JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

PERFORMANCE ANALYSIS OF ROUTING PROTOCOL USINGROADSIDE UNIT IN A VEHICULAR AD HOC NETWORK

Kaviya B
Department of electronics and communication engineering,
Kumaraguru college of technology,
Coimbatore, India.

Suriya K.C
Department of electronics and communication engineering,
Kumaraguru college of technology,
Coimbatore, India.

Dr.S. David
Department of electronics and communication engineering,
Kumaraguru college of technology,
Coimbatore, India.

Abstract: A VANET is a collection of wireless vehicle nodes that form a temporary network without a highly centralized roadside unit (RSU). Because of dynamic topologies and symmetric network links, VANET protocols face significant challenges. A suitable and costeffective routing mechanism helps in the proper deployment of vehicular ad-hoc networks. The selection of a protocol for communication in such ad hoc networks, where efficient and timely message delivery is important, is data integrity and data delivery. Routing protocols are used in networks to find the shortest path from source to sink for packet trans mission and to make efficient use of limited resources in sensor nodes in order to extend the network's lifetime. Sensor nodes are battery-powered and will become redundant after the battery's power consumption, making it difficult to design a routing protocol. We will discuss some of the major flat routing protocols (i.e., AODV, DSDV, OLSR) and hierarchical routing protocols (LEACH) for wireless sensor networks in this paper. The main aim of this project is to improve energy consumption using the leach protocol. Because leach is a clustering protocol. Clustering is considered one of the most popular techniques used to reduce traffic in routes and minimize energy consumption in large wireless networks by collecting the nodes into groups. The collection of the nodes is constructed according to the distance; it means each node is connected to its nearest nodes. So, first, we'll go over the various routing protocols, followed by a comparison of their performance evaluations based on Qos parameters.

IndexTerms - Wireless network, network lifetime, cluster, routing protocols, Qos parameters.

I. INTRODUCTION

VANET is a wireless ad hoc communication network in which vehicles are referred to as nodes, and they communicate information peer-to-peer. Because this is a new technology in India, the government has placed a high priority on it. There are numerous VANET applications available, including Vehicle Collision Warning, Security Distance Warning, Driver Assistance, Cooperative Cruise Control, Road Information Dissemination, Internet Access, Map Location, Automatic Parking, and Driverless Vehicles. In VANET each vehicle has the ability to communicate information either among each other through vehicle to vehicle communication (V2V) or directly to an external base station called Road Side Unit (RSU) through vehicle to infrastructure communication (V2I). In this paper, we compared the performance of the AODV, DSDV, OLSR, and LEACH routing protocols on the RSU connection pattern with different network parameters and different measured performance metrics such as packet delivery ratio, throughput, and end-to-end delay. The unique characteristics of VANET include:

High Dynamic Topology: The topology in VANET varies quickly depending on the speed of vehicles.

Different Communication Environment: The traffic Condition differs from city to rural environment, which is simple in rural environment and complex in city due to obstacles like building trees and others.

Variable network density: The traffic density in VANET is not identical during the day and in all types of environments.

Frequently disconnected network: Due to the high speed of vehicles, VANET will not have constant connectivity. Hard delay constraints: Most of applications in VANET require the minimum delay than the high data rates.

II. LITERATURE SURVEY

The overview of Vehicular Ad-hoc Network (VANET), which is a most critical class of mobile ad-hoc network (MANET) that enables intelligent communication among vehicles and also between vehicle and roadside infrastructures. It is a promising approach for the Intelligent Transport System (ITS). It has a very high dynamic topology and constrained mobility which makes the traditional MANET protocols unsuitable for VA NET. The aim of this review paper was to give an overview of the vehicular ad hoc networks, its standards, applications security issues and the existing VA NET routing protocols [1].

Accident prevention and traffic signal control for ambulance, police van, and normal vehicles too. To overcome this they have implemented a highway model, intersection model that manages vehicle mobility and shows the actual communication between vehicle to vehicle (V2V) and vehicle to infrastructure (V2I). The security of VA NET technology is one of the most critical issues because their information transmission is propagated in open access environments. Over a period of years, VANET has received increased attention as the potential technology to enhance active and preventative safety on the road [2].

Intelligent Transportation Systems (ITS) that have been receiving significant interest from various stakeholders worldwide. ITS promise major enhancements to the efficiency, safety, convenience and sustainability of transportation systems. To satisfy the diverse vehicular application requirements, this paper had proposed, an integration of IEEE 802.11-based VANET and LTE cellular network using mobile vehicular gateways. IEEE 802.11 g is used for V2V communications and LTE for V2I communications. A burst communication technique is applied to prevent packet losses in the critical uplink ITS traffic. A performance simulation-based study was conducted to validate the feasibility of the proposed system in an urban vehicular environment. The system performance was evaluated in terms of data loss, data rate, delay and jitter. The results indicated that the proposed Multi-RAT system offers acceptable performance that meets the requirements of the different vehicular applications [3].

VANETs that are highly dynamic in nature due to mobility of nodes and this dynamic nature caused topological change in the network, which may affect the communication and security of whole network. There are various attacks which may effect the network, but wormhole attack is one the harmful attack which may affect the communication in VA NET. This is so because wormhole may lead to attacks like Denial of service attack, data tampering, masquerading etc. In this paper performance of different routing protocols were analyzed on the basis of metrics like throughput, end-to-end delay and jitter. Performance of routing protocols were analyzed in two cases first , without wormhole attack and second is with wormhole attack and it has been checked how much performance of routing protocols AODV, OLSR and ZRP was degraded with wormhole attack[4].

Primarily categorized the various possible applications of vehicular network, along with its features, and implementations in the real world. The applications of VANETs are of the classes :1) Safety oriented, 2) Commercial oriented 3) Convenience oriented and 4) Productive Applications, had proposed an idea to optimize signal control at traffic intersections which used vehicular ad hoc networks (VA NETs) to collect and aggregate real-time speed and position information on individual vehicles. An online algorithm, referred to as the oldest job first (OJF) algorithm was used to minimize the delay across the intersection. The results were compared with vehicle-actuated methods ,Webster's method ,and pre-timed signal control methods [5].

III. ROUTING PROTOCOLS IN VANET

In VANET technology, the routing protocols are classified into five categories: Ad-hoc based routing protocol, Location based routing protocol, Cluster based routing protocol, Broadcast routing protocol, Geo-cast routing protocol. Based on this routing protocol, we take four different protocols for analysis. Ad hoc on-demand distance vector (AODV), Destination-Sequenced distance vector routing (DSDV), Optimized link state routing protocol (OLSR), and Low energy adaptive clustering hierarchy (LEACH) routing protocols are used in VA NET applications to provide quality of service.

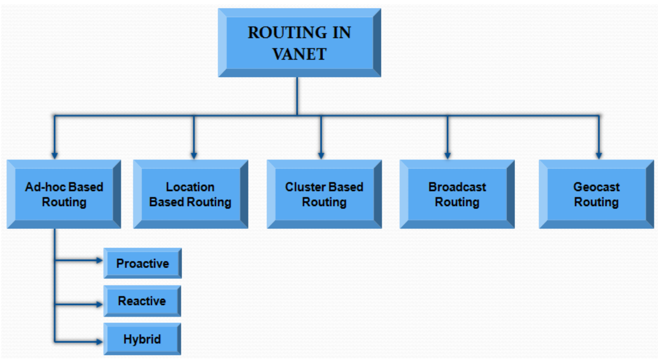


Figure 1: Classification of routing protocol in VANET

A. Ad-hoc on demand distance vector (AODV)

AODV is an on-demand dynamic routing protocol that uses routing tables with one entry per destination. When a source node needs a route to a destination, it initiates a route discovery process to locate the destination. Every node in the network maintains a routing table which stores routing information. Routing using AODV is done by mainly two processes: Route Discovery and Route Maintenance.

1. The Route Discovery Process
2. Process of Route Maintenance

AODV defines three types of control messages for route discovery and maintenance: route request (RREQ) messages, route reply (RREP) messages, and route error messages (RREQ).

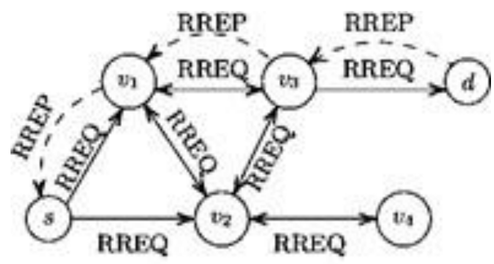
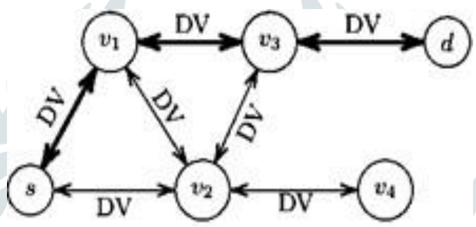


Figure 2: AODV routing discovery

B. Destination-Sequenced distance- vector routing (DSDV)

The DSDV protocol is based on the Bellman-Ford distance vector algorithm and is categorized as a table-driven or proactive protocol. The routing tables store, e.g., the number of hops, destination address and Sequence Number (SN). These tables are renewed periodically through update messages, and with each new entry, a new SN is generated. Network nodes use the table to check the SN of the information received. If a node receives two update messages at the same time, it gives priority to the information with the highest SN. The periodic updates of the table maintain the consistency of the stored data, requiring high bandwidth consumption and restricting its applicationto small networks.

Figure 3: DSDV route discovery



C. Optimized link state routing (OLSR)

OLSR is a proactive link-state routing protocol designed for VA NETs, which have low bandwidth and high mobility. OLSR is a type of classical link-state routing protocol that relies on employing an efficient periodic flooding of control information using special nodes that act as multipoint relays (MPRs). OLSR is designed to work in a completely distributed manner and does not depend on any central entity. The protocol does not require reliable transmission of control messages; each node sends control messages periodically and can therefore sustain a reasonable loss of some such messages. Such losses occur frequently in radio networks due to collisions or other transmission problems. The use of MPRs reduces the number of required transmissions. OLSR daemons periodically exchange different messages to maintain the topology information of the enter network in the presence of mobility and failures.

D. Low energy adaptive clustering hierarchy(LEACH)

The LEACH protocol is a TDMA-based MAC protocol. The main aim of this protocol is to improve the lifespan of wireless sensor networks by lowering the energy required. In this protocol, clusters are formed among different nodes in the network, and for the formation of base station, randomization techniques are used with different algorithms are used to select a random cluster from the base station. The leach protocol can send and receive signals over very long distances in the order. The available network grouped together to form a cluster would be based on different attributes among the nodes within a cluster head. After sending it to the base station, that may be placed at a free realized distance in each round of communication based on the stream of signal. The leach protocol consists of two phases: 1) Phase of setup 2) Consistent phase. The operation of the leach protocol consists of several rounds with two phases in each round. The Leach protocol is a typical representation of a hierarchical routing protocol. It is self- adaptive and self-organized. The Leach protocol uses rounds as units. Each round is made up of a cluster set-up stage and steady state storage for the purpose of reducing unnecessary energy cost.

The setup phase: The main goal is to make a cluster and select the cluster for each of the clusters by choosing the sensor node with maximum energy

Consistent phase: which is considerably longer in direction than the set-up, deals mainly with the aggregation of data at the cluster heads and transmission of aggregated data to the base station

.

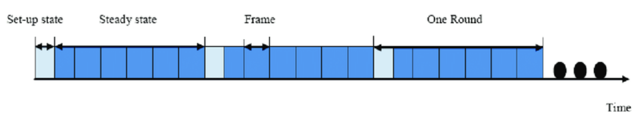


Figure 4: life cycle of LEACH protocol

IV. NETWORK SIMULATION

Simulation of a Network The advantage of using clustering can be demonstrated by analyzing the performance of an ad-hoc network using Cluster Based Routing protocols. The performance of cluster routing protocol LEACH and three other routing protocols, AODV, DSDV, and OLSR, is compared using Qos parameters such as throughput, Packet Delivery Ratio (PDR), and average end-to-end delay. The simulations are carried out in network simulator using Python.

V. PERFORMANCE MATRICS

1. *Throughput:* The ratio of correctly received data to simulationtime is defined as throughput.

$$Throughput = \frac{NumberOfReceivedPackets}{TotalSimulationTime} * PacketSize$$

2. *Packet delivery ratio*: The packet delivery ratio is defined as the ratio of total data packets delivered to total data packets sent.

$$\mathrm{PDR} = \frac{\sum \mathrm{ReceivedPackets}}{\sum \mathrm{SentPackets}}$$

3. *End-to-End delay (E2E or EED)*:This metric measures the time it takes data packets to reach their destination nodes. Time can be calculated by dividing the total time difference between packet sending and receiving. A low end-to-end delay average in a network is a good indicator of the routing protocol's performance.

$$\mathrm{EED} = \frac{\sum_{i=0}^{n} TimePacket\,Rcv_i - TimePacketSent_i}{\mathrm{NumberOfPacketsReceived}}$$

VI. RESULTS AND ANALYSIS

Throughput:

Throughput increases when the LEACH routing protocol is used. The throughput varies with the number of nodes. Because of the use of LEACH, there are improvements in throughput between LEACH and the other routing protocols. The difference between LEACH and the other routing protocols is small when the number of nodes is small, but when the number of nodes is increased to (20 and 50 nodes), the difference between them grows. LEACH has the highest throughput, which increases as the number of nodes decreases, followed by DSDV and OLSR, and AODV has the lowest throughput.

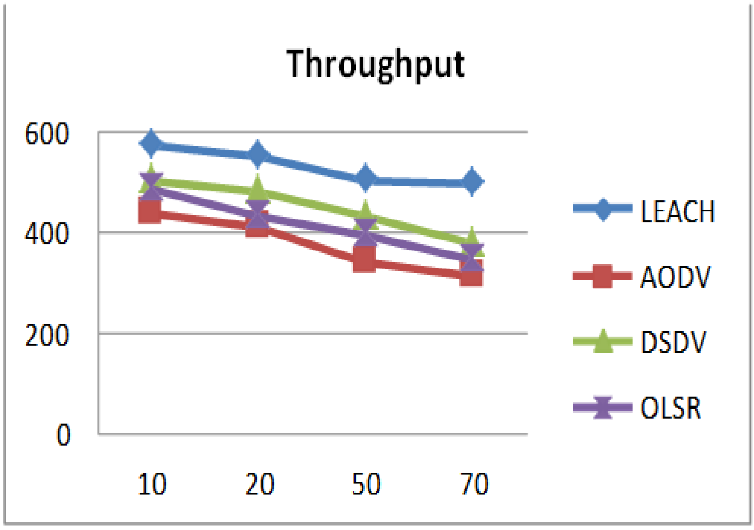


Figure 5: No of nodes Vs Throughput

Packet Delivery Ratio (PDR):

When compared to the other routing protocols, LEACH has the highest packet delivery ratio, followed by AODV, DSDV, and OLSR. The packet delivery ratio in LEACH increases as the number of nodes increases. As a result, LEACH has the best packet delivery ratio performance. The main reason for this advancement is that the cluster-based routing protocol can improve ad-hoc network stability by grouping nodes. so that all nodes can remain stable for as long as possible. This resulted in an increase in the number of received corrected packets.

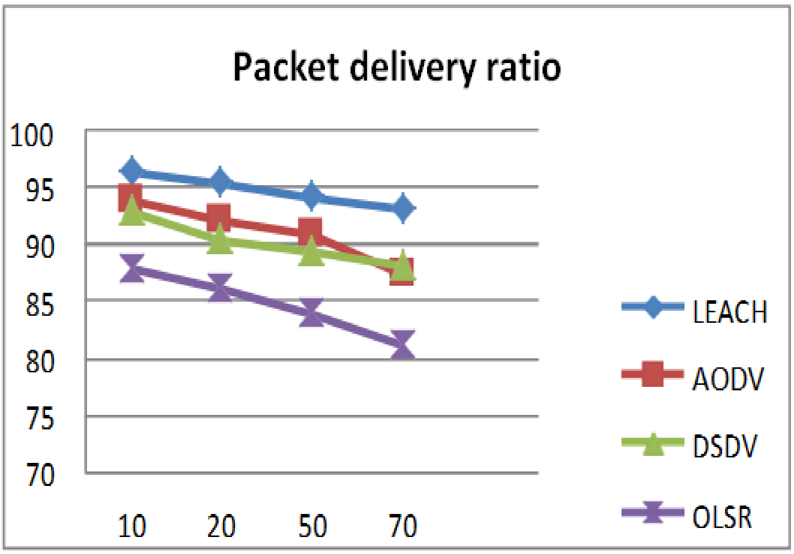
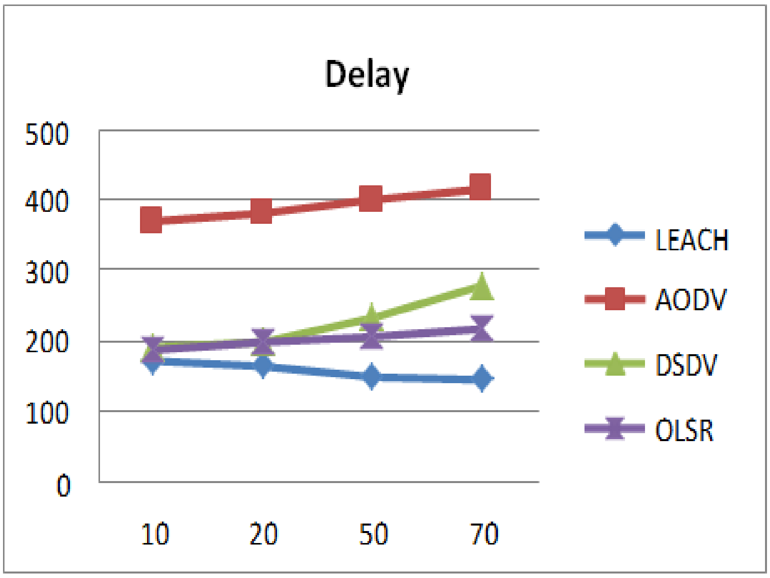


Figure 6: No of nodes Vs packet delivery ratio

End-to-End Delay:

When the LEACH Routing Protocol is used, the end- to-end delay is minimized, whereas the maximum end-to-end delay is obtained with AODV. This value varied depending on the number of nodes. When the number of nodes in LEACH decreases, the end-to-end delay increases, and vice versa. The main reason for this result is that the clustering algorithm will rely on an accurate strategy in selecting the correct routes with high stability, low congestion, and low traffic load, resulting in a reduced time delay.



. Figure 7: No of nodes Vs End to End Delay

Table 1: performance evaluation value of LEACH, AODV,DSDV, and OLSR Routing protocols

Routing Protocol	LEACH	AODV	DSDV	OLSR
Throughput	570.24	435.32	502.32	485.25
	550.96	410.95	480.32	430.25
	502.36	340.12	432.35	395.32
	498.24	312.11	378.21	342.99
E2E Delay	170.25	370.96	190.25	186.25
	165.23	380.25	198.32	198.25
	150.35	399.65	231.05	205.68
	144.44	414.25	278.35	217.77
PDR	96.25	93.81	92.88	87.95
	95.21	92.04	90.29	86.22
	94.06	90.94	89.40	83.96
	92.95	87.32	88.03	81.18

Table 2: Comparison table of LEACH, AODV, DSDV and OLSR routing protocols

Routing protocol	**LEACH**	**AODV**	**DSDV**	**OLSR**
Throughput	High	Low	Average	Belowaverage
E2E delay	Low	High	Average	Below average
PDR	High	average	Below average	Low

VII. CONCLUSION

The aim of this paper is to emphasize the significance of the clustering algorithm, which is used to decrease. The routing traffic load by grouping the network into a number of clusters. The simulation results of this study show that leach is one of the cluster-based routing protocols with the highest throughput and packet delivery ratio when compared to the other three routing protocols, which are considered non-clustering routing protocols, even when the network size is increased. When compared to the other three routing protocols, the leach routing protocol has the shortest end-to-end delay. After considering all of this, it is possible to conclude that the clustering algorithm can be used to improve the performance of ad hocnetworks.

REFERENCES

1. Hamid and E AIT-MLOUK • Performance Analysis of Vehicular Ad Hoc Networks (VA NET) Route Agreements AODV , DSDV and OLSR , BARKOUK Hamid and EN-NAIMI El Mokhtar Analyzing Many Terms, A. 1-6.

2. G. Santos, M. Alves, and M by G Santos 2016 Quote 1
— Análise de desempenho dos protocolos de roteamento DSDV , AODV e OLSR , applicados a uma rede de comunicação VA NET.GUILHERME -072, Porto , Instituto Superior de Engenharia do Porto, Politécnico do Porto, Rua Dr.

3. Z. Xu et al., –DSRC competes with 4G-LTE Integrated Car Applications: A study of service process in integrated vehicle communications. International Journal of Advanced Research in Computer Science, vol. 2017.

4. "ISO 24102-6: 2018, Intelligent Transport Systems - Access to Mobile Phones (CALM) - Local Channel Management - Part 6: Traffic and Flow Management."

5. Ebrahimzade, H., Khayati, G.R. & Schaffie, M. PSO– ANN-based forecast for the level of cobalt leaching from lithium-ion litter batteries. J Mater Cycles Waste Manag 22, 228–239 (2020).

6. Pitchaimanickam, B., Murugaboopathi, G. Hybrid firefly algorithm with particle swarm optimization for sufficient power to select cluster heads on wireless nerve networks. Neural Comput & Applic 32, 7709–7723 (2020).

7. Suganthi, B., Ramamoorthy, P. An Advanced Fitness Based Routing Protocol for improving qos on VANET. Wireless Pers Commun 114, 241–263 (2020).

8. Raut, C.M., Devane, S.R. (2020). Vehicular Ad Hoc Network Performance Testing In The Case Of The Road Side Unit Failure. In: Mallick, P., Balas, V., Bhoi, A., Chae, GS. (eds) Cognitive Informatics and Soft Computing. Software Development and Computer Development, vol 1040. Springer, Singapore.

9. Abdeen, M.A.R .; Beg, A .; Mostafa, S.M .; abdulghaffar, A .; Sheltami, T.R .; Yasar, A. Performance Testing of VANET Routing Protocols in Madinah City. Electronics 2022, 11, 777.

10. Fotros, M., Rezazadeh, J., Ameri Sianaki, O. (2020). A survey of vanets Routing Protocols for iot Intelligent Transportation Systems. In: Barolli, L., Amato, F., Moscato, F., Enokido, T., Takizawa, M. (eds) Web, Artificial Intelligence and Network Applications.WAINA 2020. Development of Smart Systems and Computers, vol 1150. Springer, Cham.

11. Smiri, Safae, Routine Performance Analysis for Road Infrastructure Unit in Vehicu lar Ad Hoc Network (2020). International Journal of Computer Networks &Communications (IJCNC) Vol.12, No.4, July 2020.

12. GURJEET SINGH, Drs. Ad hoc Progress Performance Testing on the Vehicu lar Ad hoc Network (VANET). Global Journal of Computer Science and Technology, [S.l.], mar. 2022. ISSN 0975-4172.