error rate increases and also cause lower channel capacity, Doppler spread are used to solve the problem by speeding the Doppler's on OFDM to decrease the interference [8]. Parameters of the PHY have been changed in order to solve the problem but not totally solved. Sub-Carrier has been divided into two (OFDM uses 48 sub-carriers while others are used for pilot carrier and data transmission), when IEEE 802.11p uses the sub-carriers but divides (3MPs-27MPs) the bandwidth per channel from 20 MHz to 10 MHz and doubled the time domain parameters in IEEE 802.11a. After making some possible adjustments to the (Integrated Services) IntServ and (Differentiated Services) DiffServ models to provide QOS, another Proposals to provide QOS based on the networks Layers' modification (Layer 2 and Layer 3) were proposed by using Multiprotocol Label Switching (MPLS) modifying the Layer 2 to improve the amount of throughput, end to end delay and reduce the amount of packets lost [8] Due to the unreliability of V2V communication, an urban area with a large number of RSU is used transmitting data via "Roadside Backbone Network (RBN): Multiprotocol Label Switching (MLPS) domain" [8]. An international scale of handover technique is a key, but ample researchers are dedicating time on urban areas, and limited attention is put on a large area [1]. Nonetheless, a heterogeneous mobile networking architecture to provide an international scale of "ubiquitous heterogeneous communication" in VANET system is used by [2], The speed of the vehicle, size of beacon and beacon frequency were observed in providing an ideal channel utilisation and having the best unified connectivity by providing [1] framework was also used to examine problems in handover [1][2].

However, *[10]* used a clustering algorithm: "Quality of Service Optimised Link State Routing (QOS-OLSR)", accomplishing the requirements and Providing a firm communication and firm clusters and linking the failures.
Hence [10] findings ignore high speed mobility controls constraints because it is a dedicated-on behalf of MANET (Mobile Ad Hoc Network) because the algorithm used in the finding is -based algorithm. Mobility based algorithms is an algorithm which fails to consider the major VANET applications amongst which are the Safety application, emergency application and entertainment application (multimedia) [10] Furthermore, proposed heterogeneous network schemes, using mobility engages in mobile network via Internet Service providers(ISP) and uses multiple mobile routers based handover scheme in vehicle (destined packets are received by Mobile router, packet loss is reduced because they provide no disruption of service to each other). [19]

Media communication can be transmitted over heterogeneous wireless access networks not only to achieve overall load balancing among all access points, but also to maximize the data throughput of all networks [9]. To enhance network`s performance and handover performance [18] uses a vertical handover mechanism, denoted Proxy MIPv6-based Mobile Internal Vertical Handover (PMIP-MIVH).

The proposed architecture scheme in [9] mobile network mobility in heterogeneous networks is provided seamlessly. Multiple home agents from different administrative domains are included in Multiple Mobile Router Architecture, IPS provides mobility and handover is performed smoothly. A seamless mobility across the network in the proposed architecture was provided by [11]. Throughput, packet loss, signal overhead, handover latency, interference/disruption time were enhanced; reception of overlapped packets without reducing the latency of handover, packers received from different Access routers help in minimising the loss of packets in handover [11]. A proposed Leader-based scheme assumes the use of Dynamic.[15]

Host Configuration Protocol (DHCP) server, DHCP is an automatically configured protocol, proposed exploits VANET and a stable and rapid address configuration is provided by the leader-based scheme. Since it assumes DHCP, it is a proactive protocol and has an issue of control message overhead [11]. There have been other proposed protocols like

Network Mobility (NEMO), Global Mobility Management (GMM), GMM is proposed to be used for vehicular handover in inter-VANET. The proposed schemes based on Mobile Internet Protocol Version 6 (MIPv6) have a common problem due to the issue of vehicle mobility, is the latency in handover, sending and receiving of packets within the time interval for vehicles during handover is not achieved [11][16].

## METHODOLOGY

Source-Source Destination-Destination (SSDD) protocol was used for the enhancement of VANET Handover in this paper. In kernel space of the EstiNet Network Simulator and Emulator (EstiNet) architecture, Real-life IP protocol stack is used to make IP Packets forward/routing accurate unlike the direct forwarding/routing function used by the kernel, the routing scheme is modified [12].

We introduce a new handover optimization technique, a mobility prediction algorithm coupled with previous handover events logs was used to predict when and where the handover will take place. [1] "This mechanism is identifying the routing rule of each node in one computer. So, the user needs to know how to configure the routing rule by S.S.D.D and need to know how to get the tunnel id". When IP data such as handover data is requested by a node, it switches control channel to one service channel periodically. The IEEE 80211P module-based car has one physical module as shown in Figure , a single-PHY, as the following picture shows and Supports six service channels (172, 174, 176, 180, 182, 184) and one control channel (178).

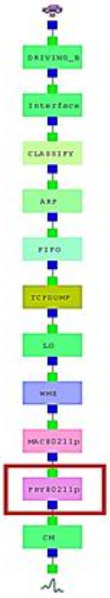


**Figure 1**, IEEE 80211P Module-Based Car Physical Module

When two subnets (1 and 2) are connected to an Ethernet router using Class C IP Address; 1.0.1.0/24s (subnet 1) 1.0.2.0/24 (subnet 2) with host tunnel interface as tun1, the other interface is connected to subnet 2, its tunnel interface is tun4 and IP address is 1.0.2.2. In other words, when two OBUs (OBU 1 and OBU 2) connected to the server (Host) via the RSUs. [12].

Bash script files are installed on each OBU application setting program to execute the SSDD protocol. The files are saved in the topology configuration directory and another copy of the files are saved in the dir /usr/local/estinet/tools.

*Example of a script is as follows below:*
***NODE8***

```
#!/bin/bash
ip route del 1.4.3.0/24 via 1.4.1.3
# this line is sending a permission to delete
# the IP address 1.4.1.3
 ip route add 1.4.3.0/24 via 1.4.1.2 dev tun8
# this line is adding a new IP address 1.4.1.2
# the tun8 is the tunnel interface
```

The first two codes indicate the routing rule for Node 8 *(1.4.1.3)* *the whole kernel has only one routing table, thus* each node is required to have a routing rule,

***ip route del 1.4.3.0/24 via 1.4.1.3(****1.4.1.3)*
(1.4.1.3) indicates destination IP (1.4.1.3), that is, the Ethernet interface of RSU4.
***ip route add 1.4.3.0/24 via 1.4.1.2 dev tun8***
And "1.4.3.0" indicates that the source (node8, IP:1.0.1.4) is going to the subnet of 1.0.3.0.
As a result, the meaning of the first routing rule is to delete one exit routing rule: ***1.0.1.4 go to 1.0.3.0 subnet via 1.0.1.1.***

To avoid conflict, The script is adding and removing the IP Address record, the OBU is initiating handover and helping the nodes identify one another. Tun1 is used to send an outgoing packet directly if the destination of an outgoing Packet is the same subnet as host 1 (if outgoing packet's destination IP address is 1.0.1.2.) If the IP address of an outgoing packet destination is in a different subnet such as 1.0.2.1 or

1.0.2.2, it is sent to the gateway interface. Host 1, Host 2 and The Router use the rules to set the routing entries.

- The last two octets of the Host /node output tunnel interface IP are used to replace the first two octets of the Host/Node IP address.
- The router has two tunnel interfaces and as a result the number of routing entries doubled.
- The tunnel IP address is used to change the IP address of one another.

SSDD makes use of the third and fourth octets of the tunnel Interface IP Address when identifying the tunnel interface and the first octets and second octets are ignored. The first octet is set as (0*01 in hex), and the second octet is set as (0*00 in hex) by default in EstiNet [12]. Using the Routing rule setting, single direction handover is achieved appropriately. It is a single direction because the topology traffic is UDP package; from OBU Node8 to RSU Node 3) "IPs in EstiNet simulator are of an exclusive format".[1]

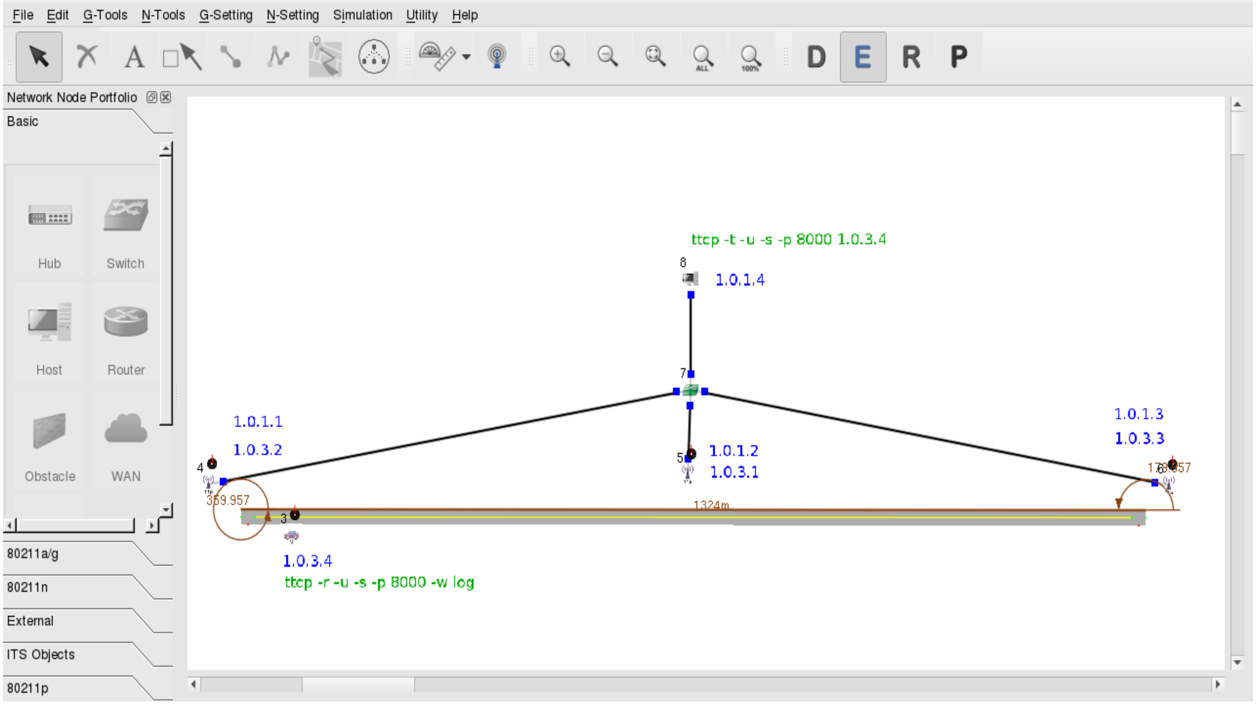
## RESULTS AND DISCUSSION

Analysing and Evaluating VANET QOS in this paper include: -

i. Dropped Packets
ii. Throughput

At the following time(sec) in the simulations, 31.00, 61.00, 96.00, 131.00, 171.00, 201.00, 241.00, 281.00 the routing rule has been set to switch the OBU from one RSU to (next RSU in range) i.e., during handover.

### First Topology



```
ttcp -t -u -s -p 8000 1.0.3.4
```

```
ttcp -r -u -s -p 8000 -w log
```

Figure 2

**S**imulation interface of EstiNet First Topology Setup.

Table 1 below shows the time OBU executes the handover from the script file, and the number of Drop packets, and Throughput rate. Whereas figure 2 shows the combined Graphical representation of dropped packets, and the throughput output of First Topology.

***Table 1 Showing Values of the Dropped, and Throughput packet* in the first topology *during handover.***

| **Time (Sec)** | **Drop Packet** | **Throughput (Kb/S)** |
|---|---|---|
| 31.00 | 64 | 199.434 |
| 61.00 | 53 | 148.016 |
| 96.00 | 55 | 151.298 |
| 131.00 | 16 | 214.75 |
| 171.00 | 44 | 167.708 |
| 201.00 | 33 | 179.742 |
| 241.00 | 60 | 131.606 |
| 281.00 | 28 | 195.058 |

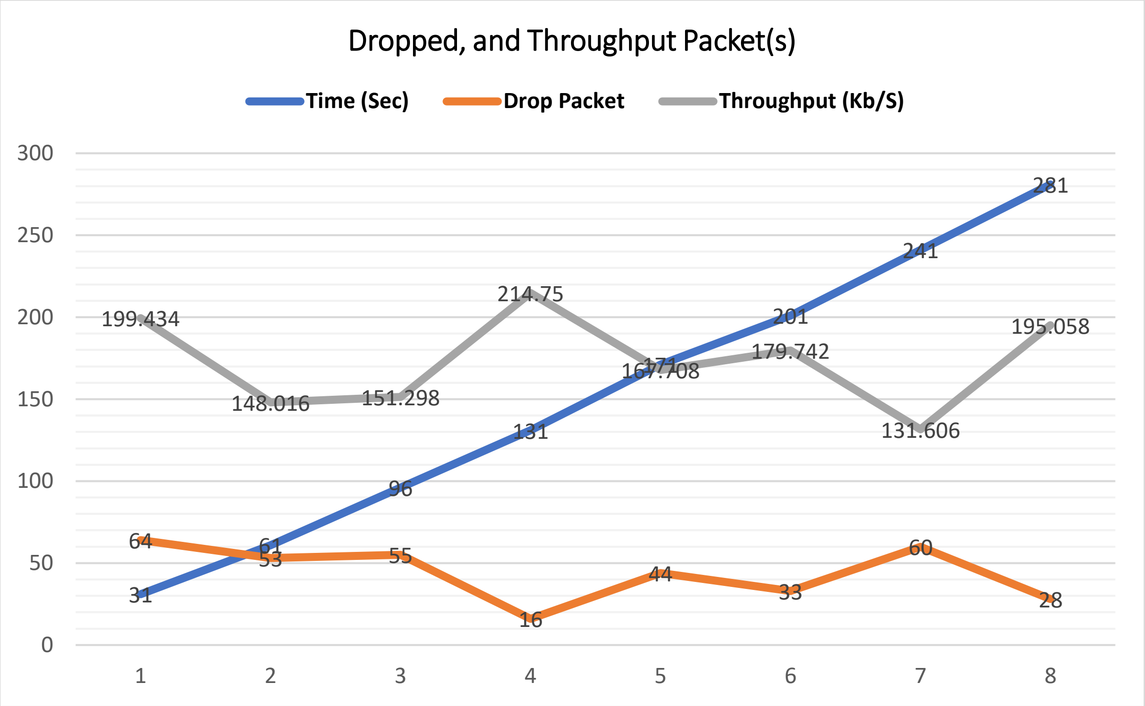
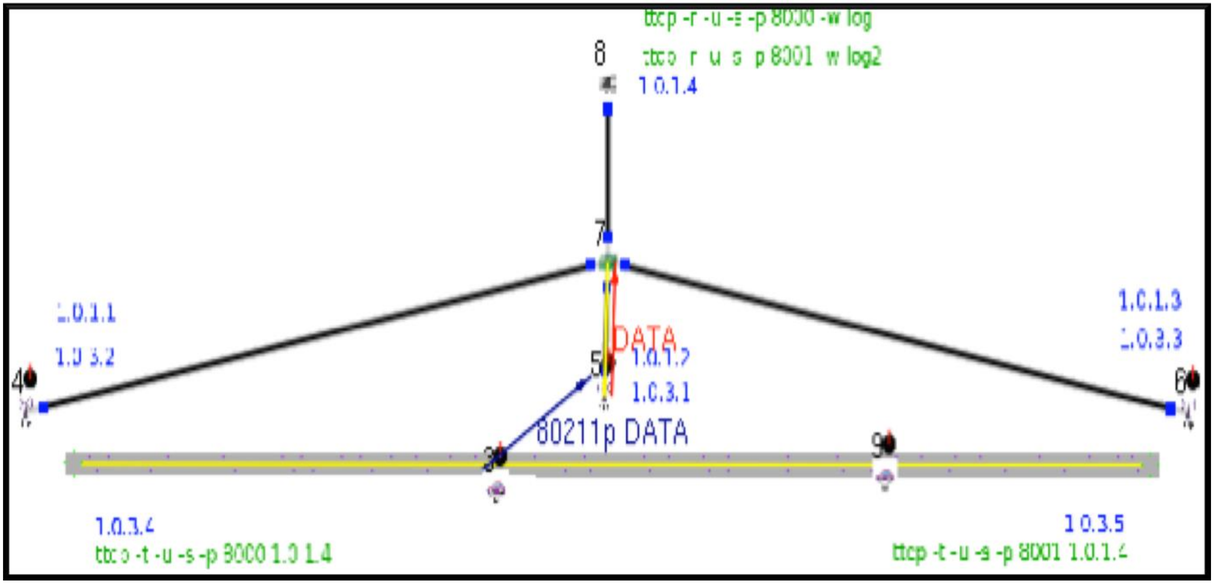


*Figure 3*
*Graphical Representation of Node 3; showing: Drop packets and Amount of throughput output in the first topology during handover,* **total number of packets dropped are 436 in the complete simulation.**

At the following time (seconds) 96.00, 61.00, 31.00, 281.00, 241.00, 201.00, 171.00, 131.00 during the simulation, one seconds after the routing rule has been set to switch the OBU from one RSU to (next RSU in range) another; (Handover) the packets dropped at the highest rate.

## Second Topology



```
ttcp -r -u -s -p 8000 -w log
ttcp -r -u -s -p 8001 -w log2
ttcp -t -u -s -p 8000 1.0.1.4
ttcp -t -u -s -p 8001 1.0.1.4
```

**Figure 4; Showing the simulation interface of EstiNet second Topology Setup with Node 2 and Node 9**

In figure 4, There are two OBUs in this simulation **Node 3 and Node 9**. The OBUs at the beginning of simulation communicating with the RSU, Node 3 connects to RSU 4, Node 9 connects to RSU 6, the figure below shows the nodes moving toward RSU 5, handover has been initiated. Node 3 connects First before Node 9 because of the distance between and the application setting as the routing protocol script is configured 10 second before Node 9, (Node 3 at 20.00 Seconds, Node 9 at 30.00 Seconds) then thus Node 9 also sends requests.

**Table 2**

**Showing Values of NODE 3 Dropped, and Throughput packet *in the second topology during handover.***

| Time (Seconds) | No Of Drop Packets | Throughput (KB/s) |
|---|---|---|
| 43 | 10 | 0.76 |
| 44 | 10 | 0.618 |
| 46 | 14 | 0.902 |
| 49 | 10 | 0.902 |
| 54 | 13 | 1.236 |
| 57 | 10 | 0.76 |
| 96 | 10 | 0 |
| 97 | 17 | 0.142 |
| 117 | 11 | 1.236 |
| 120 | 12 | 0.618 |
| 173 | 10 | 0.618 |
| 187 | 12 | 1.448 |
| 193 | 12 | 0.76 |
| 197 | 12 | 0.618 |
| 242 | 14 | 0.142 |
| 243 | 13 | 0 |
| 255 | 10 | 0.618 |
| 260 | 11 | 0.618 |
| 261 | 11 | 0.76 |
| 266 | 10 | 0.76 |
| 270 | 10 | 0.76 |
| 273 | 10 | 0.76 |
| 276 | 12 | 0.618 |

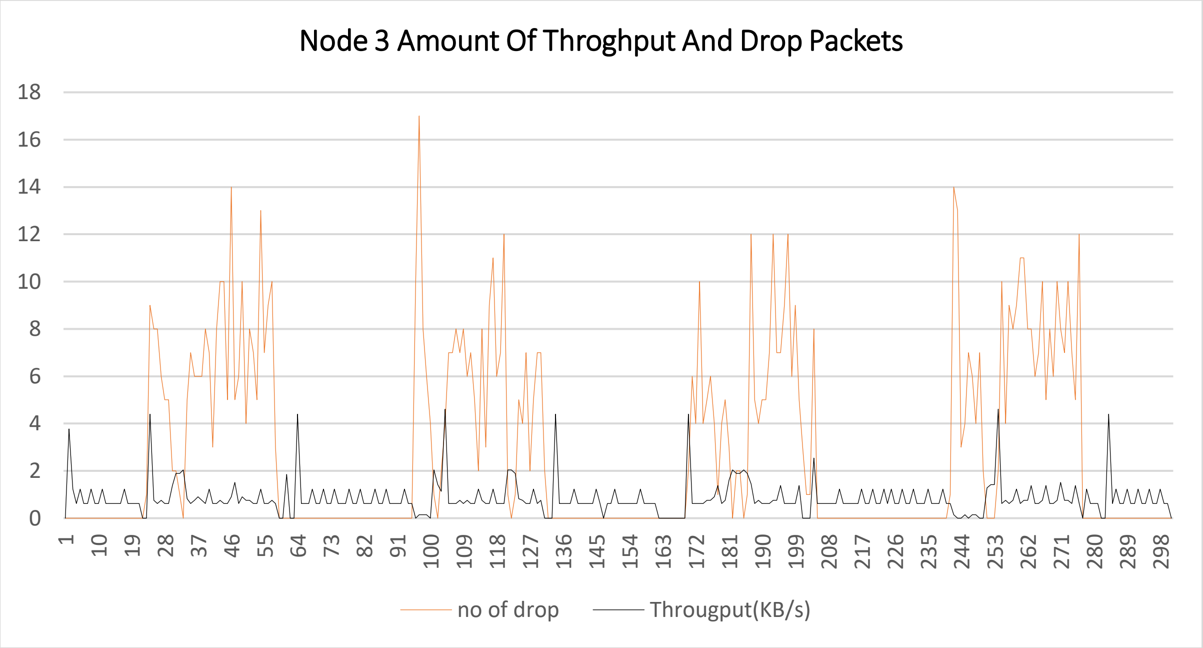


*Figure 5*
*Graphical Representation of Node 3; showing: Drop packets and Amount of throughput output in the second topology during handover.*

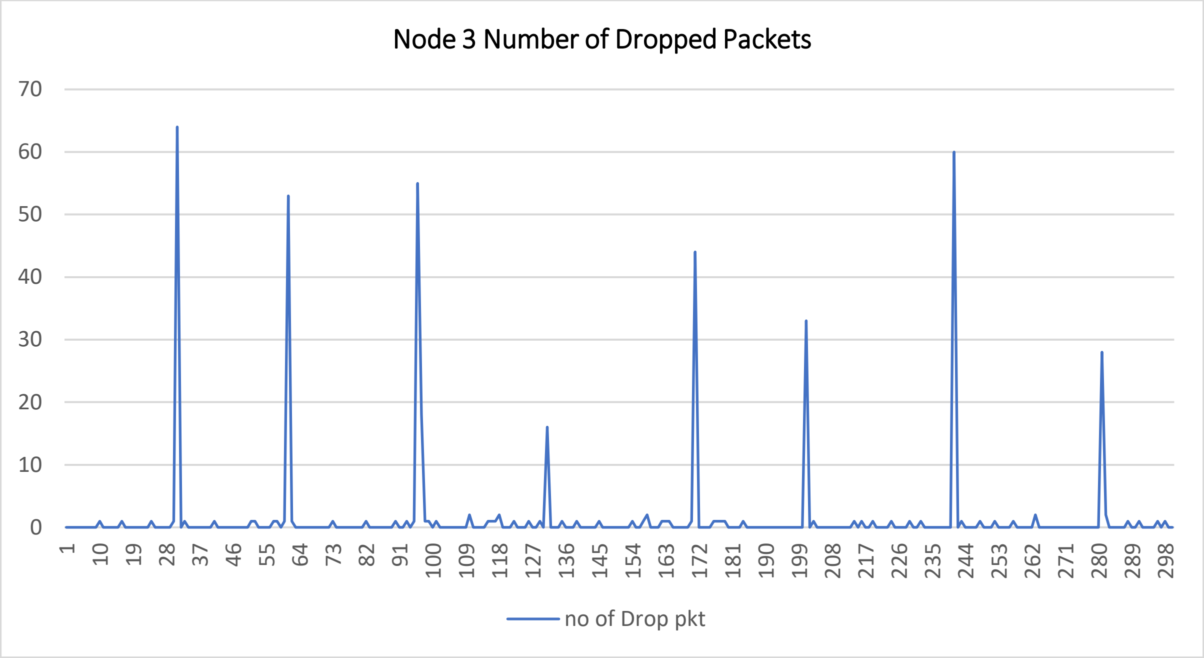


**Figure 6**
*Graphical Representation of Node 3 showing: Drop packets in the second topology during handover.*

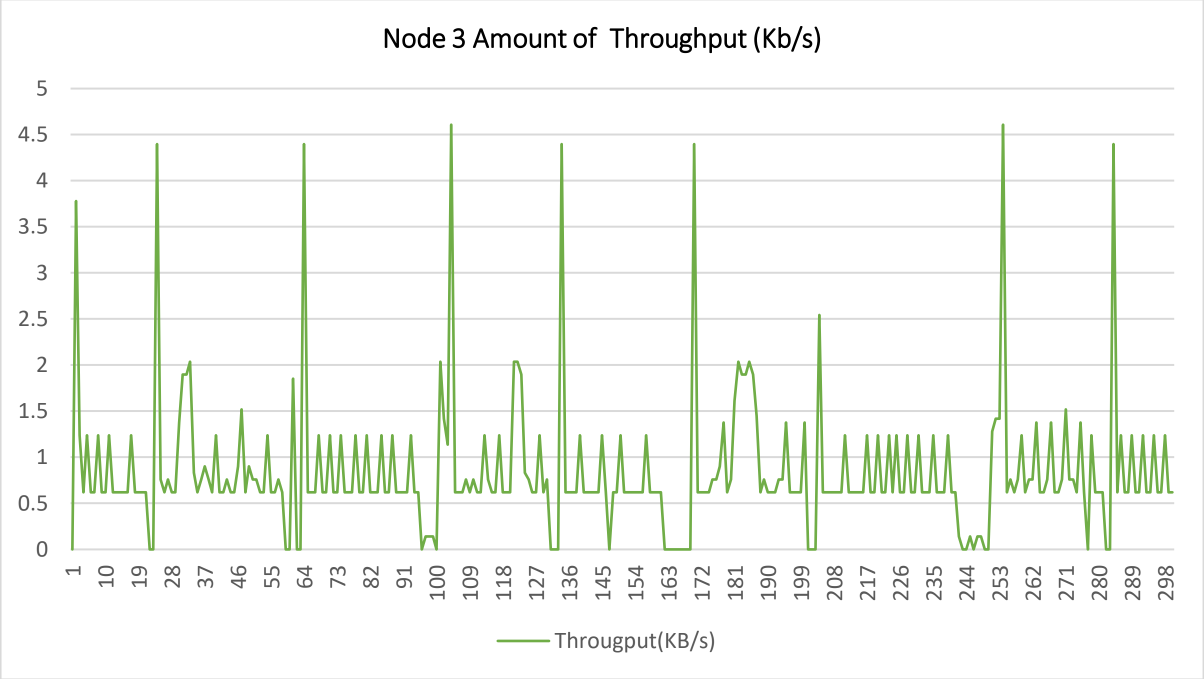


**Figure 7**
*Graphical Representation of Node 3 and showing: Throughput Packets in the second topology during handover.*

**In Node 3,** the highest number of packets dropped as shown in Figure 5 in a sequence is 64, which occurred at the 31.00 seconds of the simulation, lowest throughput drop as in Figure 7, is 131.606 KB/S at 249.00 seconds and total number of packets dropped are 436 in the complete simulation. Whereas NODE 9 highest number of drop packets in a sequence is 17, which occurred at the 24.00 seconds and 97.00 seconds.

***Table 3: Showing Values of Node 9 Dropped and Throughput packet*** **in the second topology during handover.**

| Time (seconds) | No of Drop packets | Throughput (KB/s) |
|---|---|---|
| 24 | 17 | 143.526 |
| 27 | 12 | 148.926 |
| 46 | 14 | 157.344 |
| 54 | 13 | 126.428 |
| 96 | 11 | 155.348 |
| 97 | 17 | 150.02 |
| 98 | 4 | 139.08 |
| 100 | 3 | 135.656 |
| 117 | 11 | 132.658 |
| 120 | 12 | 129.994 |
| 124 | 24 | 130.468 |
| 170 | 4 | 134.916 |
| 172 | 3 | 139.08 |
| 173 | 13 | 143.314 |
| 175 | 8 | 141.41 |
| 177 | 8 | 131.564 |
| 187 | 12 | 136.03 |
| 193 | 12 | 169.854 |
| 197 | 12 | 128.758 |
| 242 | 15 | 141.552 |
| 243 | 15 | 135.656 |
| 244 | 3 | 136.892 |
| 247 | 3 | 141.268 |
| 248 | 4 | 136.892 |
| 249 | 4 | 143.314 |
| 276 | 12 | 132.992 |

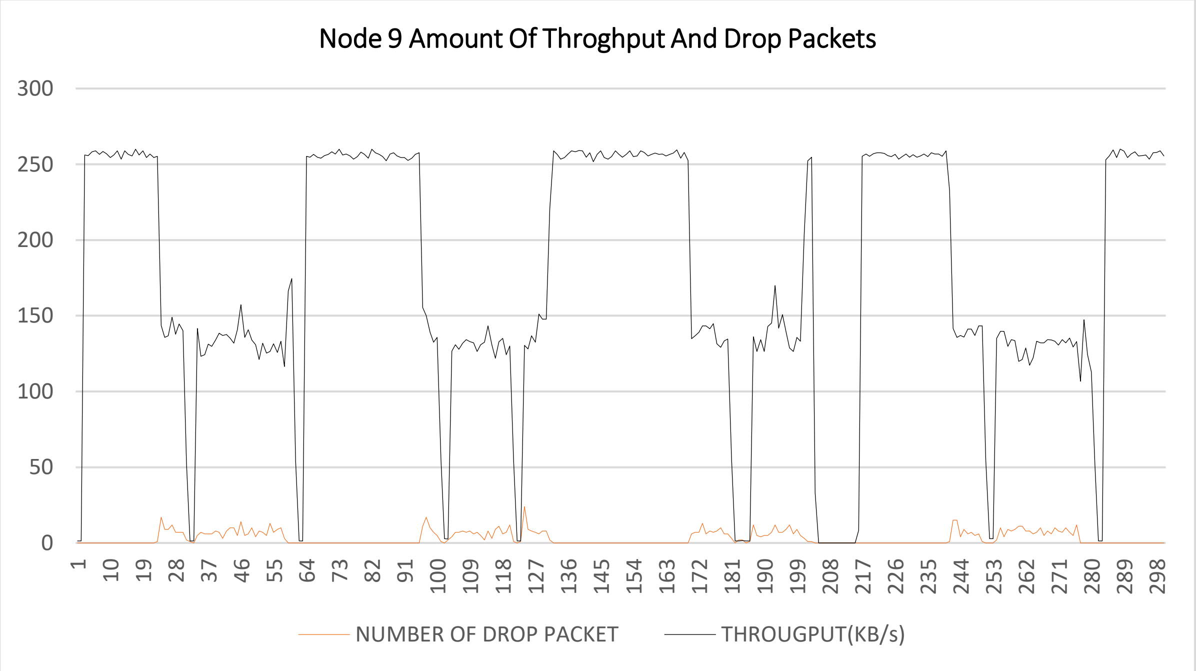


**Figure 8**

*Graphical Representation of Node 9 showing Drop packets and Amount of throughput output in the second topology during handover.*

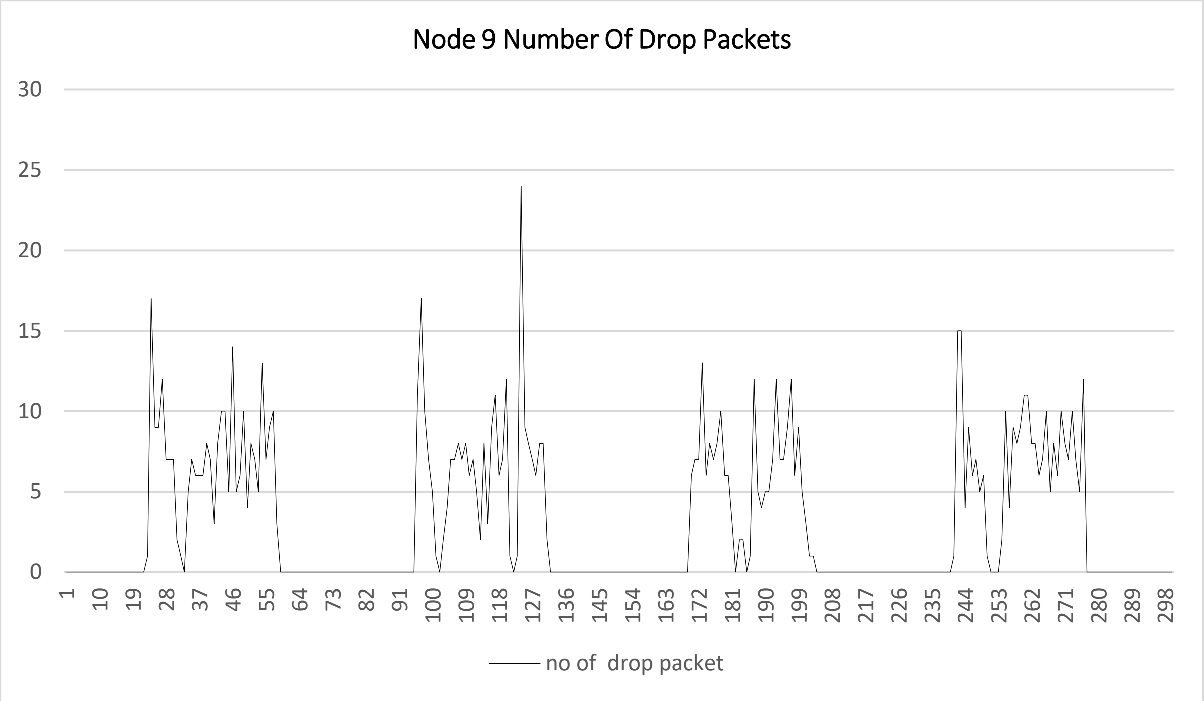


**Figure 9**
***Graphical Representation of Node 9 showing Drop packets in the second topology during handover.***

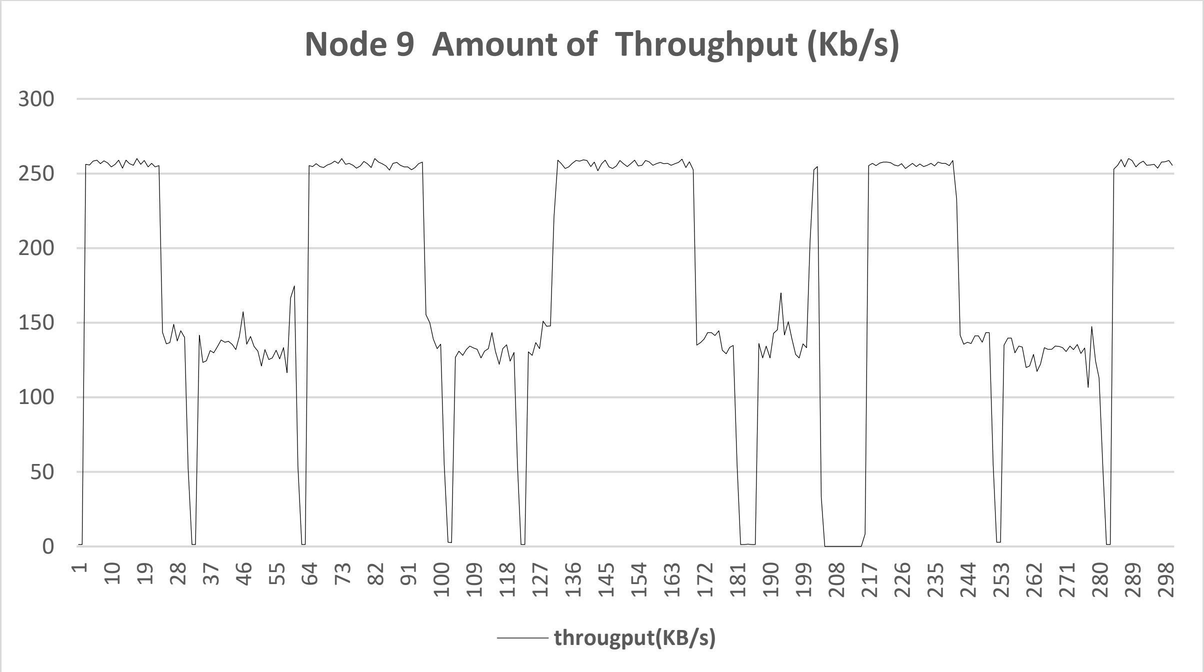


**Figure 10**
***Graphical Representation of Node 9 showing Amount of throughput output in the second topology during handover.***

## Third Topology

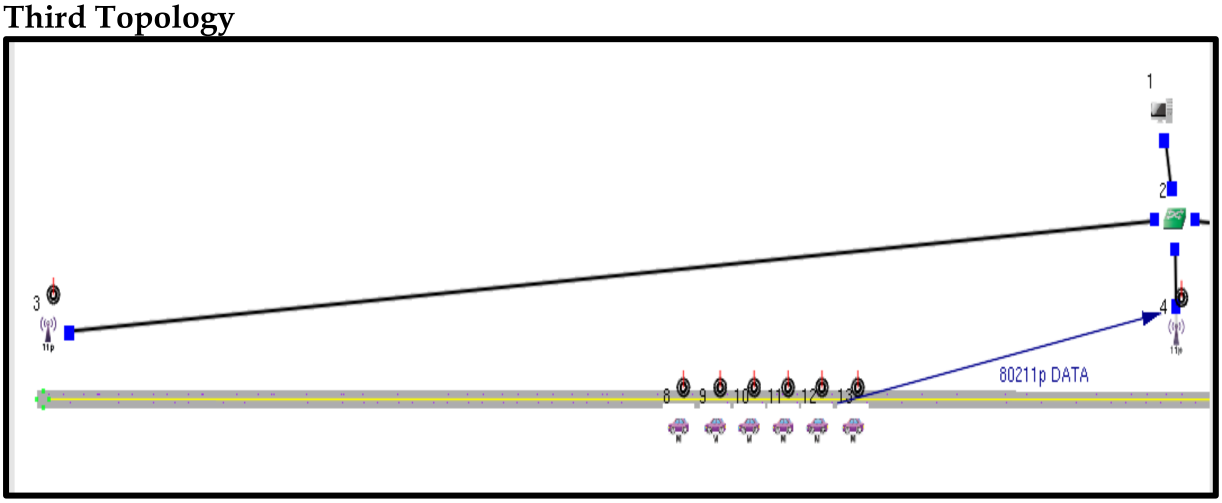


**Figure 11**
Evaluating the Number of dropped packets in the third topology, this is a graphical representation of Node 8, Node 9, Node 10, Node 11, Node 12 Node and Node 13.

### Third Topology Drop Packets

Evaluating the Number of dropped packets in the third topology, this is a graphical representation of **Node 8, Node 9, Node 10, Node 11, Node 12 Node and Node 13.** An enormous number of Packets was dropped in this Topology especially when OBUs are transmitting with RSU 3 and 5. From 109.00 seconds of the simulation, to 233.00 the packet loss is less.

Enormous numbers of Packets were dropped in this Topology especially when OBUs are transmitting with RSU 3 and 5. From 109.00 seconds of the simulation, to 233.00 the packet loss is less.

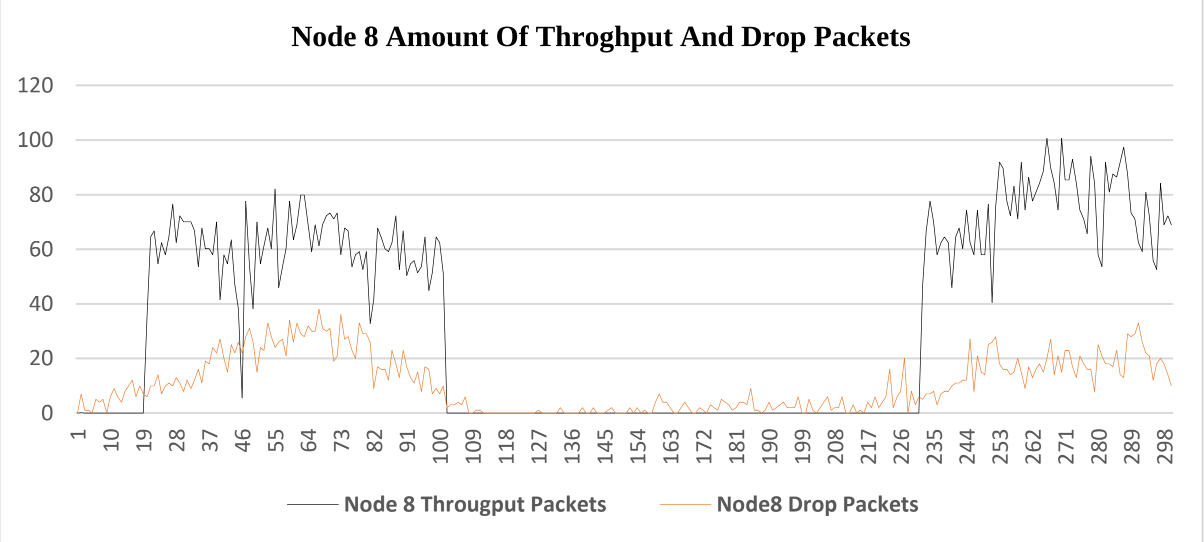


**Figure 12**
*Graphical Representation of Node 8 showing Drop packets and Amount of throughput output in the second topology during handover.*

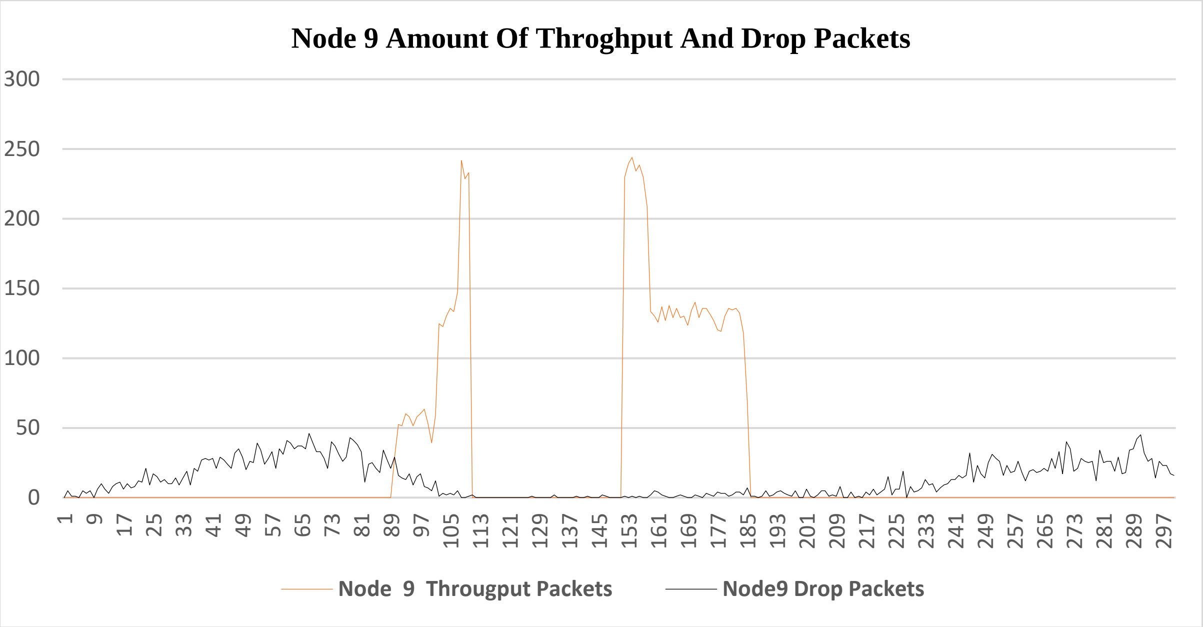


**Figure 13**
*Graphical Representation of Node 9 showing Drop packets and Amount of throughput output in the second topology during handover.*

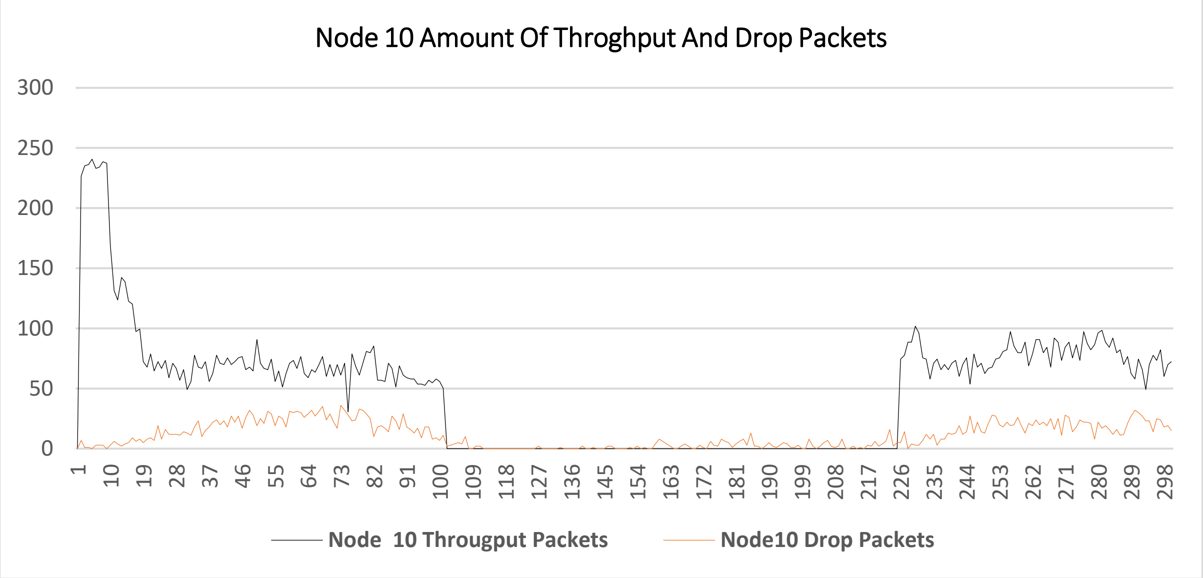


**Figure 14**
*Graphical Representation of Node 10 showing Drop packets and Amount of throughput output in the second topology during handover.*

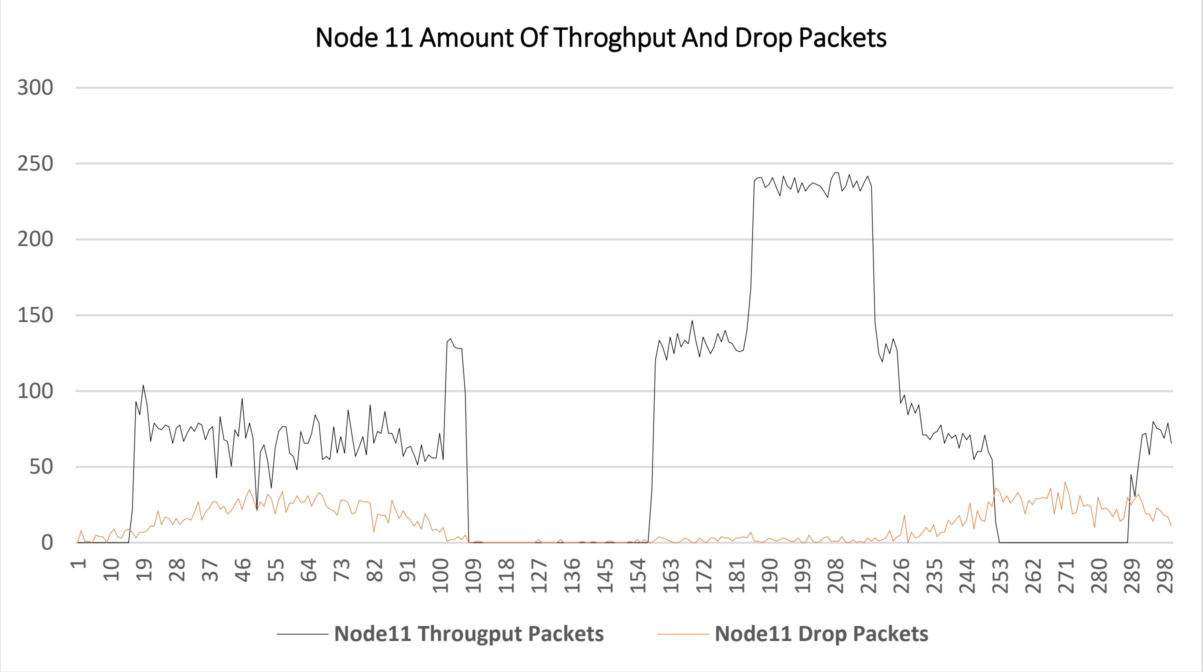


**Figure 15**
*Graphical Representation of Node 11 showing Drop packets and Amount of throughput output in the second topology during handover.*

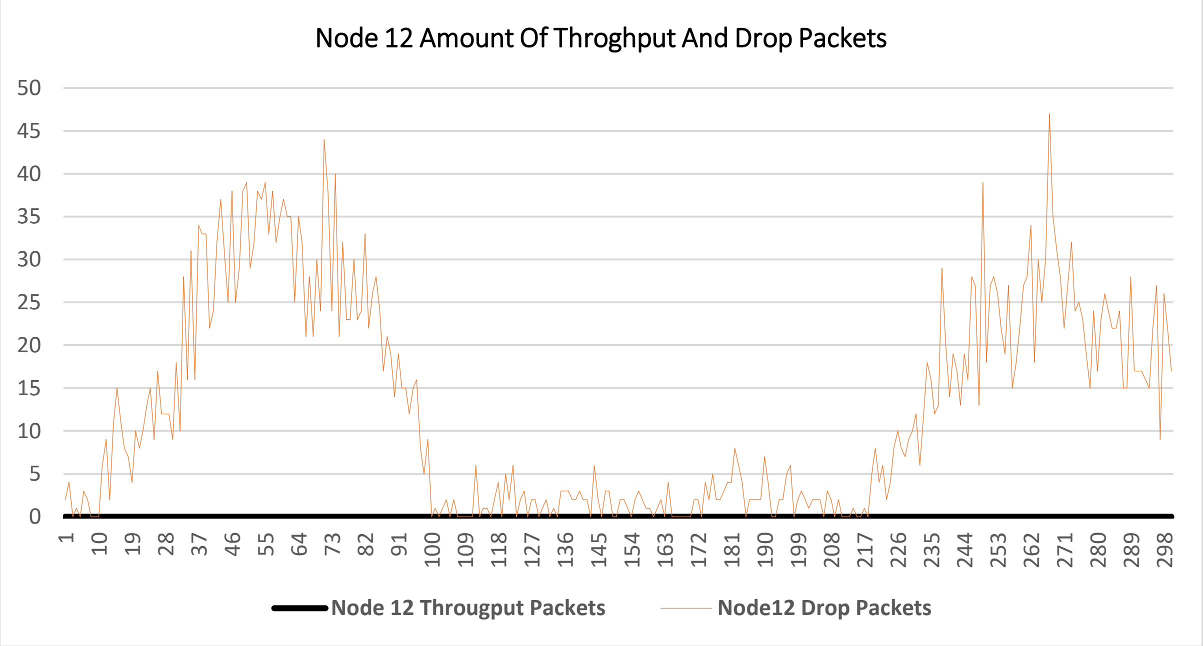


**Figure 16**
*Graphical Representation of Node 12 showing Drop packets and Amount of throughput output in the second topology during handover.*

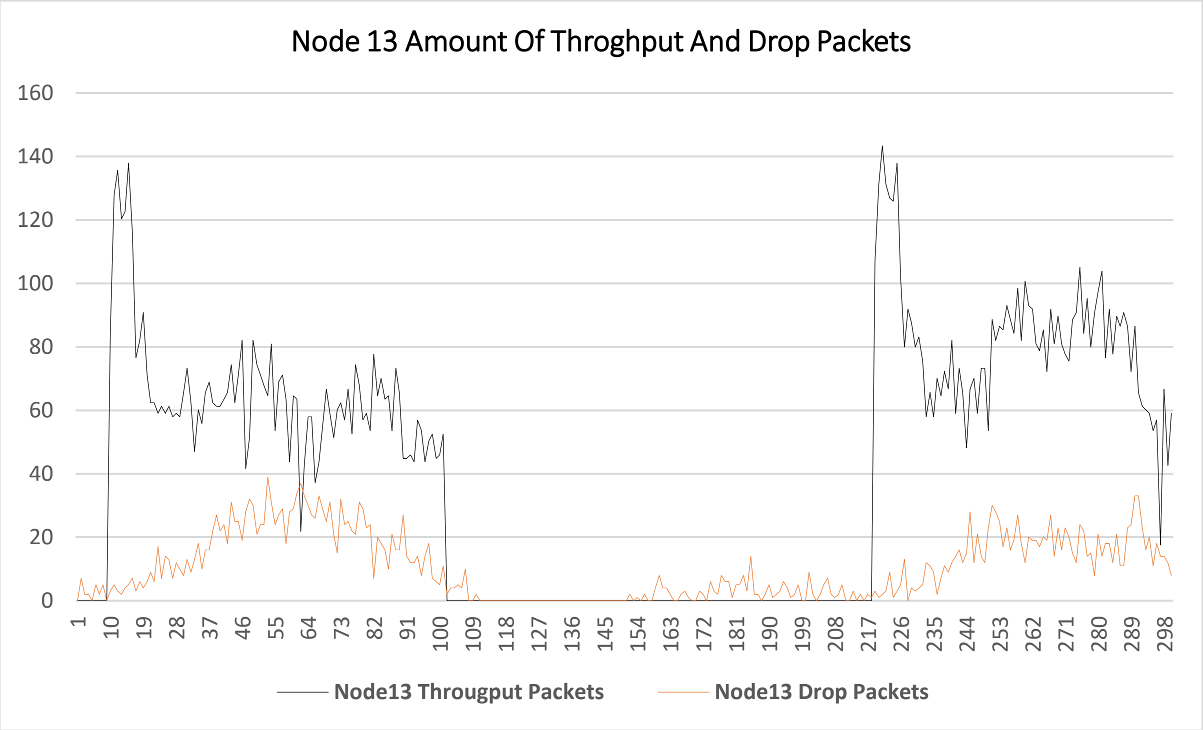


**Figure 17**
***Graphical Representation of Node 8 showing Drop packets and Amount of throughput output in the second topology during handover.***

The amount of Packet Drop and Packet Collision in Third topology in, the congestion of the vehicles causing Collision and as result the packets drop.

## CONCLUSION

In conclusion, after looking at the different topologies (Scenarios) created, it is important to provide adequate QOS in the VANET system.

Second topology/Scenario: the two cars send UDP packets to node 1, sometimes when they cover the transmission range, they will compete for media resources. So, the drop and collision packets are more than the first topology.

The third topology/Scenario, there are six cars. They all send UDP packets to node 1 at the same time and they are close to each other (and in the same channel) so the competition situation is easy to see. That is, drop and collision packets are very much.

At 110 seconds, the RSU 5 deletes its provider service (using 172 channels), so during 110~150 seconds, no car can send packets to RSU 5.

Using the routing rule (SSDD) updating the routing table to achieve handover QOS used in this dissertation; Changing the setting of routing rules, handover can be accomplished. The routing rules are altered in specific seconds to change traffic from RSU4□□□RSU5□□□RSU6□□□RSU5 □□□RSU4. The routing rules are a bash script file installed and executed by OBU from the application settings program.

The amount of Packet Drop and Packet Collision in Third topology in, the congestion of the vehicles causing Collision and as result the packets drop. Furthermore, in Second Topology (Second Scenario), two OBUs are available unlike the third topology, with six topologies 50 metres apart.

Therefore, as the traffic increases QoS becomes difficult to achieve; the more the traffic the less the QoS.
Architectures are used by research to enhance the QOS such as: Integrated Services (IntServ) architecture which is an unscalable architecture. Differentiated service (Diff) architecture has also been used to enhance QOS in VANET but it functions well in core networks. Unfortunately, as of now it is difficult if not impossible to achieve a 100% free Packet Drop and Packet collision mechanism (QOS) in VANET, nevertheless it can be reduced/minimised and enhanced.

EstiNet Application does not provide the IEEE 80211p Module-Based OBU/car with a Multi-PHY- Layer, this results in the inability to use dedicated channels for data processing/transmission and other channels for handover process. One channel is active at a time.

Many protocols, Mechanisms and Architecture used in QoS enhancement are yet to provide an absolute solution for all VANET environments.
A new approach to solving these issues (Topologies created) can be by Using heterogeneous network to free the traffic and minimise collision.

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