Dynamic MANET on Demand with Different Bit Rate using Highway Scenario over WiMAX on VANET

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Abstract— **Since last decade, the challenge and issues of Vehicular ad-hoc Network (VANET) have attracted the researchers from academia as well as industry for research towards the safety on road. Due to High velocity of vehicles on highway the major challenge is to maintain route information consistent and improvements in data packet delivery. In this paper we study analysis on Dynamic MANET on Demand (DYMO) with different bit rate using highway scenario over WiMAX on VANET in Vehicle 2 infrastructure(V2I) communication with respect to packet delivery ratio, throughput, End-to-End Delay, Data Packet loss and link break. In this paper we have proposed WiMAX as infrastructure for VANET to improve the network coverage.**

Keywords- VANET, DYMO, WiMAX, V@I, ad-hoc network

I. INTRODUCTION

VANET is special kind of Wireless network in which mobile nodes are vehicles. There are two forms of VANETs: Infrastructure and Ad-Hoc. In Infrastructure mode base stations and access point are installed along the road side which is known as Road side unit (RSU) to connect to cloud through RSU. On the contrary NO RSU exists in ad-hoc form of VANET. In VAVET, carriers are vehicles with high velocity. As per the survey the ad hoc routing protocols are used in VANET by researchers for their research work. There are two types of routing: Topological Based and Position based for determining the route between source and destination pair. Further Topological routing protocols are classified in to Proactive, reactive and Hybrid. Proactive routing protocol are table driven protocols in which each node keeps routing info of its neighbor and select the path but in VANET the major challenge is that vehicles has to update the neighbor information frequently. Reactive protocols are demand routing protocol in which route is discovered on demand basis between source and destination. Hybrid is combination of Proactive and Reactive ad hoc protocols and example of such protocols are DSDV, AODV, and DYMO etc. In Position based protocol each vehicle is installed with global position system (GPS) to know location of vehicle for forwarding packets. Examples of such protocol are GPSR, GEOCAST etc. [1][7]

The aim of this paper is to check the feasibility of highway communication using DYMO protocols with different bit rate over WiMAX on VANET and examine the performance of DYMO in network layer with earlier kind of VANET infrastructures.

II. RELATED WORK

DYMO is extension of AODV protocol which is one of the important routing protocols in MANET. There is research work done by researcher not only in MANET but VANET scenario also. Simulation results for DYMO found in various papers with wireless network mainly ad hoc network, MANET, VANET scenario in terms of its performance with respective end-to-end delay, packet delivery ratio. In this paper we have simulated and implemented DYMO in highway VANET scenario in V2I communication using WiMAX networks.

III. DYNAMIC MANET ON DEMAND (DYMO)

DYMO is reactive routing protocols in which route is discovered on demand between source and destination, developed by IETF's MANET working group. It was built upon the experience of previous mainly Ad hoc on demand distance vector routing protocol to maintain route information consistent. The major difference between DYMO and AODV is that DYMO maintain the newly discovered path with all intermediate along with target node at each node. Whereas AODV stores only target node with net hop at each node of discovered path DYMO was also designed to use sequence number to enforce loop freedom. [1],[2],[3],[4]

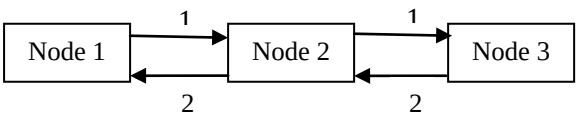

Figure 1. a: Routing info dissemination in AODV

When using AODV source node 1 knows only Target node 5 and Next hop node 2 as shown in figure 1. a..

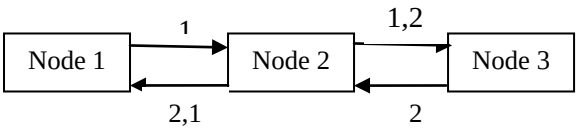

Figure 1. b: Routing info dissemination in DYMO

When using DYMO source node 1 knows Target node 5 and Next hop node 2 as well as routing info of 3,4 also as shown in figure 1. B. [2]

IV. SIMULATION AND RESULT

A. *Simulation Environment*

QualNet is one of the well-known simulators for VANET development. This is used to evaluate routing algorithm in VANET scenario in wireless network.[9]

We have done simulation in highway environment which consists of 4 vertical roads in each direction of base station which is installed along the highway with 1500m x 1500m simulation area. Scenario was implemented for 12 vehicles with varying velocity (6 either side of highway) and 4 base station from BS1 to BS4 with 900s simulation time. 802.16 used in MAC layer protocol with DYMO as routing protocol. DYMO protocol was tested for different packet size i.e. different bit rate of 1kbps,2kbps,4kbps,8,kbps,16 kbps with constant bit rate (CBR) application between source-destination pair.[6]

TABLE I. PARAMETER FOR SIMULATION ENVIRONMENT

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 packets	variable
09	Simulation area	1500m x 1500m
10	Simulation time	15 min
11	Initial battery	mAhr
12	Routing Protocols	DYMO
13	Source and destination	fixed
14	Start time to send packet	100s
15	Antenna height	1.5 m

Initially Vehicles (mobile nodes) 5, 13 are connected to base station 1 which is part of wireless subnet 1. Similarly other vehicles are part of wireless subnet 2 to 4. Start time for delivering packet is set to 100 s to get mobility in the vehicles. The infrastructure was WiMAX with MAC protocol 802.16 and physical radio 802.16 for improving the network connectivity as well as network coverage.

B. *Simulation Parameter*

- Packet Delivery Ratio (PDR): Success of any protocol is how much packets are delivered to destination.

  PDR=Number packet sent as source / Number packet received at destination

- Link Breakage: For the routing information consistently if there is less no. of broken links. If more no. of broken link represent then it leads to sending number of times control packets like RREQ

- Data Packet loss: Efficiency of any protocol is good if it has less number of data packets losses.

- Throughput: Number of bits received successfully per second. This implies the quality of routing protocol

- End to end delay: It is the difference between end time and start time to send packet.

- Jitter: Jitter is the variation in the end-to-end delay between packets arriving at the destination

C. *Simulation Results*

Following graph shows the performance of DYMO in highway scenario over WiMAX on VANET the results indicate that as bit rate increases the PDR

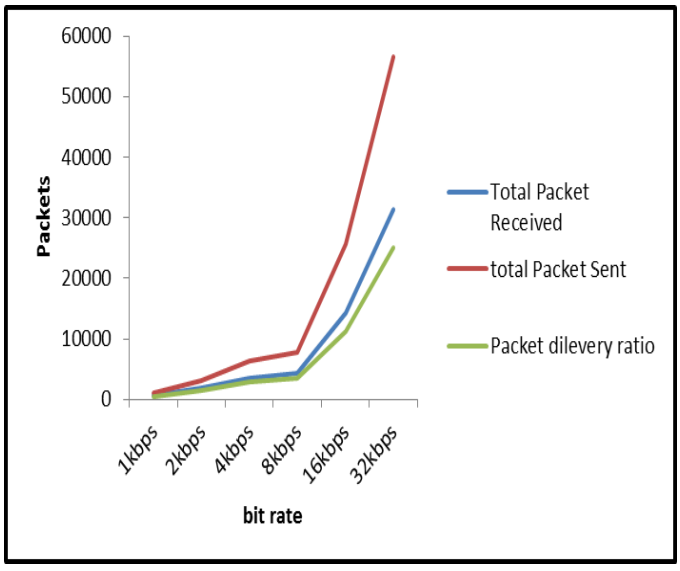

Figure 2. Packet delivery ratio Vs bit rate

Next set of graph shows the end-to-end delay,Throughput and Jitter at each base station as well as entire simulation.

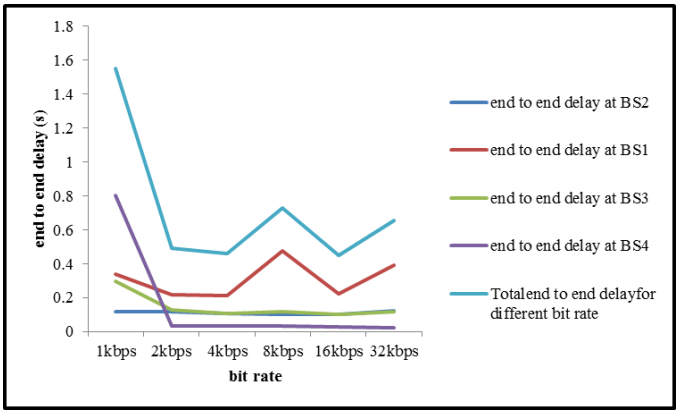

Figure 3. end to end delay Vs bit rate

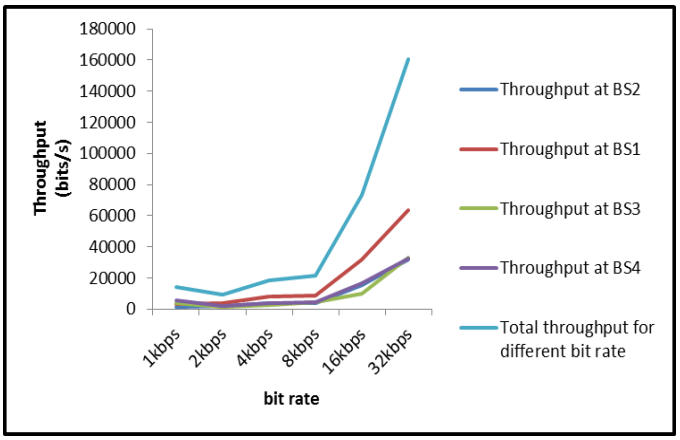

Figure 4. Throughput Vs bit rate

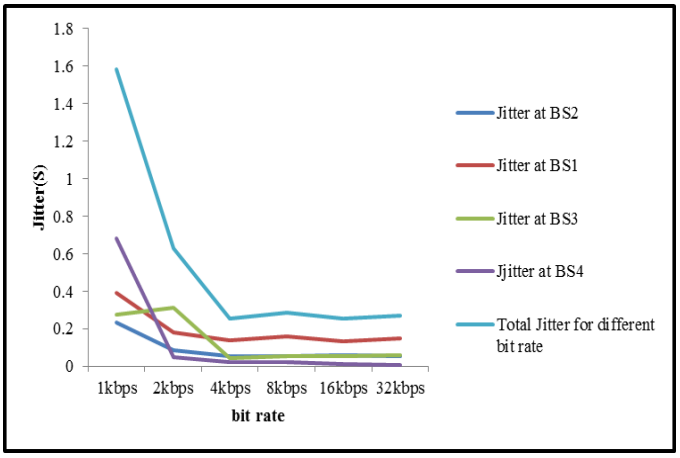

Figure 5. Jitter Vs bit rate

The next set show the link stability. If more links break, more control packets are required. Figure 6 shows DYMO is not stable for higher bit rate[8]

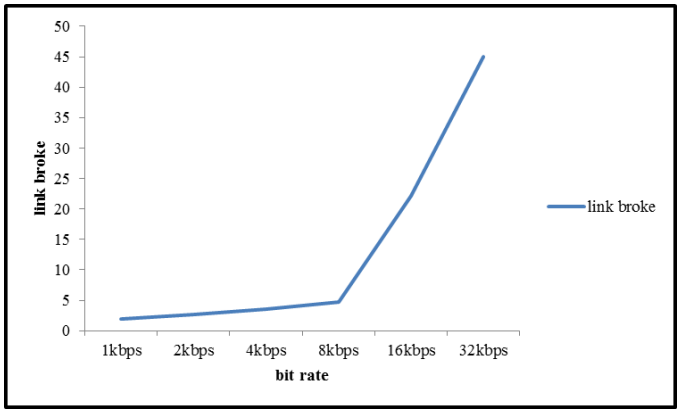

Figure 6. Link broke Vs bit rate

The next set of graph shows details about RREQ packets, Data packets loss, RREP Packet

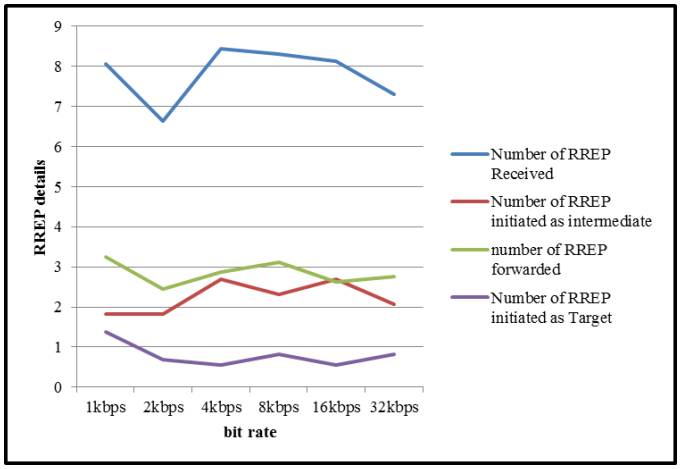

Figure 7. RREQ PacketsVs bit rate

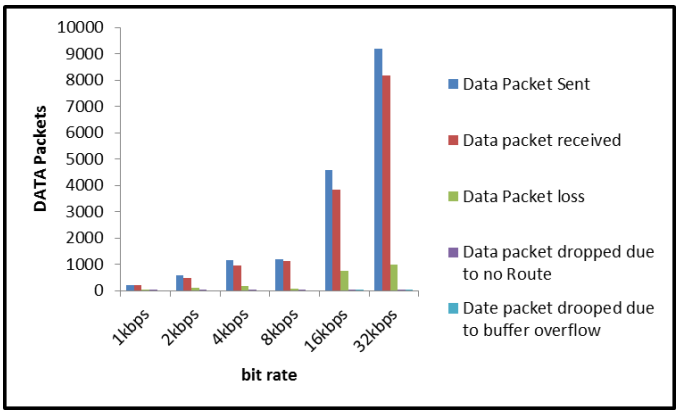

Figure 8. Data Packets Vs bit rate

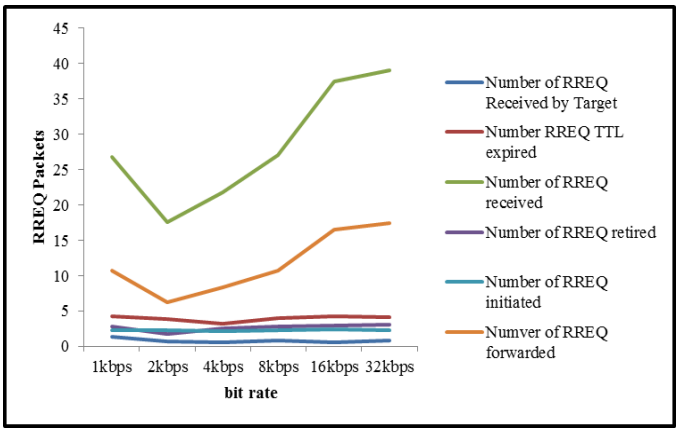

Figure 9. RREQ Vs bit rate

CONCLUSION

In this paper we have evaluated the performance of DYMO in highway scenario with different bit rate over WiMAX on VANET. Therefore we conclude that the performance of DYMO is improved in WiMAX on VANET for variable bit rate.

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