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Improved OLSR Protocol for VANET

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Abstract — *VANET is now rapidly growing and the hot emerging research area but still it faces lots of grate challenges on quality of service due to high mobility and limited transporting distance. The demand of multimedia data like video streaming, listing a song, and web surfing is increasing day by day by people in the road so due to high mobility and limited contact time between vehicles, It very challenging task in VANET to support the multimedia data and provide quality of service for multimedia data. The performance of VANET is partly operated by the routing protocol which determines how packets are forward from node to node. However, the rapid network topology change and the effects of signal attenuation means that established paths do not stay valid for long and the recomputation of the path affects the application traffic performance. Due to the rapid topological changes and provide better quality of service in VANET, we prompted our research on reactive routing protocol OLSR. The main aim for this research to check the performance and quality of service of Optimized Link State Routing protocol (OLSR) using bandwidth based MPR selection. OLSR is a link state and a table driven proactive protocol which preferred owing to its multipoint relaying (MPR) feature. All the simulation will be performed in NS2, SUMO and MOVE.*

Keywords*-MPR Selection; VANET; OLSR; Multimedia Data; Routing in VANET*

I. INTRODUCTION

Vehicular Ad Hoc Networks (VANETs) are a subclass of mobile ad hoc networks (MANET). VANET have a number of technical challenges, especially from the point of view of their mobility models. VANETs are distributed, self-organizing communication networks built up by moving cars as nodes in a network to create a very high mobility of nodes and limited degrees of freedom in nodes movement patterns. It turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 meters of each other to connect and in turn, create a network with a wide range. VANET integrates on multiple ad-hoc networking technologies such as Wi-Fi IEEE 802.11 b/g, WiMAX IEEE 802.16, Bluetooth for easy, accurate, effective and simple communication between vehicles on dynamic mobility. Currently, the field of VANETs has gained an important part of the interest of researchers and become very popular. More specifically, VANETs can operate without fixed infrastructure and can survive rapid changes in the network topology.

VANET is now rapidly growing and the hot emerging research area but still it faces lots of grate challenges on quality of service due to high mobility and limited transporting distance. The demand of multimedia data like video streaming, listing a song, and web surfing is increasing day by day by people in the road so due to high mobility and limited contact time between vehicles, It very challenging task in VANET to support the multimedia data and provide quality of service for multimedia data. Due to the rapid topological changes and provide better quality of service in VANET, we prompted our research on reactive routing protocol OLSR. The problem of us is to check the performance and quality of service of Optimized Link State Routing protocol (OLSR) using bandwidth based MPR selection. OLSR is a link state and a table driven proactive protocol which preferred owing to its multipoint relaying (MPR) feature. The route information of OLSR may include data such as broken link information, which leads to distinctness. Multimedia/TCP traffic is concerned in MANET which is actually major part of total traffic on internet, OLSR is evaluated as a best routing protocol in all respect and found better suited for transporting TCP traffic. We want to check the performance of OLSR protocol using bandwidth based MPR selection in VANET to measure the quality of service and check the metrics like Delivery Rate, End-to-end Delay and Throughput.

The Optimized Link State routing protocol (OLSR) is an optimization of the pure link state algorithm. It is proactive in nature & table-driven. The key concept specific for this protocol is to use the multipoint relays (MPRs). OLSR minimizes the overhead from flooding of control traffic by using only selected nodes, called MPRs, to retransmit control messages. This technique significantly reduces the number of retransmissions required to flood a message to all nodes in the network.

MPR in OLSR reduce the flooding of packet by reducing the duplicate retransmission of broadcast packet in the same region. It restricts the set of nodes retransmitting a packet from all nodes (regular flooding) to a subset of all nodes and the size of this subset depends on the topology of the network. All nodes selects and maintains their own MPRs. Figure 1 show that the node N selects the MPR node from its 1-hop neighbor node and only node which are selected as an MPR node are only sent messages to its 2-hop neighbor nodes. The 1-hop neighbor, which are not selected as MPR set are read and process the packet, but it cannot retransmit the broadcast packets received from any node N[5].

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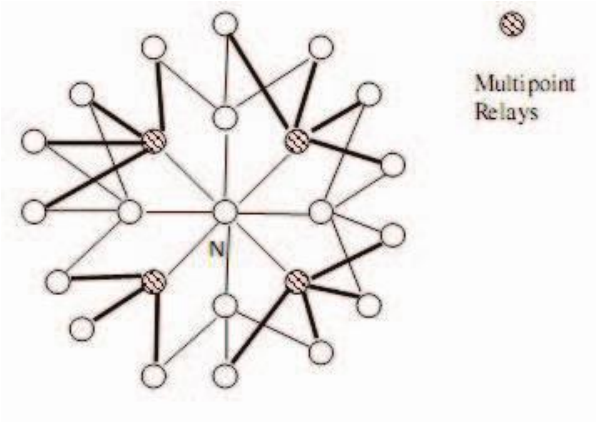

Figure 1.[5] MPR Selection in OLSR Protocol

II. LITERATURE REVIEW

Barkouk Hamid and En-Naimi El Mokhtar[1] also analyzed the performance of OLSR, AODV and DSDV protocols in a VANET network. They conclude that the VANET protocols depend on a set of variables that make up the simulation environment such as mobility, density, network size, etc. They have noticed that further performance evaluation is required to verify performance of a routing protocol with other routing protocols based on various traffic scenarios. O. Barki, Z. Guennoun and A. Addaim[2] verified a set of properties of the standard MPR selection algorithm using the statistical model checking. The simulation results showed that the standard MPR selection algorithm satisfies all the properties regardless of the number of nodes involved in the MANET network. R. B. Patil and A. B. Patil[3] proposed with new version of original OLSR based new three criterions for MPR selection as link stability, residual energy and queuing capacity of the node. After the executions of simulation, it observed that reduction in packet drop and MPR count which directly affect the performance of the network and also concluded that proposed approach performs better than the existing OLSR approaches. S. J. Soni and J. S. Shah[4] compared and evaluated performance of four MANET routing protocols under various CBR and TCP traffic patterns in NS2 and notice that for CBR traffic, AODV (reactive) protocol performs better than rest of routing protocols while for TCP traffic, OLSR (proactive) protocol performs better that rest of routing protocols. Surmukh Singh and Sunil Agrawal[5] studied the merits and demerits of the protocols in VANET for different supported numerous traffic situations. They also have analyzed that more analysis is needed to verify the numerous characteristics of a routing protocols.

III. CHALLENGES AND ISSUES

The main drawback of OLSR is the necessity of maintaining the routing table for all the possible routes. Such a drawback is negligible for scenarios with few nodes, but for large dense net-works, the overhead of control messages could use additional bandwidth and provoke network congestion. This constrains the scalability of the studied protocol [8]. At last, the performance of OLSR significantly depends on the selection of parameter but still few issue and open research issues exist in routing of VANETs which is the most important area for research today. In OLSR, The selection of MPR (Multipoint Relay) is important to reduce the broadcast packet during a flooding process. Those issues are given below:

i. Dynamic Topology and High Mobility
ii. Fault Tolerance
iii. Flexibility and Scalability
iv. Delay Constraints and Real-time Transmission
v. Security Enhancement

IV. ROUTING PROTOCOL

Routing is a process of sending data packets from source node to destination node. Routing protocols for VANETs are mainly classified in two different categories according to their position accusation and the route update method. They are:

i. Position Based Routing Protocol: In this Routing Protocol, whenever a source node communicate with the destination node using their geographical positions besides of its network address.
ii. Topology Based Routing Protocol: In this Routing Protocol, It uses the information about the link that resides in the network to forward the packet from source node to destination node. It can be classified into three other main categories: 1). Proactive Routing, 2). Reactive Routing and 3). Hybrid Routing.

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iii. Broadcast Based Routing Protocol: In this Routing Protocol, It floods the packet over the entire vehicular network among all available nodes inside a broadcast domain. Whenever the destination vehicular node is outside the transmission range of source node then this method is used.

iv. Cluster Based Routing Protocol: In this Routing Protocol, various vehicles having similar characteristics like velocity, direction etc. are grouped together to form a cluster in the network.

v. Geo Cast Based Routing Protocol: It uses mobicast messages to communicate with the vehicles and its main factor of consideration is time.

In this research we will work and check the performance of Topology Based Routing Protocol OLSR which is proactive in nature & table-driven protocol.

V. PROPOSED ALGORITHM

For better connectivity among vehicle, we analysis the OSLR routing protocol in VANET with bandwidth based MPR selection. We proposed a one method for check the performance analysis of OLSR routing protocol using the bandwidth based MPR selection in VANET which is given below:

ALGORITHM : BANDWIDTH BASE MPR SELECTION

Step 1	[Initialization of sets S1 & S2 which are the M's 1-hop neighbors & 2-hop neighbors respectively] S1 ∈ M's 1-hop S2 ∈ M's 2-hop
Step 2	[Check for coverage] If S1 = ∅ Wait until routing table updates Repeat Step-1 else S1.i <- in coverage, where i ∈ S1
Step 3	[Check for the node] If find equal link (j ∈ S2, i ∈ S1) i <- Max bandwidth (S1) else Goto Step-4
Step 4	[Delete Reachable Node] Delete (reachable (i, S2))
Step 5	[Check for equal bandwidth] If(bandwidth(i ∈ S1) == bandwidth(j ∈ S1)) j <- Max (! coverage (S2))

Step 6	[Check Connectivity]
	If (Node connected in S2) {
	Repeat Step 1
	} else {
	X: MPR set of M
	}

Figure 2. Algorithm

In the algorithm which we proposed, our method is the selection of MPR which is based on the bandwidth based in OLSR routing protocol with the degree of 2-hop neighbor node. In the algorithm, let assume M is a node which want to compute its MPR. S1 is a 1-hop neighbors set whereas S2 is a 2-hop neighbors set of node M. if set of S1 empty, then wait until the routing table update.

If set of S1 in not empty, select the node i in S1. Now Check for the Node in S2 which has symmetric link with node i of S1. After that, Choose Node i in S1 which has the maximum bandwidth as MPR called it Node N. After that delete the node of S2 which are symmetrically connected and can be reached by the N (MPR). In some cases check for

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the bandwidth, if any two or more node which have the same bandwidth, select the node in S1 which reaches the maximum number of uncovered nodes of S2. In last check that all the nodes are connected in S2, if yes, repeat the first step in algorithm otherwise X is MPR set of M.

VI. SIMULATION ENVIRONMENT AND RESULTS

In this section the simulation results are shown for parameters like average throughput, end to end delay and packet delivery function by comparing OLSR and proposed OLSR protocol in a network. Initially, we collect reading for above mention parameters for 10,20,30,40 and 50 nodes respectively. The wireless environment is formed using network simulator 2.35. The following table indicates the simulation parameters.

Table 1 Simulation parameters

Simulator	NS2 (Version 2.35)
Simulation Area	1000m × 1000m
Routing Protocol	OLSR, Proposed OLSR
Number of Nodes	10,20,30,40,50
Traffic	CBR
Mobility Model	Fixed
Simulation Time	100s

In all figures below on x-axis shows number of nodes and on y-axis shows the parameter. Figure 3. shows the values of avg. throughput against numbers of nodes for both OLSR and proposed OLSR routing protocol. Clearly shows increase avg. throughput in proposed OLSR protocol.

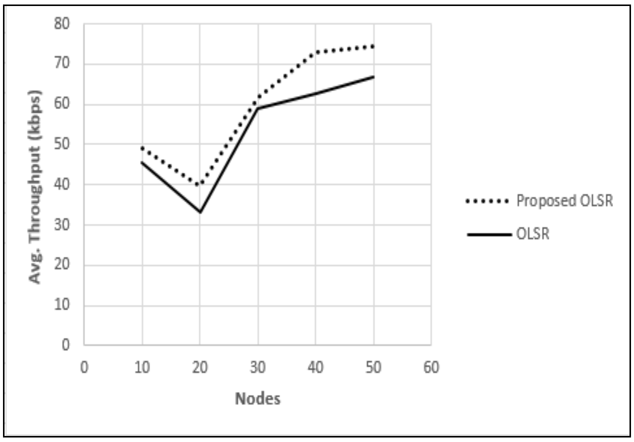

Figure 3. Avg. Throughput Comparison

In Figure 4. Shows the values of end to end delay against numbers of nodes for both OLSR and proposed OLSR routing protocol. Clearly shows decrease end to end delay in proposed OLSR protocol.

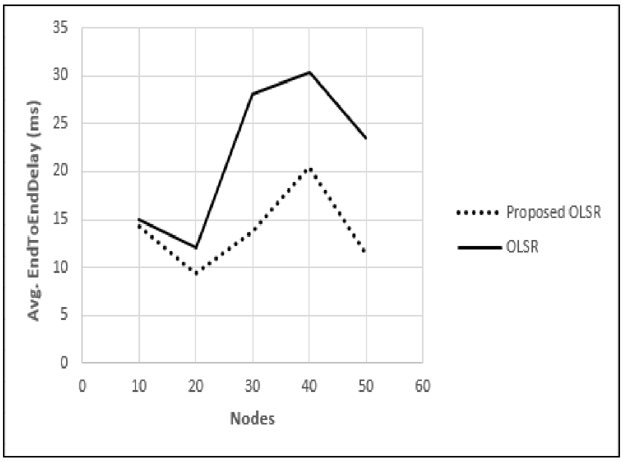

Figure 4. End to end delay Comparison

In Figure 5. shows the values of packet delivery function against numbers of nodes for both OLSR and proposed OLSR routing protocol. Clearly shows increase packet delivery function in proposed OLSR protocol.

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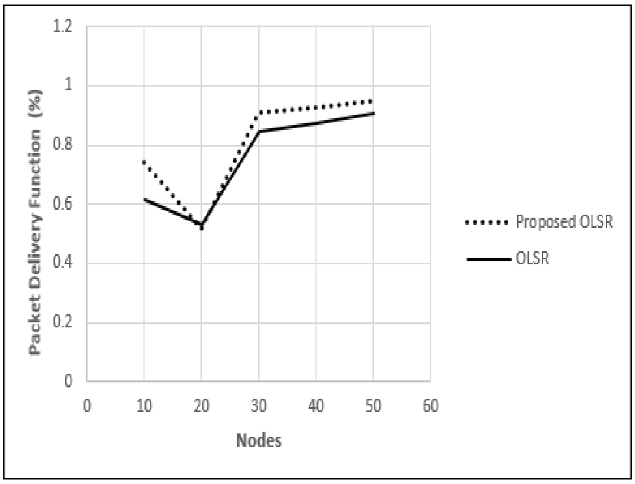

Figure 5. Packet Delivery Function comparison

VII. CONCLUSION

We notice different performance metrics like average throughput, packet delivery function and average end-to-end delay using different numbers of nodes using OLSR protocol. The simulation result and graphs clearly suggest that performance of proposed algorithm using OLSR protocol gives quite better performance for various performance metrics.

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