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OLSR Routing Protocol Optimization for VANET

Er. Gulshan Rana, Prof. .Mahesh Kumar
ECE & Kurushetra University
Haryana, India

Abstract— ***OLSR routing protocol is one of the foremost used proactive routing protocol used in VANETS. It can be viewed as an autonomous network, consisting of multiple sensor nodes, which are mobile in nature. The routing is the most key issue in VANETS, as the nodes are mobile in nature, so it is not possible to have a fixed topology.The paper presents an optimization technique to tune the parameters of OLSR protocol for routing operations. The paper focuses to discuss the impact of genetic algorithm which overall improves the performance of algorithm by tuning parameters and discussing the variation shown by the results.***

Keywords— ***routing, throughput, OLSR***

I. INTRODUCTION

Vehicular ad hoc networks (VANETs) have come forward as one of the most successful commercial applications of mobile ad hoc networks. One major aspiration of VANET deployment is to boost road safety and moving efficiency. Mainly VANET research has resolute on analysing routing algorithms in a highly dark network topology under the over easy assumption that a classic vehicular network is well allied in nature. Another phenomenon that could lead to network disintegration in VANET is the low breach ratio of the DSRC technology at the first stages. This case implies that, even during hasten hours; the number of cars that are capable with DSRC radios could be extremely little due to the low incursion ratio of the DSRC expertise. This disconnected network problem poses a fundamental research confront for embryonic a reliable efficient routing protocol that can hold up safety applications in extremely diverse VANET topologies. The intention of this paper is to optimize the OLSR protocol by selecting proper Multipoint Relays (MPR) and effective tuning of OLSR parameters. Along with the hot developments in the VANET field, a number of striking applications, which are exclusive for the vehicular locale, have emerged. VANET applications comprise onboard active save systems that are used to help out drivers in avoiding collisions and to organize among them at vital points such as intersections and highway entries. Safety systems may wisely propagate road information, such as incidents, real-time traffic clogging, high-speed tolling, or surface circumstance to vehicles in the environs of the subjected sites. This helps to avoid group vehicles and to accordingly improve road capacity. With such active wellbeing systems, the number of car accidents and coupled injure are likely to be largely reduced. In addition to therefore mentioned safety applications, IVC relations can also be used to provide comfort applications. The latter may take account of weather information, gas station, infotainment applications, and interactive relations such as Internet access; music downloads, and content liberation. In this paper, our focus is more on the provision of such pleasurable applications. The design of valuable vehicular communications poses a chain of technical challenges. Guaranteeing a firm and reliable routing method over VANETs is a main step toward the realization of effective vehicular communications active routing protocols, which are customarily, designed for MANET, do not make use of the unique features of VANETs and are not right for vehicle-to-vehicle communications over VANETs. Without a doubt, the control messages in reactive protocols and route update timers in proactive protocols are not worn to foresee link breakage. They only indicate presence or nonexistence of a route to an agreed node. Consequently, the route safeguarding process in both protocol types is initiated only after a link-breakage event takes place. When a course breaks, not only portions of data packets are vanished but also in scores of cases, there is a extensive delay in establishing a new passage way. This delay depends on whether an extra valid path already exists (in the case of multipath routing protocols) or whether a new route sighting course needs to take place.

Benefits of OLSR

1) Being an upbeat protocol, routes to all destinations within the arrangement are known and maintained ahead of use. Having the routes existing within the model routing table can be useful for some systems and network applications as there is no route detection delay coupled with finding a new way
2) The routing overhead authored, while by and large superior than that of a reactive protocol, does not swell with the quantity of routes.
3) Default and network routes can be injected into the structure by HNA messages allowing for link to the internet or other networks within the OLSR MANET cloud. Network routes are a bit reactive protocols do not currently implement well.

Routing in VANETs

Routing in VANET can be classified under transmission strategies or routing information. Unicast, broadcast, multicast are various transmission strategies. Topology based and position based routing protocols used various routing information, such as position based routing required preinstalled map or route information[23].

Transmission strategies based classification

According to transmission strategies routing can be classified under Unicast, broadcast and multicast. Multicast further partitioned into geocast and cluster based routing protocols.

Unicast routing one to one communication take place using multihop scheme; where intermediate nodes are used to forward data. This is the widely used class in ad hoc network. For VANET many Unicast routing protocols are proposed; most of the topology based routings are Unicast such as AODV, DSR, GPSR etc.

Broadcast routing one to all communication take place. Flooding, BROADCOMM, DV-CAST etc are broadcast protocols. This is most frequently used routing protocol in VANET especially to communicate the safety related message. Simplest of broadcast method is carried by flooding in which each node rebroadcast the message to other nodes. But with larger density of nodes, this causes exponential increase in bandwidth.

Multicast routing one to many communication take place. This can be further partitioned into geocast and cluster based. In cluster based routing, nodes automatic partitioned into cluster and one cluster head is selected and all outgoing and incoming communication taken place through it. COIN and CBDRP are cluster based routing. In geocast routing, message delivery to other nodes lie within a specific geographic area, like area where accident taken place. Eg. ZOR (Zone of Relevance)

Routing Architecture for VANET

The architecture of routing in VANET is basically the same as the architecture of routing in other connectionless networks. As usual, the conceptual framework and terminology of VANET are more highly elaborated than those of its roughly equivalent peers [39]. The VANET routing architecture applies to hop-by-hop connectionless open systems routing in general. The routing architecture for VANET is given in figure-2. The VANET routing scheme consists of:

- A set of routing protocols that allow end systems and intermediate systems to collect and distribute the information necessary to determine routes.
- A routing information base containing this information, from which routes between end
  Systems can be computed i.e. directory information base, the routing information base is an abstraction and it doesn't exist as a single entity. The routing information base can be thought of as the collective (distributed) information of an entire subsystem concerning the routing relevant connectivity among the components of that subsystem.
- A routing algorithm that uses the information contained in the routing information base to derive routes between end systems.

End systems (ES) and intermediate systems (IS) use routing protocols to distribute some or all of the information stored in their locally maintained routing information base. ES and IS send and receive these routing updates, and use the information that they contain and information that may be available from the local environment, such as information entered manually by an operator to modify their routing information base. The routing information base consists of a table of entries that identify a destination e.g. a network service access point address, the sub network over which packets should be forwarded to reach that destination also known as the next hop, or "next hop sub network point of attachment address, and some form of routing metric which expresses one or more of the characteristics of the route i.e. its delay properties or its expected error rate in terms that can be used to evaluate the suitability of this route, compared to another route with different properties, for conveying a particular packet of class of packets.

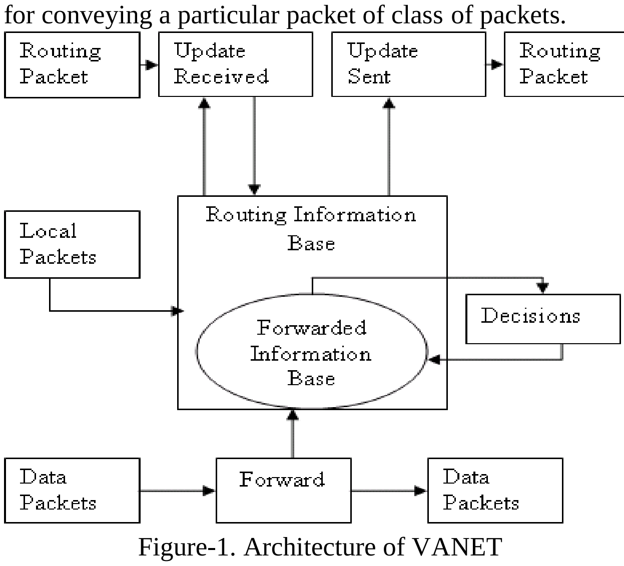

Figure-1. Architecture of VANET

II. LITERATURE SURVEY

Automatic Tuning Of OLSR

A method of automatic tuning of OLSR is provided by M.Gunasekar in 2014**[1]** Vehicular adhoc network (VANET) provides wireless communication among vehicles starved of any underlying Network Infrastructure. In such Network Quality-of-service (QoS) is difficult because the network topology may change constantly and the on board state information for routing is inherently unspecified. However, due to the vehicle dynamism, limited wireless possessions and the lossy face of a wireless channel, providing a trust worthy multi hop communication in VANETs is particularly tricky. Therefore, offering an efficacious routing strategy is decisive to the setting out of VANETs. Intelligent Water Drops (IWD) algorithm is used in this paper to optimize the parameters setting in optimized link state routing protocol (OLSR). IWD Algorithm harmonizes the state of affairs in OLSR for better QoS. The QoS sorts of the IWD tuned OLSR routing protocol do straighten out the Packet Delivery Ratio, reduce the communication outlay and network traffic load in the steep speed movement sketches.

The Adaptive Optimized Routing Protocol for Vehicular Ad-hoc Networks

This method is provided by Kunal Vikas Patil in 2013 [2]. The vehicular ad hoc network (VANET) is a superior new technology. Vehicular ad hoc network (VANET) is a set of MANET that is mobile ad hoc networks. Vehicular ad hoc network favor wireless communication among vehicles (V-2-V) and vehicles to roadside (V-2-R) equipments. The communication amid vehicles is more relevant for safety and more apparently for entertainment as well. The implementation of communication hinge on how good the routing takes place in the link, Routing of data hinge on routing protocols being cast off in Link. The performance of routing protocols in vehicular ad hoc network (VANET) hinge on different state of affairs that are the city and highway, Position based routing protocols are extremely satisfactory for vehicular environment. Furthermore, it also serves robustness in strikingly dynamic wireless ad hoc networks such as for VANET. The OLSR is most highly convenient for larger mobile network. It is having affecting aspects like configuration, multipoint relays (MPRs). In proposed routing protocol the standard greedy approach is retrieved with necessity first algorithm (NFT). By making use of proposed protocol the network traffic load of administrative packet is piped down. The proposed routing protocols are most highly opposite for vehicular network which are highly dynamic in framework.

Exhaustive Study on the Influence of Hello Packets in OLSR Routing Protocol

The method of Exhaustive study on the influence of hello packets in OLSR routing protocol is provided by Jatin Gupta in 2013[4] OLSR routing protocol is solitary of the leading used proactive routing protocol used in MANETS. The MANETS is an autonomous network, made up of many sensor nodes, which are transportable in nature. The routing is the meanest concern in MANETS, as the nodes are movable in nature, so there is no preset topology. In this paper our significance is focused on the OLSR routing protocol, which make use of hello and topology control (TC) messages to discover and then propagate link state information all the way through the mobile ad hoc network. In this paper we discuss the blow of Hello messages on the performance of OLSR in tenure of load, delay and throughput using OPNET.

Server Based Dora in VANETS and Its Applications

The Server Based Dora in VANETS and Its Applications is given by R.Thenamuthan in 2013[6] n this paper, we study Vehicle-to-vehicle (V-2-V) and Vehicle-to roadside (V-2-R) communications for vehicles that scheme to upload a file when it is within the AP's coverage ranges, where both the channel advancement level and transmission data rate vary over time. Dynamic optimal random access (DORA) algorithm pattern earn an upload ratio 130% and 207% which is far better than the heuristic schemes at low and high traffic densities, respectively. The problem with this DORA is that it favour communication to all nodes when one node apply for the tune-up, this trouble can be unvalued by the same vehicle based algorithm with server based manner. The performance of our system is evaluated using the ns2 simulation platform and contrasted our scheme to presented solutions.

VANET Routing Protocols: Pros and Cons

This Pros and Cons of VANET Routing Protocols: Pros and Cons is given by Bijan Paul in 2011[9] VANET (Vehicular Ad-hoc Network) is a new technology which has taken giant attention in the recent time. Due to rapid topology shifting and numerous disconnection makes it difficult to design an efficient routing protocol for routing data between vehicles, called (V-2-V) or vehicle to vehicle communication and vehicle to road side infrastructure, called (V-2-I). The present routing protocols for VANET are not efficient to meet each traffic conditions. Thus design of an efficient routing protocol has taken powerful attention. So, it is very compulsory to identify the pros and cons of routing protocols which can be spent for further progress or maturity of any new routing protocol.

III. PROPOSED WORK

Functionality of OLSR

OLSR protocol periodically exchange different messages in order to maintain the topology information of the entire network in the presence of mobility and failures. The core functionality is performed mainly by using three different types of messages:

1) HELLO,
2) TC (topology control), and
3) MID (multiple interface declaration) messages.

• **HELLO** messages are exchanged between neighbours' nodes (1−hop distance). They are employed to accommodate for link sensing, neighbourhood detection. These messages are generated periodically, containing information about the neighbour nodes.

• **TC (Topology Control)** messages are generated periodically by MPRs to indicate which other nodes have selected it as their MPR. This information is stored in the topology information base of each network node which is used for routing table calculations. Such messages are forwarded to the other nodes through the entire network. Since TC messages are broadcasted periodically a sequence number is used to distinguish between recent and old ones.

• **MID (Multiple Interface Declaration)** messages are sent by the nodes to report information about their network interfaces employed to participate in the network. Such information is needed since the nodes may have multiple interfaces with distinct addresses participating in the communications.

The OLSR mechanisms are regulated by a set of parameters predefined in OLSR .

Table 1.OLSR Parameters

Parameter	Standard Configuration	Range
HELLO INTERVAL	2.0 s	R € [1.0, 30.0]
TC INTERVAL	5.0 s	R€ [1.0, 30.0]
MID HOLD TIME	3× TC INTERVAL	R €[3.0, 100.0]

IV. RESULT

To increase the throughput, packet delivery ratio and decrease End-to-End Delay the Genetic Algorithm is used. The data are selected and transferred from the source to the destination. In this result we implemented the simulation of OLSR protocol and calculated its performance such as throughput, packet delivery ratio and end- to-end delay.

In this paper an attempt is made to discuss the impact of " Hello packets" on the load, delay and throughput. An attempt is made to overall improve the performance of algorithm by varying time interval of " Hello" packets and discussing the variation shown by the results. Normally or default value of OLSR is set at 2.0 Hello interval.

Result and Discussion

Hello Packet interval Impact on PDR–

This is an important issue in highly dynamic VANETs, since a low packet delivery ratio directly implies a higher packet loss, which makes the OLSR protocol to generate additional administrative packets with an impact in the network congestion.

OLSR sends periodic HELLO messages locally to detect neighbor changes, and exchanges topology information among all the nodes of the network. More the value of

Exchange, better is the performance .When we tune the parameter, OLSR is optimized that gives enhanced value of PDR. Overall conclusion is that when tuning is done by genetic algorithm, PDR increases.

Hello Interval's Impact on DELAY-

The delay in OLSR is also a function of its tuning, as it largely depends upon hello interval time. The simulation result has shown that the delay is nearly same for 2 rounds of hello interval value. The delay starts to marginally increase with detraction of hello interval value.

Hello Interval's Impact on THROUGHPUT-

The throughput is the most important performance parameter considered for any routing protocol. Our basic aim is to achieve the maximum throughput. The throughput of normal OLSR is at 2.0 hello interval. Our attempt to increase throughput is successful when we set the value of hello interval to 0.5. The throughput shows the enormous increase , when the value of hello interval is 0.5.

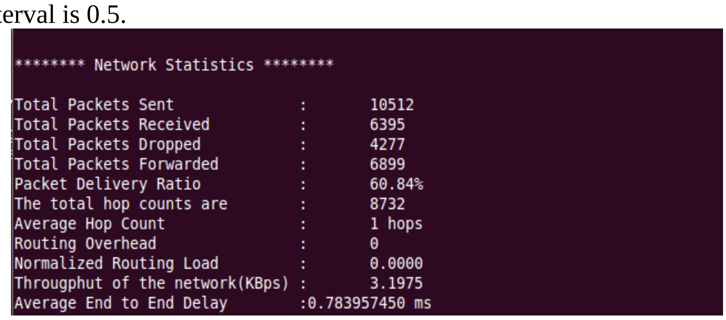

Figure 2. OLSR without optimization.

Here ,PDR=60.84%
THROUGHPUT=3.1975
E2ED=0.783
OLSR is run for 3 rounds that apply an optimization strategy trough simulation.

```
topology_tuple: 6 (local) ==> 2 , delay 10.000000, quality 2.000000
topology_tuple: 6 (local) ==> 4 , delay 4.000000, quality 2.500000
topology_tuple: 6 (local) ==> 1 , delay 4.000000, quality 3.333333
topology_tuple: 6 (local) ==> 8 , delay 4.000000, quality 8.333333
topology_tuple: 6 (local) ==> 9 , delay 4.000000, quality 4.166667
topology_tuple: 6 (local) ==> 5 , delay 4.000000, quality 2.500000
topology_tuple: 1 (local) ==> 0 , delay 4.000000, quality 1.250000
topology_tuple: 1 (local) ==> 3 , delay 4.000000, quality 1.785714
topology_tuple: 1 (local) ==> 6 , delay 10.000000, quality 4.000000
Routing table for 7:
P       dest    next    iface   dist
P       0       2       7       3
P       1       5       7       2
P       2       5       7       2
P       3       5       7       2
P       4       5       7       2
P       5       5       7       1
P       6       6       7       1
P       8       8       7       1
P       9       9       7       1
49.852493: Node 1 removes link tuple: nb_addr = 7
49.852493: Node 1 removes neighbor tuple: nb_addr = 7
NS EXITING...
```

Figure 3.OLSR With GA

```
******** Network Statistics ********

Total Packets Sent              :       10512
Total Packets Received          :       6925
Total Packets Dropped           :       3621
Total Packets Forwarded         :       11863
Packet Delivery Ratio           :       65.88%
The total hop counts are        :       17317
Average Hop Count               :       2 hops
Routing Overhead                :       0
Normalized Routing Load         :       0.0000
Throughput of the network(KBps) :       3.4625
Average End to End Delay        :0.563712691 ms
```

Figure 4.Improved PDR and Throughput

```
******** Network Statistics ********

Total Packets Sent              :       10512
Total Packets Received          :       8073
Total Packets Dropped           :       2478
Total Packets Forwarded         :       12259
Packet Delivery Ratio           :       76.80%
The total hop counts are        :       17319
Average Hop Count               :       2 hops
Routing Overhead                :       0
Normalized Routing Load         :       0.0000
Throughput of the network(KBps) :       4.0365
Average End to End Delay        :0.409737285 ms
```

Figure 5. Decreased E2ED

```
******** Network Statistics ********

Total Packets Sent              :       10512
Total Packets Received          :       6392
Total Packets Dropped           :       4155
Total Packets Forwarded         :       11213
Packet Delivery Ratio           :       60.81%
The total hop counts are        :       16492
Average Hop Count               :       2 hops
Routing Overhead                :       0
Normalized Routing Load         :       0.0000
Throughput of the network(KBps) :       3.1960
Average End to End Delay        :0.535555555 ms
```

Figure 6. Increased Throughput and PDR.

	Olsr	Olsr-GA
throughput	3.1975	4.0365
Pdr%	60.81	76.8
End to End delay(ms)	0.7839	0.4097

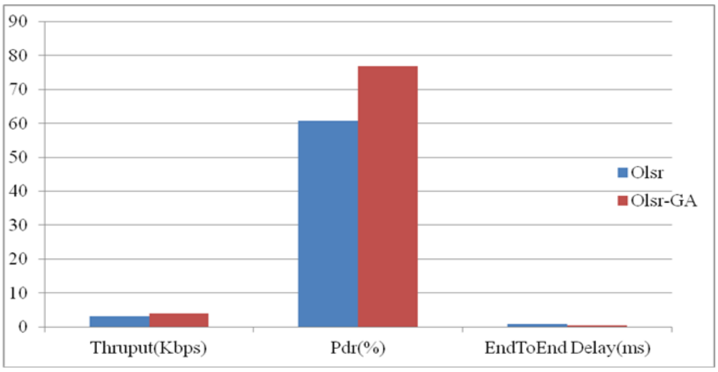

Figure 7. Comparison of Throughput, Pdr, End to End Delay between OLSR and OLSR-GA.

From all the above figures, we can infer that-
1) Average throughput decreases almost with increase in the HELLO interval.
2) Reducing HELLO interval could enhance OLSR performance in a network with less density.

V. CONCLUSION

The optimization study has shown that the tuning OLSR has great impact on the performance of various factors i.e. Pdr,end to end delay and throughput.The throughput increases as OLSR is tuned by genetic algorithm.The genetic algorithm plays a vital role in OLSR tuning. The throughput is the best measure to check the performance.When there is tuning of parameters, there is simulation that shows corpulent increase in throughput and Pdr. The Simulation study has shown that the performance of OLSR routing protocol improves, when parameters are subjected to optimization that eventually decreases delay. In future our target is to further tune the performance of OLSR with using best compatible hello interval value.

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