EVOLUTION OF V2V ROUTING PROTOCOLS IN REALISTIC SCENARIO OF NATIONAL HIGHWAY NH-5 PAKISTAN

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ABSTRACT: *Vehicular Adhoc Network (VANET) includes the communication among vehicles passing with different mobility speeds under different mobility models. Under the current situation of development work on NH-5, vehicles are moving on different speeds over multiple diversions and facing numerous problems with their communication links. Such circumference enhances the need and importance of efficient communication system between vehicles. The paper considers the V2V communication between police mobile on a real roadmap of national highway (NH-5, Pakistan) captured via Google Earth. The work is focused on performance analysis of routing protocols: AODV, AOMDV, DSR and DSDV under various call duration. For a realistic scenario for VANET the protocols are evaluated through metrics as throughput, packet deliver ratio and delay. Based on results; AODV performs best in the network delivering maximum packets and maintains the quality throughput, whereas DSDV produces results supporting minimum delay.*

KEYWORDS: MANET; AODV; DSDV; VANET; AOMDV; DSR.

INTRODUCTION

Communication Systems (ICS). Vehicular Adhoc Network (VANET), is considered as one of the most promising technology for improving the safety and competence of transportation systems [1]. It facilitates vehicles to communicate via Vehicle to Vehicle (V2V), Vehicle to Roadside communication (V2R) and Vehicle to Infrastructure (V2I) modes [2]. Vehicle communication would be beneficial in urban as well as rural areas [3], ICS could be used as a tracker to identify the traffic condition as in the urban areas where numbers of vehicles are increasing and most of the time faces issue of wastage of time due to traffic congestions, no information about accidents or road blockage. In rural areas with low population, where vehicle are running with long distance to each other, the (ITS) provide information about any mishap with any vehicle.

VANET is subdivision part of Mobile Adhoc Network (MANET). Every mobile unit in MANET is considered as node whereas in VANET every vehicle is supposed as a node [4]. A number of routing protocols have been defined by many researchers for MANET under the different kind of Scenarios, Mobility models and traffic loads. In Contrast of VANET the performance of routing Protocol showing different results due to the high dynamic mobility condition, variable transmission ranges, infrastructure type and energy consumption [5,6].

Work considers V2V, communication where vehicles are categorized by different speeds. The selected nodes for communication are only police vehicles, remaining vehicles are supposed as forwarding nodes. The system is responsible to communicate the information about the condition of road, traffic and any emergency. Here we are considering AODV, AOMDV, DSR and DSDV routing protocols in three different scenarios depending upon variables (road height, traffic load, duration, No of Vehicles, transmission range, mobility speed, Packet per Second) to analyses the performance of VANET routing Protocols. The results presented by average throughput, packet delivery ratio and Average end to end delay. The paper is organized as follows. Section II depicts literature review. Simulation setup and parameters are described in Section III. Section IV presents results. Finally, the conclusion is drawn in Section V.

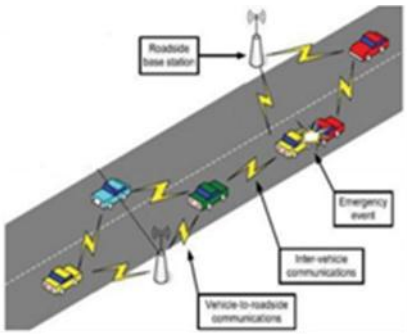

Figure. 1. ANET communication System

LITERATURE REVIEW

An "Intelligent Transport System (ITS)" is simulated and evaluated in [7], they found that the performance of AODV routing protocol improved as compared to DSR. The performance of system is evaluated by throughput, delay, load and packet drop rate. Authors discussed the congestion problem of VANET under mobility models [8], the performance of AODV routing protocol was evaluated by delay, throughput and packet delivery ratio. The work of [9] analyses the performance of routing protocols which are based on position; DSDV, DSR, AOMDV and AODV. They found that AODV works efficiently for VANET. AODV and DSDV compared and analyzed for VANET [10], focusing on inter ambulances communications for high ways. Finding proved that AODV performance is greater than DSDV in heavy data loads. In our previous work [11], we analyzed the behavior of MANET routing protocols under UDP and TCP traffic with variable bit rates. The comparative literature review of MANET routing protocols is presented in [12], where the protocols are analyzed with different situations of network size, mobility and QoS. In this work the analysis is based VANET routing protocols under different network sizes.

SIMULATION SETUP

To conduct this research, a realistic scenario of National Highway NH-5 from Hyderabad to Nooriabad is adopted; the distance covered is 55km from Hyderabad tool plaza, shown in Fig. 2. We choose NS2 for simulation of the VANET having numerous groups of isolated vehicle nodes. Vehicles are divided into five categories that are police vehicles, buses, trucks, cars and motor cycles, all have assign different movement speeds.

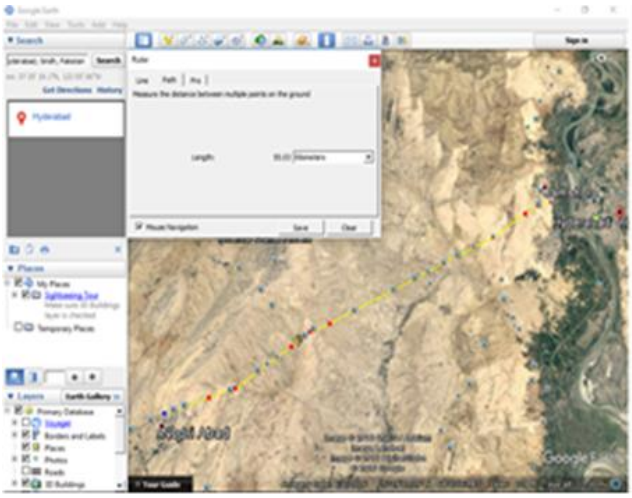

Figure. 2. NH-5, 55Km from Hyderabad to Nooriabad captured via Google Earth

For communication nodes the police mobiles are selected while remaining vehicles are used as forwarding nodes. Fig. 3 depicted the scenario of simulation. Transmission range of nodes is 416(m), supporting different protocols and call durations for full-duplex communication. The data rate remained same for all VANET nodes. Simulation time is 600 sec which is divided into two equal segments of 300 sec where different call duration are generated according to talk time and gap or silence time of communication that vary as 50/250, 100/200 and 200/100 patterns. Traffic call load generator is used to generate calls where every node starts random calls either 1 or 2 times per segments, more packets are generated into same segment when call talk time increases. Table 1 presents the used simulation parameters with values.

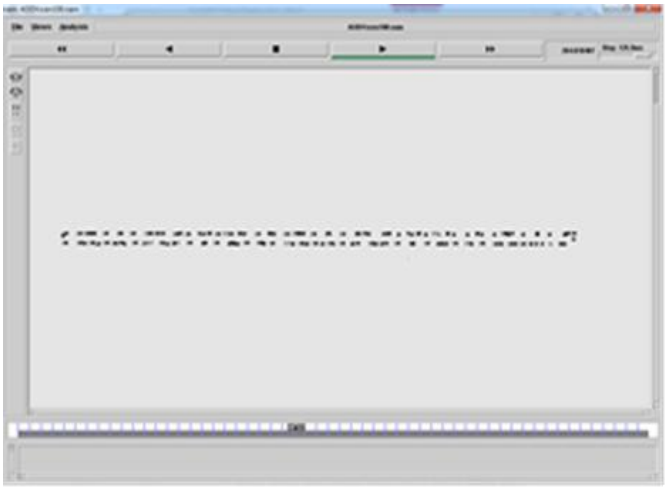

Figure.3. Simulation Setup for VANET communication (NS2)

Table I: Simulation Parameters And Settings

Parameters	Values
No Nodes	170
Application / Transport Agent	CBR/ UDP
Routing Protocols	AODV, AOMDV, DSR, DSDV
Mobility Model	Road Model for VANET
Radio Propagation Type	Two Ray Ground
Antenna Model	Omni Antenna
Transmission Range	416 meters (Power out=4.76456E-11 watts)
Mobility speeds	(20, 30, 40, 50,60)meter/sec
Packets Per Sec (kbps) = Packets Size (kbps) / Rate (bytes)	6.25 pkt/sec = (8 X 1000) / (160 X 8)
Call duration (talk time / silence time)	50/250, 100/200, 200/100
Simulation Time	600 Seconds
Total Distance	55 km

RESULTS

Simulations results are based on quality of services metrics as throughput, PDR and end to end delay. Generally, throughput is the production's amount of successfully received packets at the destination. Fig. 4. Shows throughput vs. call duration, as the call duration increases the throughput of AODV also increases. Very small increasing of throughput is observed with AOMDV, as duration increases. But still it does not maintain the huge throughput in the network. The throughput of DSDV and DSR changes at very low (negligible) rate, which decreases with increase of call duration.

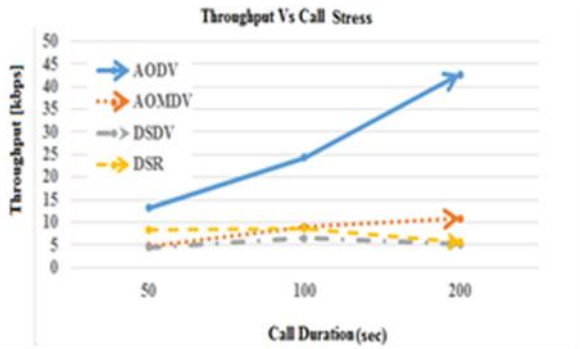

Figure. 4. Throughput vs. Call Duration

End-to-end delay is identified as overall time taken to send packet from source to destination. It is the concept of overall delay in the network. As it is small as performance of routing protocols is high in the network. Fig. 5. Shows End
To End Delay Vs Call Duration of all routing protocol. AODV maintains congestion of network under different duration condition; AODV found almost stable for end to end delay and does not decrease much with an increase in call durations. AOMDV produces best results for delay under different call durations that is due to support of multiple paths for communication. DSDV increases rapidly after call duration of 100 sec. DSR behaves poor for end to end delay,

it produces maximum delay but that delay results are almost stable for different call durations.

The concept of PDR is a ratio of total receiving packets divide by total generates packets. As PDR% of network gets high, shows improved network performance. The graph in Fig. 6 shows the PDR Vs Call duration of all routing protocols in the network. The PDR of DSDV routing protocol is in a smaller amount as compared to other routing protocols. As call duration increases the PDR of DSDV decreases rapidly. The PDR amount of AOMDV is little improved then DSDV and followed the same behave as DSDV. DSR routing protocols is affected more with call duration, it exponentially decreases as in increase in call duration. Performance of AODV is best from all using routing protocols; it produces maximum PDR amount and stable with increase in call durations.

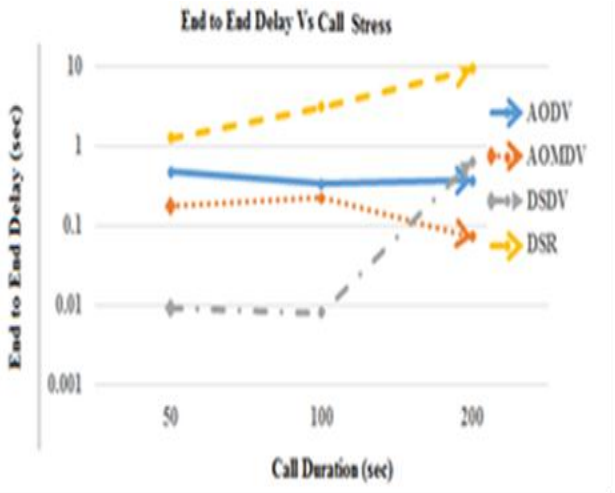

Figure.5. End to End Delay vs. Call Duration

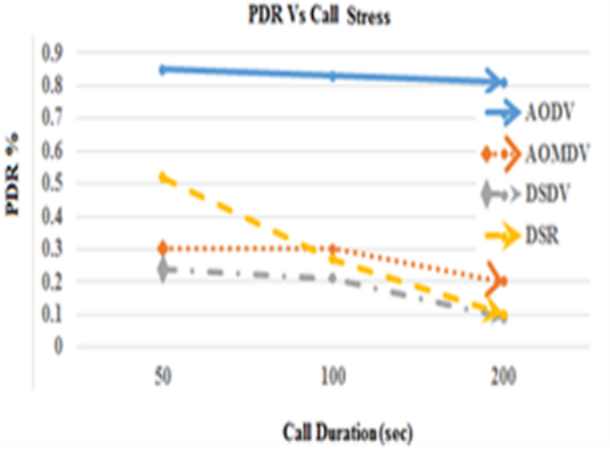

Figure.4. PDR vs. Call Duration

Table 2: Summarizes The Results Of Metrics Of All Routing Protocols

Routing Protocol	Call Duration (sec)	PDR %	Throughput (kbps)	Delay (sec)
AODV	50	0.85	13.25	0.4731
DSR	50	0.52	8.32	1.265
DSDV	50	0.24	4.51	0.009
AOMDV	50	0.3	4.73	0.1721
AODV	100	0.83	24.34	0.3336
DSR	100	0.27	8.54	3.108
DSDV	100	0.21	6.47	0.0079
AOMDV	100	0.3	8.99	0.2241
AODV	200	0.81	42.65	0.3668
DSR	200	0.1	5.6	9.399
DSDV	200	0.09	5.11	0.6396
AOMDV	200	0.2	10.83	0.073

CONCLUSION

The paper evaluates VANET routing protocols over realistic scenario of National Highway NH-5. Work considered 55 km of distance on NH-5, starting from Hyderabad tool plaza up to nooriabad, towards Karachi (Sindh, Pakistan). From the simulation results we analyze that for VANET, AODV protocol with throughput, delay and PDR performed better than other protocols. AOMDV and DSDV perform equally in particular for throughput and PDR results. The overall performance of DSR is very poor. It is observed that AODV efficiently handle the dynamic change in topology and speed with support of QoS over different call durations.

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