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Review on Optimization Techniques of OLSR Protocol for VANETs

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Abstract—: To maintain the topology information of the entire network OLSR exchange messages from time to time for every presence of mobility and failures. HELLO, Topology Control (TC) and multiple interface declaration (MID) messages are main three types of messages used for performing the core functionality. The objective of this review is to Study the scalability issue in optimized link state routing (OLSR) protocol. In this paper, study of scalability issues in OLSR in Mobile Ad hoc Network (MANET), mobility, traffic and node density are main network conditions that significantly affect performance of routing protocol. Thus the optimal parameter setting of the OLSR, by defining an optimization problem can solve the problem.

Keywords— Meta-heuristics, OLSR, Optimization Algorithms, Vehicular ad hoc networks (VANET), Techniques

I. INTRODUCTION

Vehicular ad hoc networks (VANETs) have emerged as one of the most successful commercial applications of mobile ad hoc networks. One of the most important goals of VANET deployment is to increase road safety and transportation efficiency. Most VANET research has focused on analysing routing algorithms in a highly dense network topology under the oversimplified assumption that a typical vehicular network is well connected in nature [5].

Vehicular ad hoc networks (VANETs) as a vehicle-to-vehicle or a vehicle-to road-side-unit network architecture that can be easily deployed without relying on expensive network infrastructure enabling communication between vehicles and pre-existing fixed infrastructure such as gateways to the Internet opens up number of interesting applications to both drivers and passengers. The success of VANETs revolves around a number of key elements such as message routing between the mobile nodes (MNs) and the gateway to the Internet. Without an effective routing strategy, the success of VANETs will continue to be limited. VANET-based applications are classified into two categories:

1) Those that are sensitive to delay, e.g., downloading a multimedia application from the closest Internet gateway, connecting to a virtual personal network (VPN) for video, voice conferencing and video streaming.

2) Those that are delay tolerant, e.g., sending simple text messages or sending an advertisement.

The major concern is whether the performance of VANET routing protocols can satisfy the delay requirements of such applications [1].VANET applications include on board 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 disseminate road information intelligently, for example information about incidents, high-speed tolling, real-time traffic congestion or surface condition to vehicles in the vicinity of the various sites. This helps to avoid vehicles and to accordingly improve road capacity. With such safety systems, the number of car accidents and associated damage are likely to get reduced largely.

Mobile Ad-Hoc Routing protocols are traditionally divided into two classes (Reactive and Proactive) depending on when nodes attain a route to a destination. Reactive protocols are categorized by a node attains and maintains routes on demand. i.e., a route to a destination is not attained by a node until packet is not received by a destination node example "Ad-Hoc on Demand Distance Vector Routing Protocol" (AODV) is a reactive protocols .whereas classification of Proactive protocols is done when all nodes maintaining routes to all destinations in the network at all times thus path is known in advance. Thus using a proactive protocol has a great advantage as a node is immediately able to route or drop a packet using routing table. Examples of proactive protocols include the OLSR. An OLSR is a protocol that is proactive i.e. All nodes maintaining routes to all destinations in the network at all times and thus path is known in advance, link-state routing protocol.

In Link-state routing, by determining various characteristics like link load, delay, bandwidth etc. algorithms find best route and Link-state routes are considered reliable, stable and accurate and calculates best route but are more complicated than hop count. To update such topological information in each node, periodic message is broadcasted over the entire network. OLSR routing protocol uses a proactive strategy, which is useful for ad hoc networks with nodes of high mobility generating topological changes frequently, like in VANETs [6].

Features of OLSR are:

- OLSR routing protocol follows a proactive strategy, which increases the suitability for ad hoc networks with nodes of high mobility generating frequent and rapid topological changes, like in VANETs.
- Using OLSR, the status of the links is known immediately and 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.
- For high density networks, OLSR protocol is most suitable as most of the communication is concentrated between a large numbers of nodes (as in VANETs).

A metaheuristic is a set of concepts that can be used to define heuristic methods that can be applied to different kinds of problems. In other words, a metaheuristic can be defined as a general algorithmic framework which can be applied to different optimization problems with relatively some alterations to make them adapted to a specific problem.

II. RELATED STUDY

Jamal Toutouh et. al [1] in this paper, a series of representative metaheuristic algorithms (PSO, DE, GA, and SA) is studied in order to find automatically optimal configurations of this routing protocol. Also 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 better QoS and then several human experts, making it amenable for utilization in VANETs configurations.

O.A. Wahab et. al [2] in this paper, they address the problem of clustering in Vehicular Ad hoc Networks (VANETs) using Quality of Service Optimized Link State Routing (QoS-OLSR) protocol. Proposal for Several clustering algorithms have been suggested for VANET and MANET. However, the QoS based algorithms ignore the high speed mobility constraints since they are dedicated for Mobile Ad hoc Networks (MANETs) while the mobility-based algorithms ignore the Quality of Service (Qos) requirements that are essential for VANET safety, emergency, and multimedia services .So the solution is a new QoS-based clustering algorithm that considers a trade-offs between QoS requirements and high speed mobility constraints. The main goal is to form stable clusters and maintain the stability during communications and link failures while satisfying the Quality of Service requirements.

By analysing performance and results that are obtained from simulation shows that this proposed model can maintain the network stability, reduce the end-to-end delay (E2ED), reduce the communications overhead and increase the packet delivery ratio (PDR).

M.Gunasekar et. al [5] 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 Quality of service (Qos). The QoS versions of the IWD tuned OLSR routing protocol improves the Packet Delivery Ratio (PDR), reduce the communication cost and network traffic load in the high speed movement scenarios.

Jamal Toutouh et. al [8] in this paper, the main focus is on designing routing protocols for VANETs. One such way of obtaining new routing protocols is to modify existing MANET ones and adapting them to vehicular environments. Before using them to deploy VANETs, accurate evaluation of these new protocols is necessary and one way to do this is through simulation. In this work, they assess OLSR and DE-OLSR. For this task, they have carried out a set of simulations over 36 different VANET scenarios based on real data of M´alaga (Spain) using IEEE 802.11p definition and considering traffic densities, different urban areas sizes and workloads. The quality of service (QoS) has been measured using four performance metrics i.e. PDR, NRL, E2ED, and RPL. This comprehensive performance evaluation shows that DE-OLSR is better-suited for VANETs than the standard version of OLSR, and thus improving its resource consumption and scalability.

Enrique Alba et. al [9] in this they discusses about limitations of the wireless technologies used and changes in topology frequently, designing efficient routing protocols for VANETs is becoming a main concern because Vehicular ad hoc networks (VANETs) are infrastructure-less and self-organized networks deployed among vehicles and other road users. In this study, they applied a multi-objective optimization metaheuristic, in order to find optimal OLSR parameterizations that improve the QoS of the OLSR RFC and a previous optimized configurations. Thus the optimized configuration obtained significantly reduces OLSR scalability problems keeping competitive packet delivery rates. The OLSR routing overhead is greatly reduced between 47% and 76% and the delivery times are between 32% and 38% shorter by using the optimized settings of OLSR parameters.

Kunal V. Patil et. al [11] in this paper, they discusses about performance of OLSR in vehicular ad hoc network (VANETs). Routing of data depends on routing protocols being used in network and the performance of communication depends on how better the routing takes place in the network. The performance of various routing protocols in vehicular ad hoc network (VANET) depends on different scenarios of the city and highway. The OLSR is best suitable for larger mobile networks and factors affecting OLSR are configuration and multipoint relays. The new automatic selection of optimal configuration of OLSR can offer more enhanced performance. The routing protocol proposed replaces the standard greedy approach with necessity first algorithm. Using the proposed protocol the network traffic load of administrative packet gets reduced. The proposed routing protocols are best suitable for Vehicular network which are highly dynamic in nature.

III. OPTIMIZATION TECHNIQUES FOR TUNING OF OLSR PROTOCOL

In Table 1, representation of various optimization techniques, tuning parameters and output performance metric is done.

Table1: Optimization Techniques for Tuning of OLSR Protocol

AUTHORS	**PUBLICATION YEAR**	**OPTIMIZATION TECHNIQUE**	**TUNING PARAMETERS**	**PERFORMANCE METRIC**
Jamal Toutouh, Jos´e Garc´ıa-Nieto, and Enrique Alba	2012	Particle Swarm Optimization(PSO) , Differential Evolution (DE), Genetic Algorithm (GA), and Simulated Annealing (SA)	HELLO INTERVAL, REFRESH NTERVAL TC INTERVAL, WILLINGNESS , NEIGHBHOLD IME, TOP HOLD TIME, MID HOLD TIME ,DUP HOLD TIME	1.Packet Delivery Ratio(PDR) 2.Normalized Routing Load(NRL) 3.Average End-to-End Delay(E2ED)
Omar Abdel Wahab, Hadi Otrok, Azzam Mourad	2013	Ant Colony Optimization (ACO)	Optimal MPRs satisfying both mobility and routing constraints according to an Ant Colony Optimization algorithm.	1. End-to-End Delay(E2ED) 2. Packet Delivery Ratio(PDR) 3.maintain the network stability 4. Reduce the communications overhead.
M.Gunasekar and S.J.Hinduja	2014	Intelligent Water Drops (IWD) algorithm to optimize the parameter setting in optimized link state routing protocol (OLSR)	HELLO_INTERVAL, REFRESH_INTERVAL TC_INTERVAL WILLINGNESS NEIGHB_HOLD_TIME TOP_HOLD_TIME MID_HOLD_TIME DUP_HOLD_TIME	1.Packet Delivery Ratio(PDR) 2.Normalized Routing Load(NRL) 3.Average End-to-End Delay(E2ED)
Jamal Toutouh and Enrique Alba	2011	Differential Evolution(DE)	HELLO INTERVAL REFRESH INTERVAL TC INTERVAL WILLINGNESS NEIGHB HOLD TIME TOP HOLD TIME MID HOLD TIME DUP HOLD TIME	1.Packet Delivery Ratio(PDR) 2.Normalized Routing Load(NRL) 3.Average End-to-End Delay(E2ED) 4. RPL(Routing path length)
Jamal Toutouh, Enrique Alba	2012	Non-Dominated sorting genetic algorithm, version II (NSGA-II)	HELLO INTERVAL MID INTERVAL TC INTERVAL WILLINGNESS NEIGHB HOLD TIME MID HOLD TIME TOP HOLD TIME DUP HOLD TIME	1.Packet Delivery Ratio(PDR) 2.Normalized Routing Load(NRL) 3.Average End-to-End Delay(E2ED)
Kunal V. Patil, M. R. Dhage	2013	Genetic Algorithm (GA)	HELLO INTERVAL, REFRESH NTERVAL TC INTERVAL, WILLINGNESS , NEIGHBHOLD IME, TOP HOLD TIME, MID HOLD TIME ,DUP HOLD TIME	1.Packet Delivery Ratio(PDR) 2.Normalized Routing Load(NRL) 3.Average End-to-End Delay(E2ED)

IV. CONCLUSION

The core negative aspect of OLSR is the necessity of maintaining the routing table for all the probable routes. Such a negative aspect is negligible for scenarios with a small amount of nodes, but for large crowded networks, the overhead of control messages could use supplementary bandwidth and add more in network congestion. Performance of OLSR depends much on the choice of its parameters. The recognition of topological changes can be tuned by changing the time intermission for broadcasting HELLO messages. Thus, computing the finest configuration for the parameters of this protocol is decisive before deploying any VANET.

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