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AODV in 802.11p and 802.16 based VANETS

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Abstract — The recent research in routing algorithm of Vehicular ad hoc Networks (VANETs). Due to dynamic nature and high mobility of VANET plays an important role for the researcher for consistent packet delivery ratio. In this work we have compared the result of Ad hoc on demand distant vector (AODV) in 802.11p and 802.16 based VANETS. Simulation result confirms that 802.16 is better option for VANET routing protocols. Comparison measure with respective Packet delivery ratio, throughput, end to end delay, Data Packet loss, Link breakage and number of hop count.

Index Terms — VANET, 802.11p, 802.16, AODV, Packet Deliver ratio, end-to-end delay, hop count.

1. Introduction

VANETs is hot topic in wireless networks mainly ad hoc network for the researchers not only in academia but industry also. Research in vehicle communication specifically routing algorithms and architecture of VANET is playing vital role to provide wide spectrum of safety, efficiency and comfort application to the public and governments. With the deployment of VANET along the road side can reduce traffic death rate by providing live traffic to the driver VANET can share some information between vehicles for example Service station, whether forecast, traffic density, accident for the ease of travelling on road. It can be useful for vehicle tracking system. Some of the researchers have done the research in this area and given guideline for further improvement.

In VANET Routing protocol is needed for the communication between vehicle to vehicle, vehicles to roadside to maintain route information for forwarding data packets form source(S) vehicles to destination (D) vehicles until the link breakage in the VANET requires the new route discovery between S-D pair

There are three types of VANETs. Infrastructure less VANET, infrastructure based VANET and Hybrid VANET. In infrastructure less vehicle can communicate directly with other vehicle (V2V) by following each other on the routes by crossing each other on the routes and sending/receiving data packets to and from stationary vehicles the major drawback of such VANET is frequent disconnection of network because of high velocity of vehicle on road and unpredictable behavior of driver .Packet will be dropped because of buffer overflow in heavy traffic. In infrastructure based VANET vehicle can communicate with other vehicles through road side unit (V2R or V2I) by sharing the route information with road side unit. This reduces the burden of researcher to design develop routing algorithm because less disconnection of network. In Hybrid VANET V2V and V2I can be combined. In this infrastructure vehicle can communicate with other vehicle as well as road side unit. This enables successful delivery of communication among the vehicles by providing information to RSU and neighbor vehicles.

To address specific type of VANET some of the protocols have been designed and simulate. There are three types of VANET Routing Protocols: Pro Reactive, Reactive and Hybrid. The pro reactive protocol is table driven protocol. It maintains routing information in advance. For forwarding packets it takes the information from routing table. In reactive, route is discovered at run time. It is dynamic in nature whereas hybrid is combination of both. In this category of protocol the real traffic condition is not considered and quality of road. [1], [4], [5]

Due to special characteristics of VANETs, many of the following challenges still needs to be addressed

1. Dynamic and rapidly changing topologies of vehicular networks can cause frequent communication disconnections among vehicles. As revealed in the frequent network disconnection is the most important issue in designing protocols for VANET.
2. The high as well as low density is critical issue.
3. The unpredictable movement of vehicles on the roads makes route selection more complex.
4. Due to multistory buildings, trees the wireless signal is weaken.
5. Unpredictable velocity of the vehicles causes unreliable communication.
6. Routing of Packets
7. The hidden node problem End-to-End path between the source and the destination is not known in advance [4]

In this work AODV protocol is used for comparing the 802.11p and 802.16 infrastructures in highway scenario.

2. Related Work.

Due to high speed of vehicles on highway, it is very dynamic and challenging problem to find and maintain

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route for the session between S-D pair. There are many researcher results put forward to implement routing protocol in different types of VANET. Most of the researcher have implemented the routing protocol in 801.11 p environment for example Dynamic source routing, AODV, DYMO. But research shows that they have poor performance in 802.11p VANET. Position based routing such as Greedy Perimeter Stateless Routing (GPSR), Greedy Perimeter Coordinator Routing (GPCR) and so on The mentioned protocols implemented and tested in 802.11p p VANET.[1],[5],[8][9]

3. Comparison Of 802.11p And 802.16 [2],[3]

TABLE 1
IEEE 802.11p AND IEEE 802.16

Parameter	802.11p (Wi-Fi)	802.16
Bandwidth	<=54mbps	>100mbps
latency	50ms	<30 ms
Range	< 1km	50 km
Mobility	less	high
connection	Reliable	unreliable

4. Qualnet Simulator

The QualNet simulator is used for this research work. It is cost effective method for developing and deployment of routing protocol in VANET. It allows to analyze the performance of routing protocol in terms of parameter like packet delivery ratio, throughput, Jitter by varying the value line, no of nodes, packet size, changing bit rate, [7],[8]

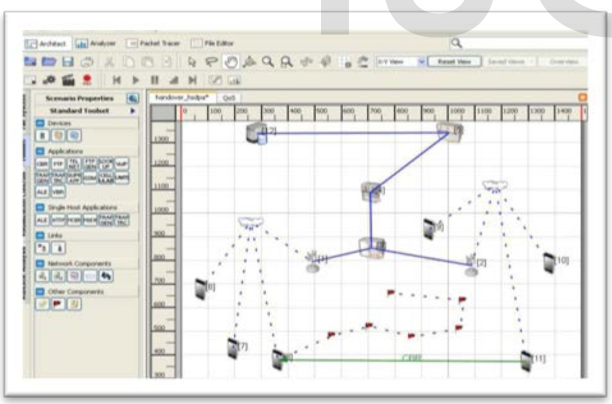

Fig1. QualNet Design Mode

5. Implementation

The AODV routing protocol is simulated in following types of VANETs Infrastructure less VANET (802.11p) and Infrastructure based VANET (802.16). In 802.11p VANET AODV is simulated with following parameters as given Table 2 and fig 2.

TABLE 2
SIMULATION PARAMETER FOR 802.11p

Sr. No	Parameter	Specification
01	velocity	variable
02	MAC protocol	802.11p
03	Physical Radio	802.11p
04	Battery model	Linear
05	Wireless channel	Wireless
06	Traffic type	CBR
07	Packet Size	512
08	Interval between packet	4 second
09	Simulation area	1500m x 1500m
10	Routing Protocols	AODV
11	S-D pair	fixed
12	Start time to send packet	100s
13	Number of nodes	**30**

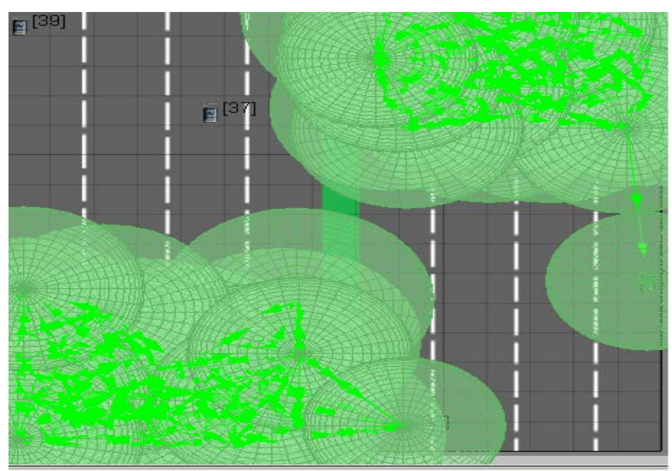

Fig 2. Highway scenario using 802.11p

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In **802.16** VANET we have simulated AODV with following parameter as given in Table 3

Table 3
Simulation parameter for 802.16

Sr. No	Parameter	Specification
01	velocity	variable
02	MAC protocol	802.16
03	Physical Radio	802.16
04	Battery model	Linear
05	Wireless channel	Two Ray
06	Traffic type	CBR
07	Packet Size	512
08	Interval between packet	4 second
09	Simulation area	1500m x 1500m
11	Routing Protocols	AODV
12	S-D pair	fixed
13	Start time to send packet	100s

6. Result

Packet Delivery ratio, throughput, End to end delay, Jitter, Data packet loss, etc. parameter are used to compare the performance of AODV in 802.11p and 802.16 VANET Simulation run for variable velocity for traffic on highway was 30 vehicles. Following set of graph shows the packet delivery ratio, throughput, End to End Delay and Jitter

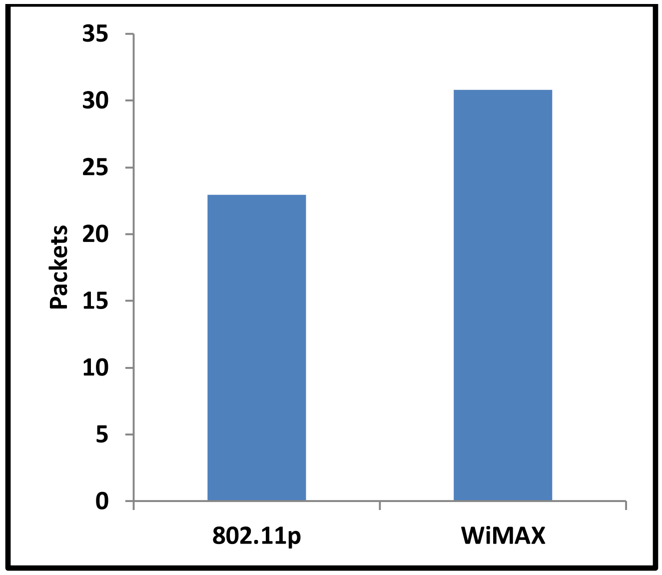

Fig 3. Packet Delivery Ratio

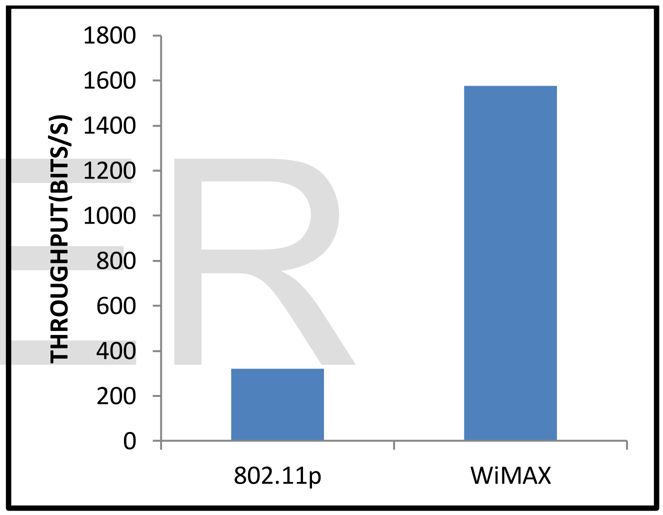

Fig 4. Throughput

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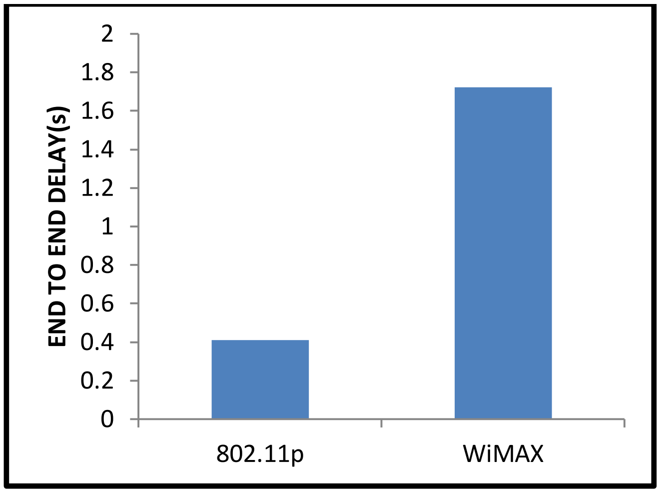

Fig 5. Average End to End Delay(s)

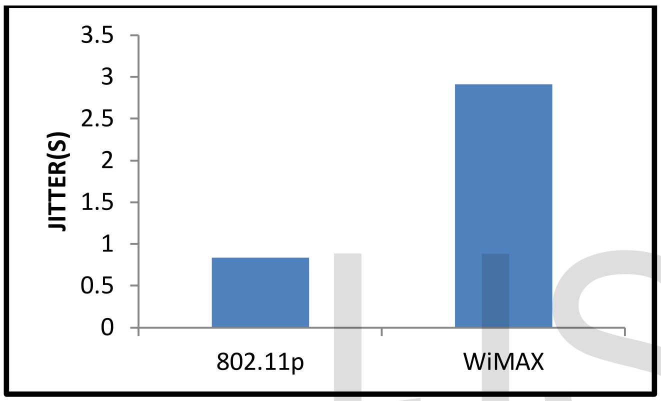

Fig 6. Average Jitter in Second

The next set of graph shows the Data Packet Details and Data Packet Loss

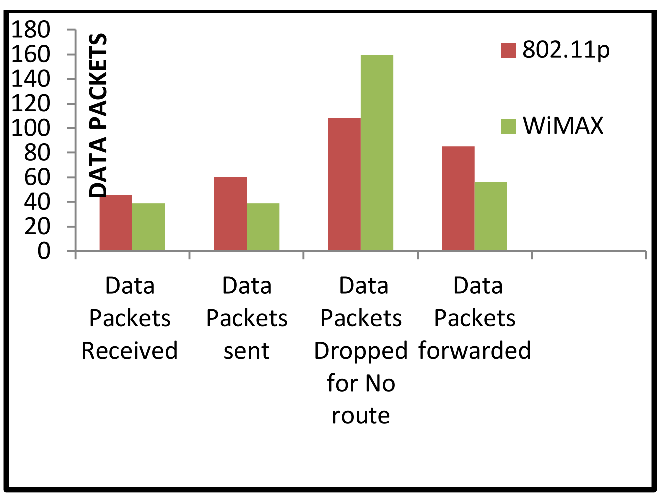

Fig 7. Data packet analysis in network layer

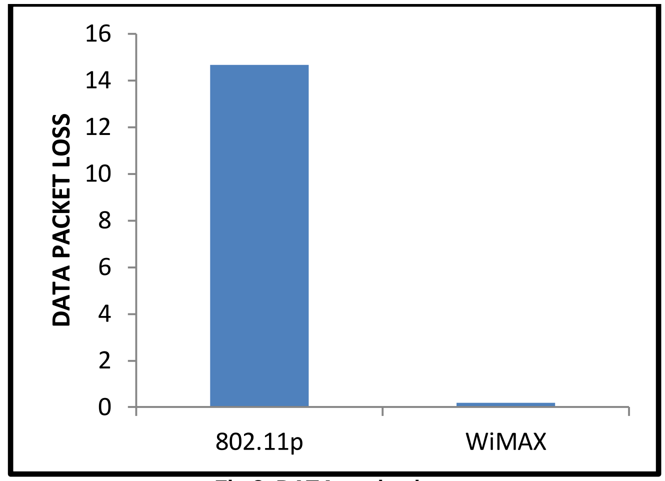

Fig 8. DATA packet loss

Next graph shows about the Route length. i.e. number of Hop Count and Result shows 802.16 is better than 802.11p

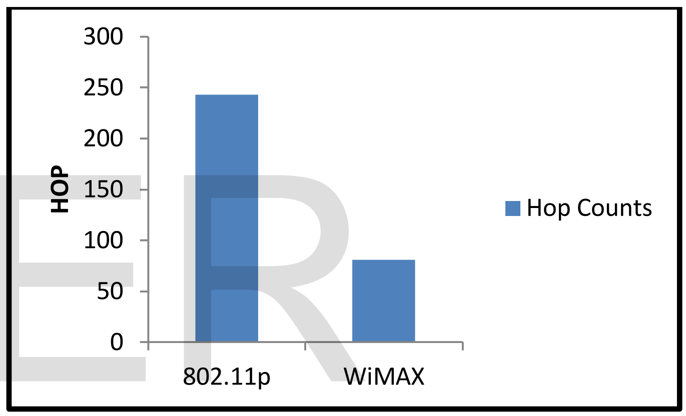

Fig 9. Hop Count

The next set of results shows the details about RREQ Packets and RREP Packets

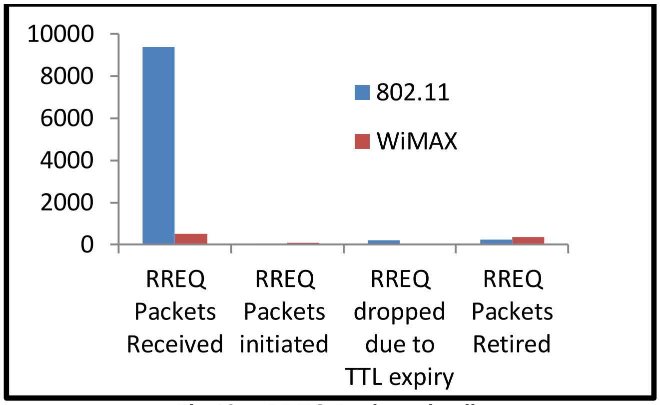

Fig 10 a. RREQ Packets details

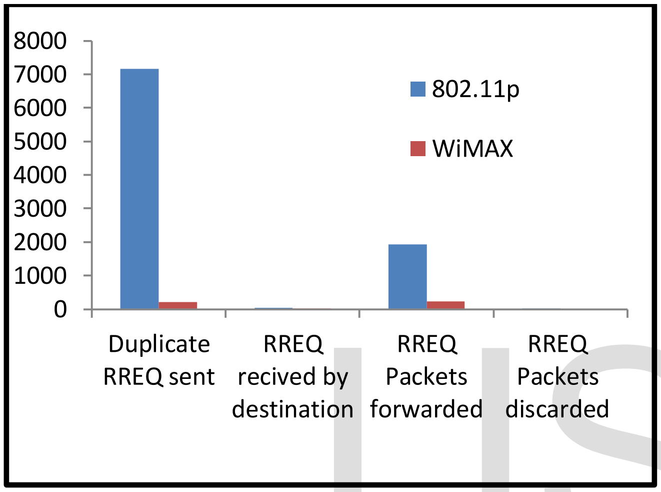

Fig 10 b. RREQ packets details

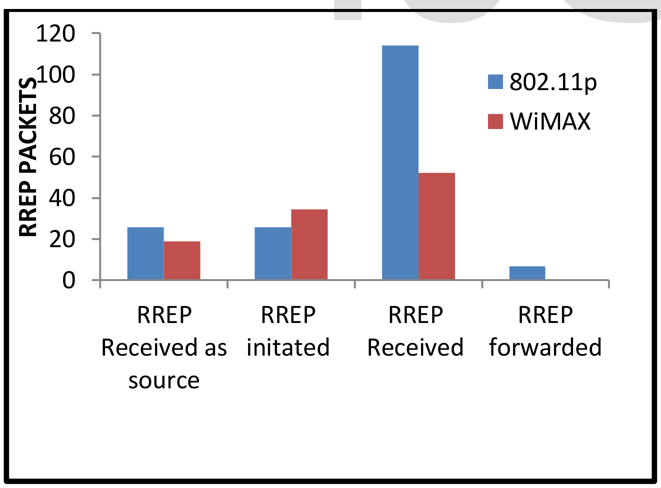

Fig 10 c:RREP Packet

The next set of graph show the link breakage and energy consumed in 802.11p and 802.16 base VANET

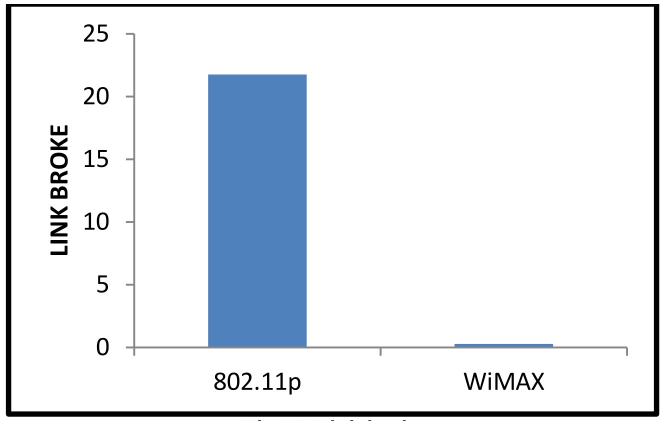

Fig 11. Link broke

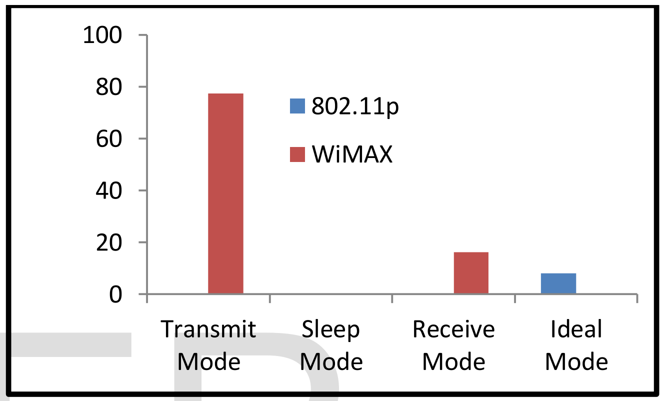

Fig 12 Energy consumed

7. Conclusion

In this paper we have presented simulation and analysis of AODV in different VANET scenario in highway mode. The result is obtained from QualNet Simulator. It is concluded that AODV performance in 802.16 is better than 802.11p with respect to PDR, throughput, end to end delay, Data packet loss and so on. Thus 802.16 will be VANET infrastructure for development routing protocols.

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