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To cite this article: Waleed Khalid Ahmed *et al* 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **917** 012078

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Comparing and Assessing the Enhancements of DYMO and OLSR in VANETs

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Abstract. The main aspect of this work is to study the differences and define the behaviour of two different routing protocols. The first side is Dynamic MANETs On- Demand (DYMO) while the other side is proactive, optimal link-state routing (OLSR) and both the first and second are interactive routing protocols in the Ad-hoc network (VANET). The efficiency of these protocols was analysed and studied based on the use of three performance indicators: PDR, normal load (NRO) and end-to-end delay (E2ED) on the ability to change the size of different nodes. Omnet ++ was used by the INET Framework. We also used the SUMO simulation tool to build random movement patterns for VANET. From full simulation, we noticed that OLSR is doing better than DYMO for VANET at a price. Late and, as a result, the development of OLSR work in VANETs compared to DYMO, packet receipt ratios (PDR), side-to-side delay, normal path load, and VANETs.

1. Introduction

VANETs are a special kind of MANET wherein nodes (automobiles) with excessive mobility can connect with every different. Typically, researchers using simulation programs to test and apply their researches, being more flexible and less expensive compared with the real environment. There must be a significant level look at so that the motion styles of motors may be modelled as it should be. VANETs are dispensed, self-organizing conversation networks built up utilizing transferring cars. These nodes are incredibly cellular and feature constrained ranges of freedom in the mobility patterns. Routing protocols must have adaptability with VANET characteristics and their techniques. Several beneficial packages have been added by way of this new concept of VANETs. Some application areas traffic management, routing in VANETs, handover, etc. [1].

For instance, vehicles are usually subject to constraints in both the interactions and their movement range with roadside infrastructure and they tend to move following regular patterns because the node mobility in VANETs is different from the models used in other mobile networks, besides that,



VANETs integrate various ad hoc networking technologies, confuse a problematic challenge for amount to effective and straightforward communication between vehicles [2].

VANETs provide a good business scope for exchanging information among all road users and road infrastructure infrastructures without relying on any other service provider. From the opinion of experts in this field, VANET networks are characterized by the communication between one vehicle to another (V2V) and from one side to the main infrastructure (V2I) and all viewers infrastructure (P2I) and the infrastructure continues (I2I) as shown in figure 1, mainly Using IEEE 802.11p wireless technology. These networks offer a wide field to create a strong information system capable of processing all data, collecting and distributing them in a timely and real time [3].

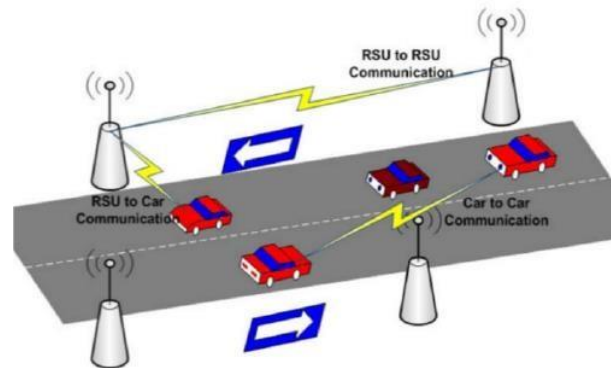


Figure 1. A typical VANET

VANET is an important and essential aspect of most developers and researchers, especially when seeking to find a robust and efficient protocol design for the purpose of delivering messages to a specific destination as quickly and effectively as possible and at an appropriate level of privacy in the world of communications Orientation based on topology [4]. The protocols are integrated into three main groups: proactive, mixed, and interactive trend protocols. On the one hand, on the other hand, dynamic router protocols rely on the development of periodic state-to-state updates using control packs, thus creating other traffic that reduces real information traffic to the highest extent (OLSR) and directive link states (OLSR) directives and mobility protocols from Post-party (DSDV) is one of the following types of protocols. On the other hand, a number of interactive routing protocols are defined by topological information or we will update them if necessary if required (upon request). DSR and AODV are types on these protocols, and DYMO (Dynamic MANET on demand) is a second interactive vector-oriented or on-demand protocol that constantly jumps the route information is not constantly updated. Last but not least, the number of hybrid routing protocols and a number of interactive and proactive behaviours has emerged in several different times [5].

2. Materials and methods

2.1 Main categories of ad-hoc networks routing protocols

In general, there are three different types of routing protocols for ad-hoc data networks, according to [6]. Proactive, Reactive and the hybrid protocols. First one is a *proactive routing protocol* which relies on the periodic broadcast of data network topology. Here, the protocol ensures that the nodes always have an updated knowledge of paths to other nodes. OLSR protocol is one of this type. The second is a *reactive routing protocol* which only looked for a route when one is needed such as DYMO, AODV and DSR. Lastly, *hybrid routing protocol* represent a mixture between sensitive and practical protocols.

2.2 Dynamic Manet On-demand (DYMO)

DYMO are a one of the reactive routing protocols. The most important feature of this protocol is care and discovery route. It is an interactive routing protocol. It discovered routes on demand and as needed. DYMO supports path accumulation and seeks to reduce unnecessary "HELLO" messages, which are primarily intended to give sequence numbers of packets [7].

In another word, this protocol is a straightforward and speedy reactive routing protocol for multi-hop network. The basic operation in DYMO protocol involves sending RREQ when there is a need to send data packet to the source. After proposing an RREQ, the DYMO router waits for a route to be discovered. A new RREQ will be issued if the route is not available within the RREQ waiting time. The repetitive discovery of a route for a specific node is utilized in order to reduce the congestion in a network. The buffer settings of data packets may lead to both positive and negative effects if the route discovery for targeted nodes has reached its maximum times of attempt. So, for data packets in the buffer, they will be dropped completely, as for unreachable messages, they will all be delivered are to the source again.

DYMO is derived from the enhancement of AODV in reactive routing protocol [8]. This routing protocol reduces system requirement and shortens the protocol performance. Table entries to its destination route and the next hop only are created by the AODV while the route is stored for each single hop by the DYMO [9]. DYMO is formulated using MANET packet and message format for future improvement.

2.3 Optimized Link State Routing Protocol (OLSR)

OLSR designed for both two types of mobile ad hoc networks (MANETs and VANETs), it's a proactive link-State routing protocol. OLSR have been introduced by [10] using genetic algorithm in order to improve the performance by tuning the parameters and variation on the tested experiments. Due to OLSR one of classical link-state routing protocol and by using particular nodes that act as multipoint relays (MPRs), OLSR routing protocol relies on employing efficient periodic flooding of control information. Three main reasons distinguish this type of protocol.

- The times of delays generated by sending packet data are short and ideal.
- It has good adaptability to the changing topology.
- OLSR protocol is easily integrated with different types of systems [11].

Reducing the number of required transmissions [12]. There are two main functions of this protocol: neighbourhood discovery for each node and to topology dissemination, which exchanges three different types of messages [13] as shown in table 1. Platooning algorithm and oldest job first algorithm (OJF) have been tested by [10] in minimizing the delay by controlling the signal in VANET. VANET-based traffic signal control architecture has been applied into mathematical modelling thus control traffic at a specific location and take the best route to reach the destination.

Table 1. Routing Protocols in Brief

Protocol	Distinguish head features	Path calculation	Packet forwarding	Flooding central mechanism	Overhead reduction
OLSR	MPRs	Dijkstra's algorithm	Hop-by-hop routing	Broadcast only through selected MPRs	MPRs

DYMO	T-updates of grat. RREPs	DBF Flooding based rout discovery	Hop-by-hop Source routing	Exchange topology Ring search algorithm	Incremental Exp. Back-off algorithm
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HELLO, message were switched among neighbours' nodes (1-hop distance). All neighbours' nodes exchange "HELLO" messages between each other (1-hop distance). They are appointed to neighbourhood detection, accommodate for relation sensing, and MPR selection signalling. All of these messages are generated periodically, and they contain neighbouring node's information, links between them, and their network interfaces, figure 2.

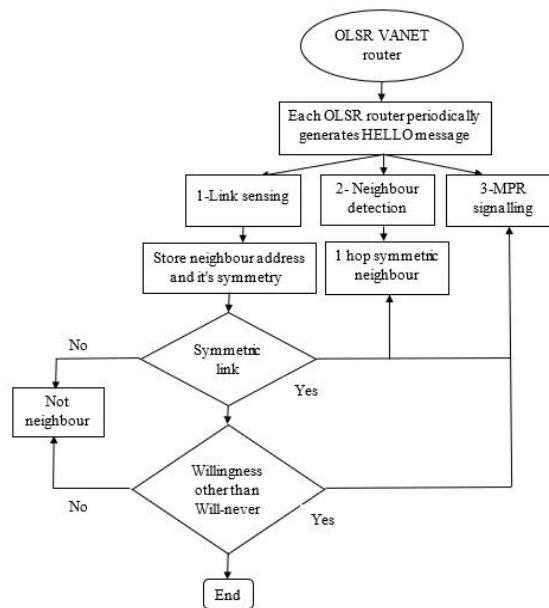


Figure 2. Flow Chart of HELLO messages in OLSR

Via MPRs, being generating TC messages periodically to indicate other nodes. In the topology information base of each network node, it will store this information, then it will be used for routing table calculations. After that, these messages are forwarded through the entire network to the other nodes. There is a sequence number using to distinguish between recent and older messages because TC messages are broadcast periodically. The nodes are reporting information about the network interface by sending MID messages to each other. This information is important since the nodes may have multiple interfaces with distinct addresses participating in the communications. The “validity times” of the data received via these three messages type, which are: NEIGHB HOLD TIME (HELLO), MID HOLD TIME (MID), and TOP HOLD TIME (TC); the inclination of a bulge to performance as MPR (to convey and forward traffic to extra nodes); and DUP HOLD TIME, that characterizes the times through which the MPRs greatest data about the conveyed sachets, figure 3.

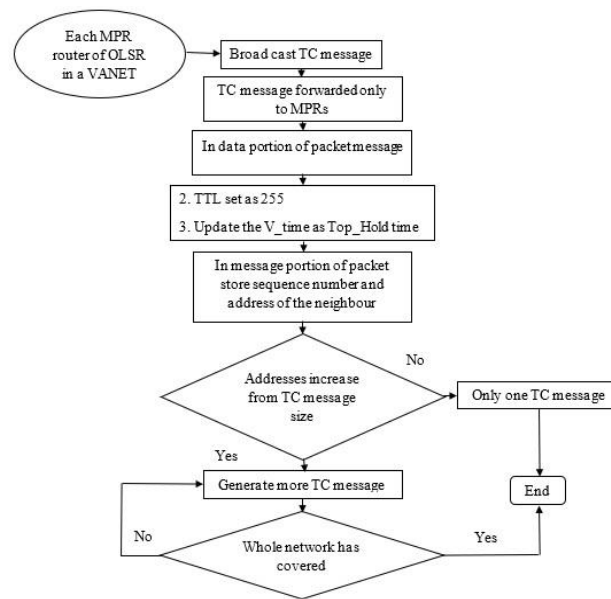


Figure 3. Flow Chart of TC messages in OLSR

Like reactive protocols. As soon as this situation-based trying out of protocols commenced, overall performance changed into altered as more quickly as dynamical the eventualities. Fleet internet mission [14] completed maximum careful studies and furnished the platform for lay conveyance communique. In the have a look at [15], AUDV, DSR, Fish-eyes country Routing Protocol (FSR) and TORA on course eventualities had been in comparison. Whereas [15] compared identical protocols in townsite visitor's eventualities. The playwrights determined, for illustration, that AUDV and FSR area unit the two pleasant, suitable protocols, which TORA and DSR area unit wholly fallacious for VANETs. At the time that DYMO considered the main candidate of MANT, it's also can be a reactive protocol of VANET at the same time. It is supported the work and expertise from preceding reactive routing protocols, specially AODV and DSR [16]. The bottom specification is determined by The DYMO draft but with the aid of victimization, the comprehensive Manet container and message layout [17], it's geared up for delays.

3. Motivation

There are four conventions AUDV, DSDVs, DYMOs and DSR, have been in comparison in [18] for VANETs wherein performance becomes evaluated on the premise of common metrics such as throughput, stop-to-cease delay, overhead, velocity, number of packets, number of nodes .. etc. AUDV and OLSR areas compared through stop-to-cease postpone PDR, and NRO in opposition to changeable scalabilities of nodes [19]. Due this assessment were achieved individual in VANETs. In [20] quit-to-give up put off, amount and NRO of DYMO and OLSR-DEF are intended as opposed to the range of nodes. These contrasts become handiest for VANETs. In this work, we examine both a responsive and practical etiquette in VANET.

4. Performance Evaluation Metrics

To compare DYMO and OLSR routing protocols, we will use some of the metrics in this study as it's explained in below.

- Packet delivery ratio (PDR): Measures the ability of the network to deliver information successfully as the ratio between total number of successfully received packets and total number of packets sent [21].

- Delay and end-to-end Delay: These metrics are referring to the average delay required to transfer a packet to its last destination and measured in second [21].
- Normalized Routing Overhead (NRO): This metric mean's number of routing packets transmitted per data packet delivered to the destination. So, it's contain all routing packet forms in the network such as (replay, error, request) [21].

5. Simulations and Discussions

Here, we present the details of the simulation performed in this paper. Within figures 4-6, OLSR -DEF points to defaulting OLSR and OLSR -MOD points to modified OLSR. Besides, DYMO -DEF chiefs to avoidance DYMO and DYMO -MOD points to adapted DYMO. In OLSR-DEF, Hello and TCc language are the evasion, which canister be 2s in addition 5s, but in OLSR -MOD, these standards are changed as 1s and 3s. Also, in DYMO -DEF, Network Width and RREQ_WAIT _ TIME are evasion which strength be 10 and 1s, but in DYMO- MOD, these morals were altered to 30 and 0.6s, as shown in table 2.

Table 2. Simulation Parameters for VANETs

PARAMETERS	VALUES
OMNET ++	5.0
DYMO Implementation	DYMOUM [22]
OLSR Implementation	UM-OLSR [23]
Number of nodes	10,20,30,...,70
Speed	Uniform 40 kph
Data Type	TCP
Simulation Time	900 seconds
Data Packet Size	1000 bytes
PHY Standard	IEEE 802.11p
Ratio Propagation Model	Two Ray Ground
SUMO Version	0.13

5.1 VANETs Results

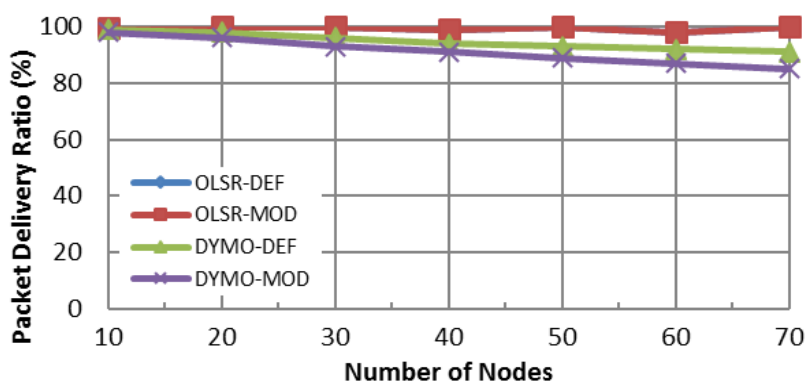


Figure 4. PDR achieved by protocols in VANETs

In figure 4, PDR of OLSR-MOD and OLSR-DEF is high in comparison to equally DYMO-MOD and DYMO-DEF since, when are packets misplaced, values are altered it will be there's high mobility.

In OLSR, the RERR memorandum is disseminated whilst a hyperlink smashing arises owed to distribution the RERR mails much a lesser amount of range of packets are dropped, so PDR is tons better. In DYMO-MOD and DYMO-DEF because of excessive mobility topology adjustments unexpectedly so extra packets are released.

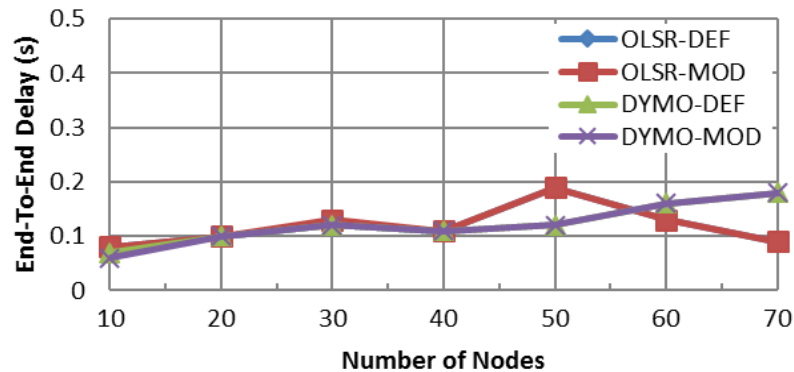


Figure 5. E2ED produced by protocols in VANETs

In figure 5, there is a delay of each OLSR-MOD, and OLSR-DEF is something better than each DYMO-MOD and DYMO-DEF, but there is a decrease at higher scalability. Postpone of OLSR-MOD was little in entirely scalability as associated to OLSR-DEF. Then the postpone for together DYMO-MOD and DYMO-DEF was nearly continual for low-slung compactness and a slight bit complex for excessive concentration due to the fact first DYMO sanitizes the relatives and at that moment forward the containers, these incomes further tremendous while for carton broadcast.

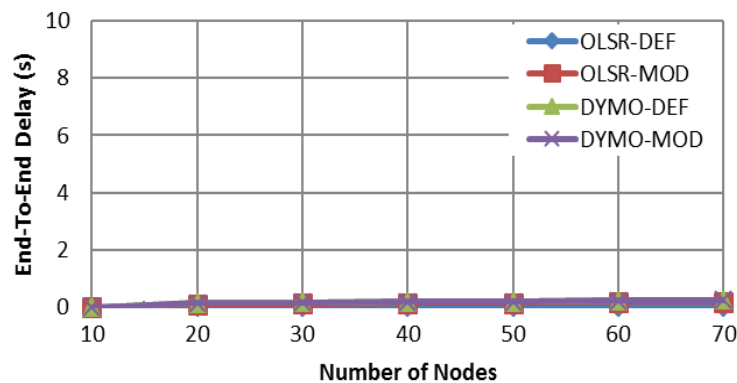


Figure 6. NRO produced by protocols in VANETs

In figure.6, NRO for both DYMO-MOD with DYMO-DEF is complex since for linkage detecting HELLO messages were showed periodically, then owing to tall flexibility, these packs were copied and reason the from top to toe NRO. Used for OLSR-DEF and OLSR-MODs, NRO is practically endless and actual little in altogether scalabilities since its meekest used the ERS set of rules. In preferred, since the consequences, we look at that lowest E2ED among those protocols is produced through both DYMO-MOD and DYMO-DEF. However, whilst speaking approximately NRO and PDR, OLSR-MOD and OLSR-DEF appear better than both. It's clear that the cost of delay of OLSR, it will be better than DYMO in VANETs.

5.2 The Trade-Offs Performance Completed By Routing Protocols

Fashionable this unit, we will take the fee waged via these directing conventions to achieve the productivity of changeable scalabilities. OLSR attains low adjournment payable to elevated circle searchres (ERS) set of rules and it additionally reduces the routing overhead. RREP it produces less put off in all scalabilities with continues squat steering overhed. DYMO reduces E2ED on the price of direction-finding upstairs owed to the fact MPRs are the best answerable aimed at advancing the packs. These MPRs proposals green inundating manage instrument; in place of distribution, manage correspondences are replaced for buddies most effective. TC messages and Hi, there was secondhand to analyze those MPRs containing the links-state facts reasons high NRO. Moreover, DYMO link nation messages are charity to compute MPRs that produces direction-finding overhead, table 3.

Table 3. Performance trade-offs made by routing protocols

Protocol	Modification to routing technique	Advances an achieved	Price to pay
OLSR	MPR calculation	Decreases E2Ed, Fig.4, 7	Less PDR, Fig3, 6
DYMO	Without route cache and gratuitous reply	Reduces NRL, Fig.5, 8 Increases PDR, Fig3, 6	Increases E2ED, Fig.4, 7

6. Conclusions

In this important work, we determined the normal performance of the OLSR DYMODEF, OLSR-DEF, DYMO-DEF and DYMO-MOD models in VANETs using OMNET ++ emulators and Two Ray Ground radio stretch models. Using the SUMO emulator to create a transport mode for and study VANETs networks and determine the presentation of MANET routing protocols (OLSR, DYM) for characteristic coordinates including giving up to a delay of delay, part of the payload, normal routing and a percentage of beam charge. Simulation results indicate that the overall outcome of the proactive protocol (OLSRMOD and OLSR-DEF) is higher than the interactive protocol (DYMO-MOD and DYMODEF) in VANETs. Because dynamic protocols begin control packets, work to define and document the routing path and maintain it when it is needed in the required time, on the other hand, DYMO starts parallel to the control packets to maintain the routing table because of this in increased mobility while the link breaks DYMO cannot convert The path is speedy; therefore, the added packets are dropped due to a PDR that is less different with OLSR. In slow motion, the difference in the overall performance of DYMO is more strongly studied with the OLSR but with a reduction in the rate of PDR and update of the NRO range. Effects show that OLSR is very good matched to both DYMO-DEF and DYMO-MOD in VANET at a reduced price. On the other hand, we highlight that the routing correlation measures are the primary and necessary aspect that determines the results of the routing-protocol. We conclude from this, that the measurement of the hyperlink works for everyone, the necessity of ending the stop paths and records of orientation from the basic degree to the moral protocol. So, in destiny, we're attentive in developing a new-fangled link metric, like [24] and [25].

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