A Review on OLSR-An Optimized Routing Protocol for Vehicular Adhoc Networks

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Abstract: Vehicular ad hoc network (VANET) is a subtype of MANET that is mobile ad hoc networks. VANETs provides wireless communication among vehicles which is important for safety and more probably for entertainment as well. The performance of this communication depends on how better the routing takes place in the network. Routing of data depends on routing protocols being used in network and their depends on different scenarios i.e. the city and the highway. The position based routing protocols are best suited for vehicular environment. The OLSR is one of the popular proactive routing protocol used in VANET. The core functionality of OLSR is performed mainly by three different types of messages HELLO, TC (topology control) and MID (multiple interface declaration)messages. OLSR routing performance largely depends on the value of the HELLO interval timer. The main objective of this review is study and analyse various optimizations to further tune the performance of OLSR with using best compatible hello interval value

Keywords: MANET, VANET, OLSR, MPR, TC, MID.

I. INTRODUCTION

Vehicular Adhoc Networks (VANETs) have emerged as one of the most successful applications of Mobile Adhoc Networks (MANETs).A major goal of VANETs deployment is to increase road safety and transportation efficiency. Most VANET research has focused on analyzing routing algorithms in a highly dense network topology under the oversimplified assumption that a typical vehicular network is well connected [7].The success of VANETs had lead to many key elements such as message routing between the mobile nodes and gateway to the Internet. Without any effective routing strategy, the success of VANETs will continue to be limited. VANETs applications can be classified into two categories:

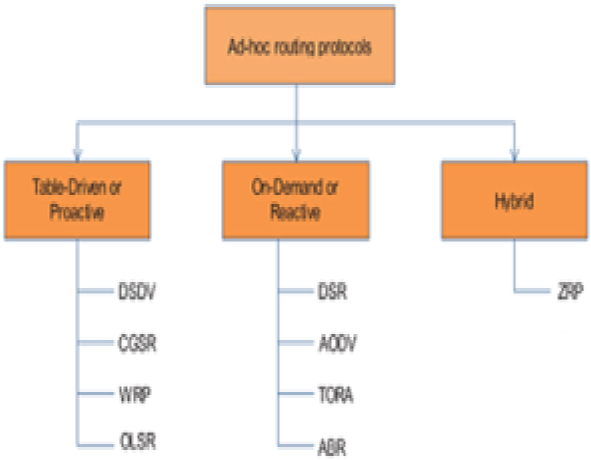
1) Those applications that are sensitive to delay example, downloading a multimedia from the closest Internet gateway, connecting to a virtual private network (VPN) for video or voice conferencing and video streaming.

2) Those that are delay tolerant e.g. sending text messages or sending an advertisement. The major concern is whether performance of VANET routing protocols can satisfy the delay requirements of such applications[2]. VANETs applications includes onboard active safety systems that are used to assist drivers in avoiding collisions and to coordinate among them at critical points such as intersections and highway entries. Safety systems can distribute road information intelligently, such as the real time traffic congestion ,incidents and surface condition to vehicles in the vicinity of the subjected sites. This helps to avoid vehicles and improve road capacity. Through these active safety systems number of car accidents and associated damage are expected to be largely reduced. Most of VANET applications depends on routing protocols. Therefore, an optimal routing strategy which makes better use of resources, is crucial to deploy VANETs efficiently that actually work in volatile networks.

Mobile Ad-Hoc Routing protocols are traditionally divided into two classes (Reactive and Proactive) depending on when nodes acquire a route to a destination. A reactive protocol is characterized by node acquire and maintain routes on demand .A route to a destination is not acquired by a node until packet is not received by a destination node. Examples of reactive protocols includes Ad-Hoc on Demand Distance Vector Routing Protocol(AODV). A Proactive protocol is characterized by all nodes maintain routes to all destination all the time in the network . Therefore, using a proactive protocol, a node is able to route or drop a packet immediately. The examples of proactive protocol includes the “Optimized Link State Routing Protocol” OLSR.

II. OLSR PROTOCOL OVERVIEW

An OLSR is a proactive(table driven) link state routing protocol. LSR (Link-state routing) protocols choose best route by determining various characteristics i.e link load, Bandwidth, delay etc. The Link-state routes are more stable ,reliable and accurate in calculating best route and more complicated than hop count. To update topological information in each node, a periodic message is broadcasted over the network.



Features of OLSR

• It is a routing protocol that follows a proactive strategy, which increases suitability for ad hoc networks with nodes of high mobility generating frequent and rapid topological changes, like in VANETs.[6]

• Using OLSR, the status of the links is immediately known. Besides, it is possible to extend the protocol information that is exchanged with some data of quality of the links, to allow the hosts to know in advance quality of the network routes.

• The simple operation of OLSR allows an easy integration into existing operating systems and devices (including smart phones, embedded systems, etc.) without changing the format of the header of the IP messages.

• OLSR protocol is suitable for high density networks, where most of the communication is concentrated between a large numbers of nodes (as in VANETs).

III. MULTIPOINT RELAYS

The idea of multipoint relays is to minimize the overhead of flooding messages in the network by reducing redundant retransmissions in the region. In the network each node selects a set of nodes in its symmetric 1-hop neighborhood which may retransmit its messages[5].The set of selected neighbor nodes is called the "Multipoint Relay" (MPR) set of that node. Node N's neighbors which are not in its MPR set, receives and process broadcast messages but do not retransmit these broadcast messages received from node N. Each node then selects its MPR set from among its 1 -hop symmetric neighbors. This MPR set is selected such that it covers (in terms of radio range) all symmetric strict 2-hop nodes. MPR(N) i.e. MPR set of node N is an arbitrary subset of the symmetric 1-hop neighborhood of N which satisfies the condition i.e. every node in the symmetric strict 2-hop neighborhood of N must have a symmetric link towards MPR(N).

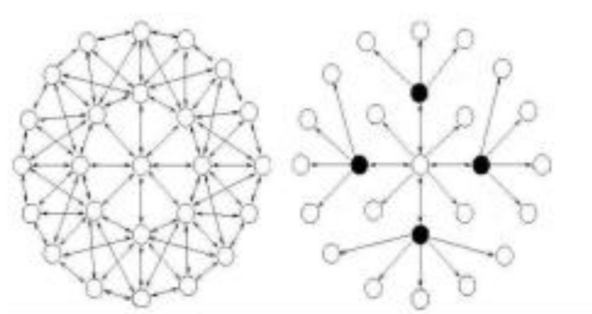


Fig1.Flooding a packet in wireless network without and with MPR

Each node maintains information about the set of neighbors that have selected it as MPR. This set is called the "Multipoint Relay Selector set" (MPR selector set) of a node. The node obtains this information from periodic HELLO messages received from the neighbors.

IV. OLSR MESSAGES

OLSR protocol periodically exchange different messages. The core functionality is performed by three different types of messages: HELLO, TC (topology control), and MID (multiple interface declaration) messages.

• HELLO messages are exchanged between neighbors nodes (1−hop distance). They are used for neighborhood detection and to accommodate link sensing.

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

• MID messages are sent by the nodes to report information about their network interfaces employed to participate in the network. Therefore, this information is needed since the nodes may have multiple interfaces with distinct addresses participating in the communications.

In order to evaluate the quality or fitness of the different OLSR configurations , Communication cost function is defined in terms of three of the most commonly used QoS metrics in this area:

1. The Packet Delivery Ratio (PDR) that is the fraction of the data packets originated by an application that are completely and correctly delivered.

2. The Normalized Routing Load (NRL) that is the ratio of administrative routing packet transmissions to the data packets delivered.

3. The End-to-End Delay (E2ED) that is the difference between the time a data packet is originated by an application and the time this packet is received at its destination.

After the simulation returns global information about the PDR, the NRL, and the E2ED of the whole mobile vehicular network scenario, it uses this information in turn to compute the communication cost (comm cost) function as follows:

Comm cost = w2 * NRL + w3 * E2ED − w1 * PDR

V. LITERATURE REVIEW

Chih-Hsun et. Al (2008) This paper presents a scheme that decreases the risk of a data packet encountering a dead-end situation as it is forwarded to its destination. Under the scheme, the mobile nodes periodically broadcast beacon messages to exchange neighbouring node information to detect dead ends along their intended transmission paths. During forwarding, the relaying nodes use this information to avoid delivering data packets to any relays known to be suffering a dead-end situation [1].

Hanan Saleet et.al (2011) This paper presents a class of routing protocols for vehicular ad hoc networks (VANETs) called the Intersection-based Geographical Routing Protocol (IGRP), which outperforms existing routing schemes in city environments. IGRP is based on an effective selection of road intersections through which a packet must pass to reach the gateway to the Internet. The selection is made in a way that guarantees, with high probability, network connectivity among the road intersections while satisfying quality-of-service (QoS) constraints. Geographical forwarding is used to transfer packets between any two intersections on the path, reducing the path's sensitivity to individual node movements. To achieve this, mathematically formulataion of the QoS routing problem as a constrained optimization problem. Specifically, analytical expressions for the connectivity probability, end-to-end delay, hop count, and bit error rate (BER) of a route in a two-way road scenario are derived and proposed a genetic algorithm to solve the optimization problem [2].

Kuldeep Vats et.al(2012) In this paper they discusses and evaluates "Optimized Link State Routing Protocol" OLSR routing protocol to better performance. Using simulator tools for the performance of OLSR routing protocol simulation, create in small network (30 nodes), medium size network (40 nodes) and large network (50 nodes) the complexity of the mobile ad-hoc network. The MPR count, "HELLO" message sent ,routing traffic sent and received, total TC message sent and forward, total hello message and TC traffic sent are analysed [4].

Jamal Toutouh et.al(2012) In this paper, a series of representative metaheuristic algorithms (PSO, DE, GA, and SA) are studied in order to find automatically optimal onfigurations of this routing protocol. In addition, a set of realistic VANET scenarios (based in the city of M´alaga) have been defined to accurately evaluate the performance of the network under our automatically optimized OLSR. In the experiments, tuned OLSR configurations results have better QoS and than several human expert, making it amenable for utilization in VANETs configurations [3].

B.A. Mohan et. al(2012) In this paper, the focus is on simulation of OLSR protocol and the study of scalability issues in OLSR with respect to increased number of nodes in MANETs is presented.[5]

Quanjun Chen et.al(2013) This paper propose the Adaptive Position Update (APU) strategy for geographic routing, which dynamically adjusts the frequency of position updates based on the mobility dynamics of the nodes and the forwarding patterns in the network. APU is based on two simple principles:

i) Nodes whose movements are harder to predict update their positions more frequently (and vice versa)

(ii) Nodes closer to forwarding paths update their positions more frequently (and vice versa). Here theoretical analysis shows that APU can significantly reduce the update cost and improve the routing performance in terms of packet delivery ratio and average end-to-end delay in comparison with periodic beaconing and other recently proposed updating schemes [6].

Jatin Gupta and et. Al (2013) In this paper our interest is focus is on the OLSR routing protocol, which uses hello and topology control (TC) messages to discover and then disseminate link state information throughout the mobile ad hoc network [7].

M.Gunasekar et. Al (2014) In this paper, Intelligent Water Drops (IWD) algorithm is proposed to optimize the parameter setting in optimized link state routing protocol (OLSR). IWD Algorithm harmonizes the parameters in OLSR for better Qos. The QoS versions of the IWD tuned OLSR routing protocol do improve the Packet Delivery Ratio, reduce the communication cost and network traffic load in the high speed movement scenarios [8].

VI. CONCLUSION

The overall study shown that the performance of OLSR in term of throughput is better than many protocols like AODV, TORA AND ABR. OLSR mainly suited for large networks. Tuning OLSR shows better throughput than simple OLSR. Hello interval in OLSR has great impact on the performance of various factors i.e. load, delay and throughput.

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