Performance Analysis of Video Streaming Applications over VANETs

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ABSTRACT
Video streaming applications are of various types like video conferencing, video chat, video on demand and live video streaming. These different applications have different resource requirements which shall be met by the vehicular adhoc networks (VANETs) according to the availability of resources. In this paper we have analyzed video streaming applications over VANETs on applying two different protocols namely Adhoc On Demand Distance Vector (AODV) and Dynamic Manet on Demand routing protocol (DYMO) in different traffic scenarios like varying node densities, node velocities and pause times. In VANETs, nodes join and leave the network quite frequently resulting in route failures. Comparative analysis has been done on application layer metrics in order to further authenticate that VOIP traffic shows better results with AODV changing the traffic conditions.

General Terms
Video streaming, VANETs, routing protocol

Keywords
VOIP, AODV, DYMO, CBR, VBR,

1. INTRODUCTION
Earlier we have seen implementation of different routing protocols on constant bit rate (CBR) and Variable bit rate (VBR) applications and seen their performance and infer certain results. In this particular study, we have implemented AODV and DYMO routing protocols on VOIP applications. Different scenarios are considered by changing number of nodes, pause times and mobility. These results will help us concluding that there is scope of improvement in AODV as AODV does not deal with route stability, which is an added feature to improve the routing strategy of AODV. VOIP applications can be implemented with different codecs such as G.711, G.729, H.261, H.263 which fall under video and audio apps category. The majority of video standards are developed by two groups namely as VCEG(Video Coding Experts Group) of International Telecommunications Union Telecommunication standardization sector(ITU-T) , MPEG(Moving pictures Experts Group) of International organization for standardization (ISO)and International Electro technical Commission (IEC) . Audio video applications have been implemented here to have an observation of certain metrics like average jitter, average end to end delay, talking time and average mean opinion score (MOS). Different scenarios have been considered like different number of nodes, different speeds and different pause times. Two protocols namely AODV and DYMO have been applied on various scenarios. VANETs give several benefits to video streaming in adhoc networks. Battery is not a problem here in vehicular adhoc networks when built-in transceivers are employed, proving that large buffers can now serve to absorb any latency arising from multi hop routing. In urban VANETs, connections are longer due to congestion as high speeds are not possible as compared to highway VANETs. There are different source coding schemes available for emergency video streaming with one scheme called as Multiple Description Scheme (MDC)[1] scheme in which two or more descriptions of the same video stream are sent over different paths, preferably disjoint routes across the network and Video Redundancy coding (VRC) [2] which is more simplified MDC scheme.

2. LITERATURE REVIEW
There are many studies proposed in VOIP based video streaming applications with different routing protocols. The authors have majorly contributed in this area by studying the effect of routing protocols to achieve robustness and quality of service of VOIP transmissions using different methodologies. [3] Vinod Namboodri , L Gao proposed a prediction based routing protocol(PBR) which works on the basis of distance between two nodes, velocity of two nodes and range of communication, lifetime of a route is predicted which is very helpful in selecting the longer stable routes which will give us less route failures. As a route is made up of one or more links, the route lifetime is the minimum of all its link lifetimes. With low vehicle density in the forward direction using routes through oncoming vehicles has an effect similar to doubling the vehicle density in the forward direction in terms of connectivity. [4] shaily mittal has done performance analysis on AODV, DSR and ZRP routing protocols in MANETs. Comparative analysis has been done for different routing protocols by [5] Vaishali D et al. In another paper "Comparative Analysis of Video Streaming Services in H. 323 Application Layered Protocol Coexisting of WLAN with Wireless Broadband Standard Networks" by Sakthisudan et al [6] a comparative study has been done on the basis of H.323 and SIP protocol on VOIP. In this paper, analytical model provides that the VoIP call set-up performance, jitter and delay in peer to peer networks can be improved significantly using the robust in application link layer such as RTP/RCTP with a comparison of heterogeneous network proposed in our paper. The analytical results are validated by experimental measurements**. [7] Ahir et al** investigated different techniques of improving QoS of video on demand and IPTV by applying some of the UDP variants for MPEG video streams . Various studies have been done on the basis of application layer metrics to observe the effects of various routing protocols such as AODV, DYMO, DSR and LAR. The effect of these protocols have been studied on CBR and VBR applications by pooja et al[8]In one of the comparative study[9] made by J Haerri, F Filali and C Bonnet title "Performance comparison of AODV and OLSR in VANETs urban environment under realistic mobility pattern ", the motive is to provide the evaluation of applicability of the vehicular protocols in different scenarios like varying node density and node mobility. S Jaap et al[10] compared and analyzed AODV, DSR, FSR and TORA on highway scenarios whereas S Jaap et al [11] compared the same

protocols in city traffic. N Qadri et al in [12] proposed an MDC scheme which is employing H.264 /AVC (Advance video Coding) [13] when hybridized with multiple path video transfer will result in high video quality. Fabio Soldo et al [14] has discussed a problem of distributing video streaming traffic from one source node to all nodes in an urban vehicular adhoc network and proposed a solution for the inter vehicular communications known as Streaming Urban Video (SUV) which adjusts to topology changes.

3. ISSUES IN VIDEO STREAMING APPLICATIONS OVER VEHICULAR ADHOC NETWORKS

As there are various fast moving nodes in Vehiuclar adhoc network traffic due to which nodes join and leave the network at a greater speed resulting in route failures, degrading the quality of service of video streaming applications. It is really a great challenge to optimize the performance of video streaming applications when routes are not very stable.

3.1 Analysis of Different Routing Protocols for Different Types of Traffic of Video Streaming

To analyze the efficacy of routing protocols on video streaming applications ,various metrics like jitter, mean opinion score, talking time etc. are considered. AODV is an on demand routing protocols which has already shown better results for video streaming applications when sent as CBR and VBR traffic. Now to further authenticate that AODV shows again better results with VOIP applications for more number of nodes, changing velocities of nodes in a scenario in vehicular adhoc networks. There are different types of routing protocols available which have different approaches for routing. There are different classification of routing protocols on the basis of topology, destination and proactive protocols. Some of them are unicast, multicast and geocast routing based on the type of casting. Each routing node has previous information of other nodes acting as routing nodes in its immediate neighborhood. Each router transfers data to its immediate neighbors and then to the whole network. Due to lack of centralized infrastructure, it is challenging to manage resources in an adhoc network due to frequent changing topology and high velocity of vehicles. There are various techniques available for video transmission over adhoc networks like Multiple Description video coding (MDVC) along with path diversity, an adaptive mode selection approach is proposed to adapt the network conditions and video characteristics. Video streaming applications can be sent over adhoc networks by different traffic patterns. One of the method can be Variable Bit Rate (VBR) traffic since MPEG -1 video is composed of various frames which have varying size so it is preferred to sent video traffic by VBR. The bit rate of the video traffic varies from time to time and hence bandwidth utilization is low. Network Quality of service (QoS) support can greatly facilitate video rates or delay of video communication as it enables a number of capabilities including resource provisioning for video data, prioritizing delay–sensitive video data in comparison to other forms of data transmission and also prioritize among the different forms of video data that must be communicated. The formation of route is very different in two routing protocols namely AODV and DYMO. Henceforth, qualitative and quantitative data of stability of routes is to be seen here in turn further increasing the quality of video streaming applications.

3.2 Adhoc on Demand Vector Routing Protocol

Adhoc on demand vector (AODV) is also an on demand routing protocol [15] as it finds a route to the destination only when a node has to communicate to that particular node. When finding a path between source and destination, source node broadcasts a route request (RREQ) packet to every other node when it initiates to search a path between two nodes.. A node helds a record of a previous node from which it received the route request (RREQ) packet; finally in the same manner it forms the reverse route backwards keeping track of route reply (RREP) packets. The route request packet (RREQ) has sequence numbers which are very beneficial to ensure that routes are not having any loop .As the route reply packet goes back to the source, the nodes along the path enter the forward route and make changes in routing tables entries. As there is a lot of mobility in vehicular adhoc network nodes, route maintenance is required very frequently. Route discovery process is reinitiated again if source node is mobile . When an intermediate node receives the same copy of request, it rejects it without routing it further to next nodes. The source sequence number is used to maintain information about reverse route and destination sequence tells about the actual distance to the final node. [16][17]

3.3 Dynamic MANET on Demand Routing Protocol (DYMO)

DYMO is dynamic, reactive, multi hop routing protocol among nodes wishing to communicate. Two important jobs of this protocol are route discovery and route management. Using adhoc on demand distance vector (AODV), DYMO takes “Path Accumulation” from Dynamic source routing (DSR) and removes unwanted route reply (RREP), precursor lists and Hello messages (Route exploration messages) thus simplifying AODV [18]. The node retains sequence numbers and Route error messages from AODV. When an intermediate node knows an active route to the requested destination node, it sends a route reply (RREP) packet back to source node in unicast manner. At the end source node gets RREP and the route is formed.

4. SIMULATION AND RESULTS

Simulation has been done on Qualnet Simulator version 5.0.Simulation experiments have been performed keeping the below mentioned parameters when having implementation of AODV on VOIP traffic. In this section effect of node density is seen by varying number of nodes in scenario on VOIP traffic. Simulation parameters are tabulated here in table 1

Table 1 Simulation parameters

Parameter	Value
Protocols	AODV,DYMO
Number of Nodes	30,50,80,120
Pause Time	30,60,100s
Simulation time	100s
Traffic Type	VOIP
Transmission Range	250 m
Mobility Model	Random Way point Model
Simulation Area	1500x1500
Node Speed	0,10,20,60,90 km/h
Interface Type	Queue
MAC Protocol	802.11 Ext
Packet Size	512
Radio Propagation Model	Two Ray Ground

Scenario 1 VOIP traffic varying node density with AODV and DYMO

Table 2 Varying Node Density

Node Density	30	30	30	30	60	60	60	60
	Avg. Jitter	Avg. MOS	Talking time	Avg. One Way Delay	Avg Jitter	Avg MOS	Talking Time	Average One Way Delay
AODV	6.79	3.29	46.7	0.030	0.90	3.27	56.06	0.0486
DYMO	8.55	3.24	55.65	.0786	6.29	3.2	54.45	0.086

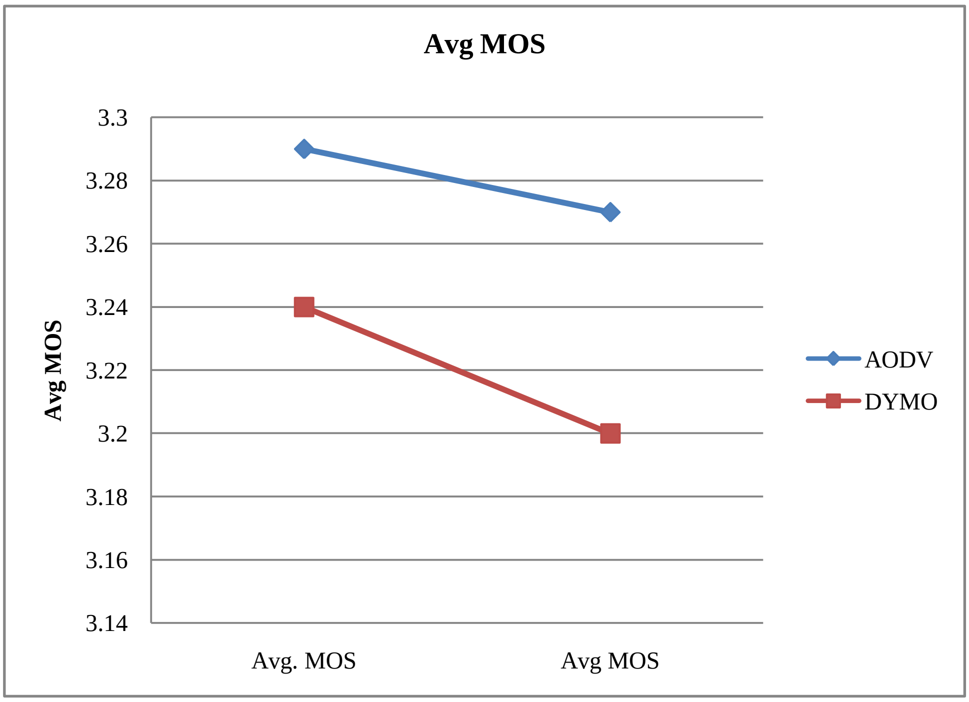

Fig 1 VOIP traffic on varying node density

The above results indicate that AODV is outperforming DYMO when number of nodes are varied in a traffic scenario by giving better Average Mean Opinion Score (MOS) which is a direct indicator of quality of video applications , in particular VOIP applications.

Scenario 2 VOIP traffic varying velocity of nodes with AODV and DYMO

Table 3 Varying Velocity of nodes

Node Speed	10-30	10-30	10-30	20-50	20-50	20-50	40-90	40-90	40-90
	Avg. Jitter	Avg. MOS	Talking time	Avg. Jitter	Avg. MOS	Talking time	Avg. Jitter	Avg. MOS	Talking Time
AODV	0.9	3.27	28	3.5	3.23	70.3	3.845	3.23	40.5
DYMO	6.3	3.2	54.45	2.23	3.2	25.27	7.42	3.17	29.59

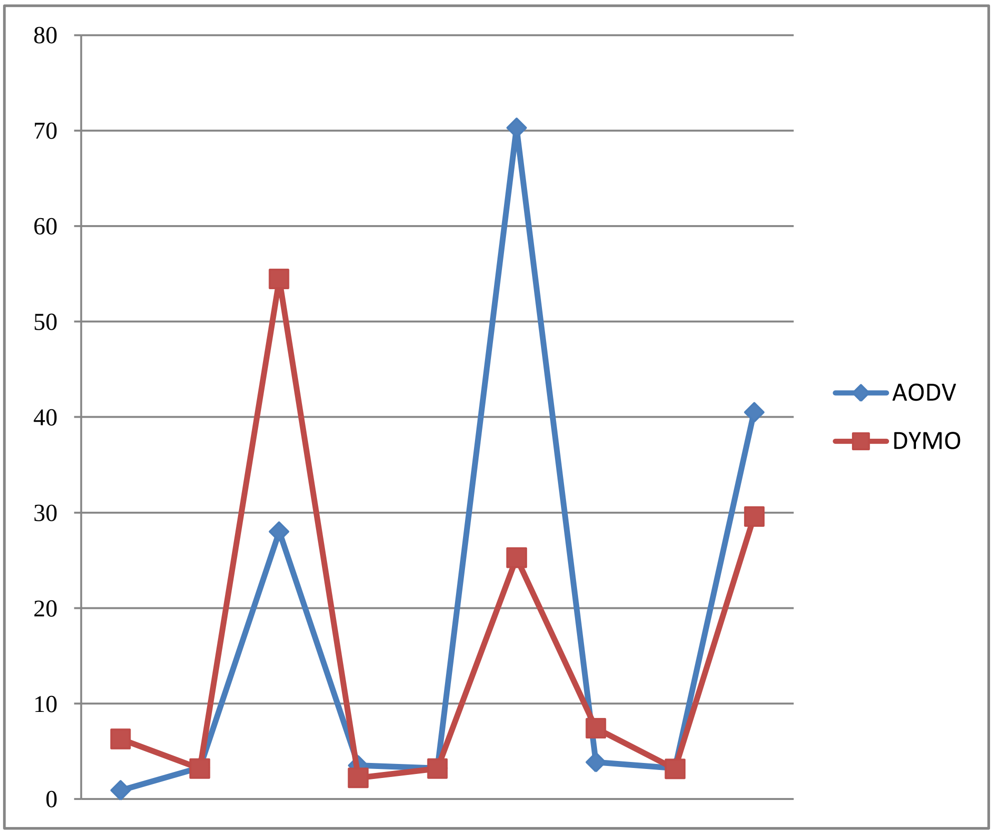

Fig 2 VOIP traffic on varying velocity of nodes

The results according to fig 2 show that when the velocities of nodes are very less DYMO is better but when speed is increased AODV has shown better talking time in comparison to DYMO. When speed of node is increasing, the talking time is more and more with the implementation of AODV.

Scenario3 Effect of varying pause times on VOIP traffic with AODV and DYMO

Table 4 Varying pause times

Pause Time	30s	30s	30s	80s	80s	80s	100s	100s	100s
	Avg. Jitter	Avg. MOS	Talking time	Avg. Jitter	Avg. MOS	Talking time	Avg. Jitter	Avg. MOS	Talking time
AODV	0.24	3.23	17.2	3.18	3.01	10.2	4.31	2.4	22.1
DYMO	2.31	3.12	23.2	0.0004	3.27	7.96	2.53	2.09	20.41

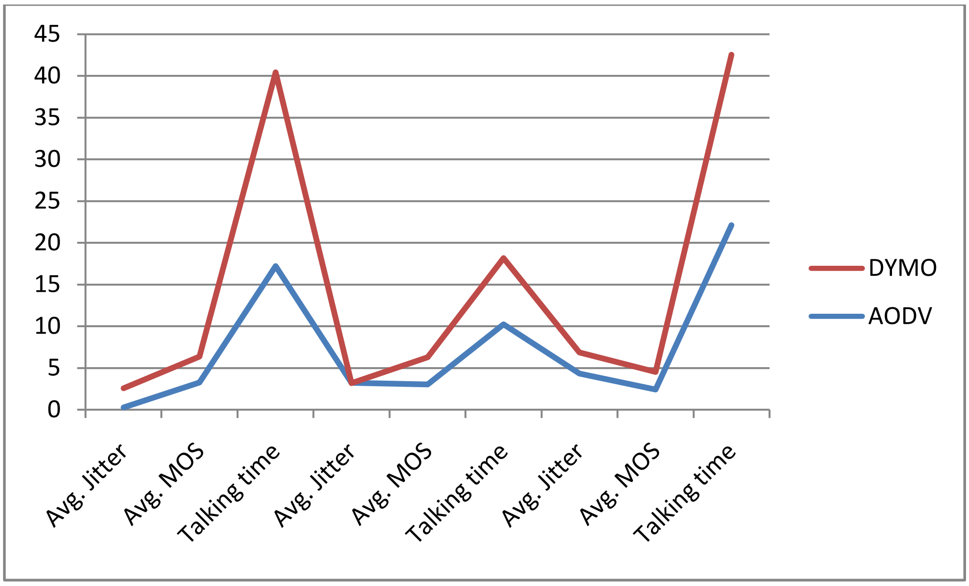

Fig 3 VOIP traffic on varying pause times

In this particular scenario we have seen that by varying pause times VOIP traffic has shown better Average MOS when pause time is less but when pause time is increased, average MOS is decreased to a greater extent with both AODV and DYMO. But with increasing pause time, average MOS has decreased with AODV. It is not so with DYMO, pause time has shown different effect on average MOS with DYMO. In this research, concluding AODV is showing less average jitter, more talking time and more average mean opinion score (MOS) as compared to DYMO in all the three scenarios

5. CONCLUSION

In this particular research paper it has been further authenticated that VOIP applications have shown better performance in terms of jitter, talking time and average mean opinion score (MOS) with AODV when compared with DYMO in all of the scenarios except when pause times are varied. Further, improvement in performance of VOIP applications can be seen with a modification in AODV. VOIP applications can be implemented with other routing protocols like LAR(Location aided Routing), DSR (Dynamic Source Routing) to see the advantages of one over another.

6. ACKNOWLEDGEMENTS

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7. REFERENCES

[1] Y. Wang, A. R. Reibman, and S. Lee, Multiple description coding for video delivery, Proc. of the IEEE 93(1) (2005) 57-70.

[2] S. Wenger, G. D.Knorr, J. Ou, and F. Kossentini, Error resilience support in H.263+, IEEE Trans. Circuits and Syst. for Video Technol., 8(7) 867-877.Y. Wang, A. R. Reibman, and S. Lee, Multiple description coding for video delivery, Proc. of the IEEE 93(1) (2005) 57-70.

[3] Vinod Namboodri , L Gao IEEE Transactions 2007 " Prediction based routing Protocol for vehicular adhoc networks.

[4] Shailey Mittal "Performance comparison of AODV, DSR and ZRP routing protocols in MANETs"

[5] Mrs Vaishali and Dr ketan Katocha "Simulation based performance evaluation of routing protocols in Vehicular Adhoc Networks" International Journal of scientific and research publications Volume 3 Issue 10 Oct 2013

[6] Sakthisudhan, K., P. Thangaraj, and C. Marimuthu. "Comparative Analysis of Video Streaming Services in H. 323 Application layered protocol coexisting of WLAN with Wireless Broadband Standard networks." *International Journal of Computer Applications* 46 (2012).

[7] Ahir, Rajesh K. "Improving a performance of MPEG video streams with different UDP variants." International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 12, December 2013

[8] Sharma, Pooja, Ajay Kaul, and M. L. Garg. "Performance evaluation of CBR and VBR applications on different routing protocols in VANETs." *Int. J. of Recent Trends in Engineering & Technology* 11 (2014).

[9] J Haerri, F Filali , C Bonnet " performance comparison of AODv and OLSR in VANETs urban environments under realistic mobility patterns

[10] S Jaap, M Bechler, L Wolf "Evaluation of routing protocol for Vehicular Adhoc Networks in typical road traffic scenarios" in proceedings of 11th EUNICE open European summer school on networked applications, Spain July 2005

[11] S Jaap, M Bechler, L Wolf "Evaluation of routing protocol for Vehicular Adhoc Networks in city traffic scenarios" in proceedings of 5th International Conference in intelligent transport systems Telecommunication , France June 2005

[12] Qadri, N., et al. "Robust video communication over an urban VANET." *Mobile Information Systems* 6.3 (2010): 259-280.

[13] S. Wenger, H264/AVC over IP, IEEE Trans. Circuits and Syst. for Video Technol., 13(7) (2003) 645-656.

[14] Fabio Soldo, Claudio Casetti, Carla Fabiana and pedro Chappro "Video Streaming Distribution in VANETs" IEEE Transactions on parallel and distributed Systems Issue No 07 –July (2011 vol. 22)

[15] Fasee ullah, Muhammad amin and Hamid Ull Ghaffar "Simulation AODV and DSDV for a dynamic Wireless sensor networks " IJCSNS International journal of Computer Science and Network Security Vol 10 no.7 July 2007

[16] Nor Suryati Mohammad Usop, Azizol Abdullah and Ahmed Faizal Amri, "Performance evaluation of AODV, DSDV and DSR routing protocol in Grid environment" IJCSNS International journal of computer science and Network Security Vol. 9 N0. 7 July 2009.

[17] Asma Tuteja, Rajneesh Gujral "Comparative performance analysis of DSDV,AODV and DSR in MANET using NS2

[18] Deepali Arora, E millman, Stephen Neville "Assessing the performance of AODV, DYMO and OLSR routing protocols in the context of larger scale Denser MANETs" 978-1-4577-0253-2/11 c 2011 IEEE