

Implementation of GPVR and its Comparison with GPSR

Jyoti Kushwaha^{1*} Dr. Kanojia Sindhuben Babulal²

¹ M.Tech Scholar, United College of Engineering and Research, Naini, Allahabad, India

² Assistant Professor, United College of Engineering and Research, Naini, Allahabad, India

Abstract – In the past few years, VANETs, because of their unmistakable societal impact that promises to revolutionize the way we drive, various car manufacturers, government agencies and standardization bodies have spawned national and international consortia devoted exclusively to VANET. Indeed, the fact of being networked together promotes car-to-car communications, even between cars that are tens of miles apart.

Keywords – VANET, GPVR, GPSR, Low routing Overhead, Enhanced Throughput.

-----X-----

1. INTRODUCTION

A large number of routing protocols have been proposed for VANET. A routing protocol governs the way that two communication entities exchange information; it includes the procedure in establishing a route, decision in forwarding, and action in maintaining the route or recovering from routing failure. [1][4]

A Vehicular Ad Hoc Network or VANET is a technology that uses moving cars as nodes in a network to create a mobile network.

2. OBJECTIVE

The primary objective of this research is the simulation and analysis of GPSR and GPVR routing protocol with mobility model for VANET. The objectives may further be categorized into various sub-tasks, which are as under:

- Implement a new protocol based on Greedy system in VANET.
- Comparison of existing protocol to proposed protocol.
- To calculate the performance of QoS parameters in NS-2.
- To propose and implement a novel protocol with novel approach based on distance vector, greedy forwarding strategy with perimeter forwarding strategy, and GPS system.

- To propose and implement a protocol based on vehicle's environment which has lower packet loss rate, high throughput, less network load and less time delay.

3. PARAMETERS TO ANALYSE

3.1 Packet Delivery Ratio

The packet delivery percentage represents the percentage of total sent packets from source nodes, which are successfully received at the destination nodes or the ratio of the number of data packet delivered to destination to the number of data packets transmitted. [2][5][11]

$$PDR = \frac{\sum \text{Number of packet receive}}{\sum \text{Number of packet send}}$$

3.2 Packet Loss Ratio / Loss Ratio

The Packet Loss Ratio represents the total number of packets lost in the network between source and destination nodes during transmission. [3][7]

$$LR = \frac{\sum \text{Number of packet drop}}{\sum \text{Number of packet generated}}$$

3.3 Aggregate Throughput / Throughput

The aggregate throughput is the total number of bytes received at the destination divided by the total time duration. This aggregates all the flows in the network. The amount of data transfer from source node to destination node in a specified

amount of time i.e. average number of bits delivered per second(Kbps), Calculated as:[7]

$$\text{Throughput} = (\text{Packet Size}/(\text{stopTime}-\text{startTime}))*(8/1000)$$

3.4 End – to – End Delay

The end-to-end delay is the averaged result of how long it takes a packet to go from the source to the destination. The average time taken by a data packet to arrive at the destination and it also includes the delay caused by route discovery process and the queue in data packet transmission and only successfully data packets that delivered to destinations that counted.[3][6]

$$\text{E2E Delay} = \sum (\text{arrive time} - \text{send time}) / \sum \text{Number of connections}$$

3.5 Routing Overhead

The measure of routing packets (non-data) generated by the protocol. [2]The total number of routing packets transmitted during the simulation i.e. the sum of all transmissions of routing packets sent during the simulation.[7][11]

$$\text{Routing Overhead} = \sum \text{Transmission of routing packets}$$

4. CLUSTERING TECHNIQUES

A beneficial technique to organize ad hoc networks and group the nodes in to smaller segments is called clustering. Clustering is helpful in large scale distributed networks for simpler management and information aggregation of each network segment. Classification of the nodes into clusters is performed according to special application requirements in order to provide a conveniently manageable network. [6]

In cluster-based routing protocols, nodes are compared to each other and the most similar nodes based on their movement patterns are selected to join the same cluster. The comparison criteria between nodes are defined based on protocol's application requirements. [8] Applying clustering techniques to VANET applications is beneficial and is being used widely Clustering has been mostly used for data dissemination and routing in VANET [9]. Employing cluster- based techniques for target tracking in VANET is still a challenge and has not been used frequently.[12]

The main entities of a cluster are: cluster members (CM), cluster head (CH), and gateway nodes (GW). [13] CH is the leader node responsible for cluster management and communication with other clusters or infrastructures in the network. CH is also responsible for relaying information between nodes

in the cluster or from cluster nodes to other clusters. CMs are the nodes which join a cluster based on their features and similarities. These nodes are responsible to send their information and application-based data to CH in specific time intervals. CMs of one cluster are not supposed to communicate with CMs or CHs of other clusters. GW nodes are the shared nodes between two clusters.

These nodes can contribute to the communication between two clusters. Clustering Advantages for VANETs in complex distributed and large scale networks, clustering is helpful for network management and data aggregation [14]. Due to VANET's special characteristics it would be effective to introduce an aggregator node responsible for data aggregation in a specific part of the network. [15]The aggregator node may be referred to as the leader node or CH. CH's role is to build and maintain the cluster structure for communication of application- specific data. The CH receives messages from member nodes in its area and aggregates these messages.

5. NETWORK SIMULATOR

Simulation can be characterized as "Emulating or evaluating how occasions may happen in a genuine circumstance". It can include complex numerical displaying, pretending without the guide of innovation, or mixes. The esteem lies in the pacing you under sensible conditions that change because of conduct of others included, so you can't expect the succession of occasions or the ultimate result.[7]

NS is an occasion driven system test system created at University of California at Berkeley, USA, as a REAL system test system extends in 1989 and was produced at with participation of a few associations. Presently, it is a VINT venture bolstered by DARPA.

NS isn't a completed apparatus that can deal with a wide range of system demonstrate. It is in reality still a non-going exertion of innovative work. The clients are capable to confirm that their system demonstrate reproduction does not contain any bugs and the group should impart their revelation to all. There is a manual called NS manual for client direction.[5]

NS is a discrete occasion arrange test system where the planning of occasions is kept up by a scheduler and ready to reenact different sorts of system, for example, LAN and WPAN as per the programming contents composed by the client. Other than that, it additionally actualizes assortment of uses, conventions, for example, TCP and UDP, arrange components, for example, flag quality, movement models, for example, FTP and

CBR, switch line administration systems, for example, Drop Tail and some more.

Since NS-2 is a scholarly task, the fundamental reason for existing is for assessing the current system's execution or the execution of system with new plan of part. In this way, to gain ground on this issue, ns-2 can without much of a stretch take every necessary step of system post reproduction examination which will additionally make ns-2 more down to earth on doing versatile reenactment.

There are two dialects utilized as a part of NS-2; C++ and OTcl (a question situated augmentation of Tcl). The aggregated C++ programming chain of importance makes the recreation effective and execution times quicker. The OTcl content which composed by the clients the system models with their own particular topology, conventions and all necessities require.

The type of yield deliver by the test system additionally can be set utilizing OTcl. The OTcl content is composed which making an occasion scheduler questions and system segment protest with organize setup helping modules. The reenactment comes about deliver in the wake of running the contents can be utilized either for recreation examination or as a contribution to graphical programming called Network Animation (NAM).

6. IMPLEMENTATION

A computer network is a complex system that requires a careful treatment in design and Implementation. Simulation, regarded as one of the most powerful performance analysis tools, is usually use in carrying out such a treatment to complement the analytical tools.

In this thesis focus is mainly on time - dependent simulation, which advances in a time domain. The time-dependent simulation can be divided into two categories. Time-driven simulation advances the simulation by fixed time intervals, while event -driven simulation proceeds from one event to another. NS2 is an event-driven simulation tools.

Tool Command language (Tcl) is a powerful interpreted and dynamic programming language. It has a wide range of usage, including web and desktop applications, networking, administration, testing etc.[5]

Tcl is a truly cross platform, easily deployed and highly extensible. The most significant advantage of Tcl language is that it is fully compatible with the C programming language and Tcl libraries can be interoperated directly into C programs.[7]

Simulation parameters used are given in the table1.

PARAMETERS	VALUE
Operating System	Linux (UBUNTU 12.04)
NS-2 version	NS-2.35 for IEEE 802.11Ext
No. of vehicles	10, 20, 30, 40, 50
Number of road segments	4
Speed of vehicles	20 m/s
Radio propagation model	Propagation/Two Ray Ground
Network interface type	Phy/WirelessPhyExts
Packet Size	512
Traffic Type	UDP/CBR
Simulation Time	100s
Antenna Type	Omni-Antenna
Transmission Range	1000*1000 m
Routing Protocol	GPVR

6.1 Optimal Route Selection Algorithm

Procedure 1: route discovery

Input: ID of source node S and Destination node D

Outputs: optimal route from source to destination

Begin

if (ID D = ID N)

Forward packet to D;

Else

Determine the rectangle restricted searching area;

searching_area = [Xmin , Xmax , Ymin , Ymax];

broadcast RREQ to D in the searching_area;

Activate (BROADCAST_TIMER);

Calculate route probability of connectivity and packet delay;

if (p max – p other > E)

return route with the probability of connectivity pmax;

else

delete routes with the probability of connectivity p other < p max – p threshold;

return route with packet delay d min;

end if

end if

End of Route Discovery

6.2 Next-Hop Selection Algorithm

Procedure 2: Next-Hop selection

Inputs: positions and speed of the neighbours

Outputs: The optimal next-hop forwarding node

begin

do

if (D forwarding_road_segment = D current_road_segment)

else

forward to the N intersection_node;

else

forward the packet directly to its farthest N neighboring_node;

while (forwarding node is not destination node);

forward packet to destination node;

end if

end if

end while

End of Next-hop Selection

7. COMPARISON OF GPSR AND GPVR

The performance of routing protocols is measured through performance metrics including the throughput, end-to-end delay and the packet delivery ratio. In general, as the traffic load increases, the routing protocol needs to transport more data across the network, which causes more transmissions on the wireless medium, resulting in more collisions and packet losses.

Similarly, high mobility also strains the performance of the routing protocol by involving constantly changing routes. The end-to-end delay is also higher for high traffic, mobile topologies since there are a large number of collisions, which requires more frequent retransmissions at the link layer, resulting in long delays.

In particular, the end-to-end delay is also tightly coupled with the network size since a large network has longer routes on average, requiring more hops and consequently, more delay.

Table 2: Parameters of GPSR

No. of Nodes	PDR	LR	E2E	TP	OH
10	49.4683	0.0505317	10	140	0.16
20	25.2967	0.0747033	10	76	0.16
30	65.1394	0.0348606	380	183	0.16
40	66.2153	0.0337847	425	188	0.13
50	66.6182	0.0666082	430	305	0.14

Table 3: Parameters of GPVR

No. of Nodes	PDR	LR	E2E	TP	OH
10	98.6753	0.0013247	11	395	0.15
20	31.6832	0.0683168	450	282	0.16
30	99.6821	0.0003179	110	392	0.14
40	99.6824	0.0003176	108	396	0.12
50	99.6913	0.0003087	150	401	0.12

It is evidentiary from the above figures and tables that GPVR is superior to GPSR according to current conventions. The PDR of the GPVR is much superior to the existing GPSR. The E2E delay of the GPVR is lesser than GPSR. The enhanced throughput and the decreased overhead affirms the better execution of the earlier proposed GPVR in contrast to GPSR.

8. CONCLUSION

GPVR is a reactive protocol and creates a very low routing overhead due to discovering routes. From the comparative analysis of routing protocols, the GPVR outperforms the GPSR. The PDR of the GPVR is much superior to the existing GPSR. The E2E delay of the GPVR is lesser than GPSR. The enhanced throughput and the decreased overhead affirms the better execution of GPVR in contrast to GPSR.

In terms of network size, mobility and traffic load GPVR shows better results than GPSR. From the simulation results the behaviors of all routing protocols for different numbers of mobile nodes was observed and we came to the conclusion that GPVR routing protocol performs well. The studies of these routing protocols show that the GPVR is better in Vehicle ad-hoc network according to the simulation results, GPVR perform always better in all the networks. Its performance may vary by varying the network. At the end we came to the point that the performance of routing protocols varies with network size and selection of accurate routing protocols according to the network that ultimately influence the efficiency of that network in an efficient way.

REFERENCES

1. E. M. Royer and C.K. Toh (1999). "A Review of Current Routing Protocols for Ad-Hoc Mobile Ad hoc Networks," IEEE Personal Communications.
2. Yan-tao Liu (2010). "Stationary of Random Direction Direction models", Second International conference on network security, wireless communications and trusted computing.
3. Puneet Manchanda and Parvinder Bangar (2014). "Modified AODV-R Routing Protocol", International Journal of Engineering, Applied and Management Sciences Paradigms, Vol. 16, Issue 01, pp. 96-101.
4. G. Elias, M. Novaes, G. Cavalcanti, and D. Porto (2010). Simulation-based performance evaluation of the SNDP protocol for infrastructure WMNs. In Proc. 24th IEEE Int Advanced Information Networking and Applications (AINA) Conf, pages 90-97.
5. Y. Bi, L. X. Cai, H. Zhao, X. Shen, and H. Zhao (2010). "Efficient and reliable broadcast in intervehicle communication networks: A cross layer approach," IEEE Transactions on Vehicular Technology, vol. 59, pp. 2404–2417.
6. F. Khan, Y. Chang, S. Park, and J. Copeland (2012). "Towards guaranteed delivery of safety messages in VANETs," in Proceedings of the IEEE Global Telecommunications Conference (GLOBECOM), pp. 207–213.
7. Parvinder, Dr. V. K. Suman (2014). "AIS DYMO : AIS based secure DYMO routing in MANET", International Journal of Electronics and Communication Engineering & Technology, Volume 5, Issue 7.
8. E. Fasolo, A. Zanella, and M. Zorzi (2006). "An effective broadcast scheme for alert message propagation in vehicular ad hoc networks," in Proceedings of the IEEE International Conference on Communications (ICC), pp. 3960–3965.
9. G. Korkmaz, E. Ekici, and F. Ozguner (2007). "Black-burst-based multihop broadcast protocols for vehicular networks," IEEE Transactions on Vehicular Technology, vol. 56, pp. 3159–3167.
10. J. Sahoo, E. H.-K. Wu, P. K. Sahu, and M. Gerla (2011). "Binary-partition assisted MAC-layer broadcast for emergency message dissemination in vanets," IEEE Transactions on Intelligent Transportation Systems, vol. 12, pp. 757–770.
11. C. Suthaputchakun, M. Dianati, and Z. Sun (2014). "Trinary partitioned blackburst-based broadcast protocol for time-critical emergency message dissemination in VANETs," IEEE Transactions on Vehicular Technology, vol. 63, pp. 2926–2940.
12. T. Rappaport (2002). Wireless Communications: Principles and Practice, 2nd ed. Theodore S. Rappaport.
13. Puneet Manchanda and Parvinder Bangar (2014). "A SURVEY ON ROUTING IN VANET", International Journal of Electronics and Communication Engineering & Technology (IJECET), Volume:5, Issue:4, Pages:1-6.
13. Y.C. Tseng, S.-Y. Ni, Y.-S. Chen, and J.-P. Sheu (1999). "The broadcast storm problem in a mobile ad hoc network," in Proceedings of the ACM International Conference on Mobile Computing and Networking (MOBICOM), pp. 153–167.
14. F. Farnoud and S. Valaee (2009). "Reliable broadcast of safety messages in vehicular ad hoc networks," in Proceedings of the IEEE INFOCOM, the Annual Joint Conference of the IEEE Computer and Communications Societies, pp. 226–234.

Corresponding Author

Jyoti Kushwaha*

M.Tech Scholar, United College of Engineering and Research, Naini, Allahabad, India

jyotikush1993@gmail.com