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Comparative Analysis of LAR Routing Protocol in 802.11 P – VANET

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ABSTRACT *Evolvement of population and communication involving with regards to seamless roaming for their routine life and its safety give researcher to work on to fulfill their booming demand of optimization for wireless routing protocol give site to research that VANET can be a special class of MANET in which every node is a vehicle moving in traffic with due consideration of parametric effect, opened door for enhancement in routing protocol like safety, efficiency w.r.t. time-distance-fuel consumption along with throughput, node delay, overhead, QoS etc. High mobility, varying node density, high processing power, movement at high speeds, difficult communication scenarios with short link lifetime are the variety of uniqueness which transplant MANET into VANET. Recent work on routing protocol such as AODV, DSR and LAR shows significant performance ping pong effect on their parameters. LAR shows considerable advantage over AODV and DSR. In this thesis performance optimization has been carried out on NS-2 simulation tool considering most of the parameters for LAR with comparison of already existing protocol.*

KEYWORDS : Routing protocol , vehicular ad-hoc networks, IAODV , AODV , LAR , DSR

Introduction

Traffic congestion on roads is a big problem in cities. The congestion and vehicle accumulation problem is accompanied by a constant threat accident. Lack of road traffic safety and increase in the no of high speed vehicle takes a no of precious human lives.

According to National Highway Traffic Safety Administration, 6.3 million Police reported traffic accidents, 43,000 people were killed. The economy effects caused due to these accidents were more than $230 billion and Millions of people were injured [1]. Preliminary precautions like airbags and seat belts are used but they cannot eliminate problems due to drivers inability to predict the situation ahead of time. On a highway or in a turning point a vehicle cannot predict the current speed of other vehicles. However, with the use of wireless communication equipment, sensor and computer speed could be predicted and a warning message sent every 0.5 seconds could limit the risk of potential accidents [2].

A Vehicular Ad-Hoc Network, or VANET, is a type of Mobile ad-hoc network which provide communications between vehicles, among nearby vehicles, and nearby fixed units, usually described as a roadside unit (RSU). The main goal of VANET is to provide safety and comfort for passengers, drivers and other road users. To achieve this special electronic device will be connected to each vehicle which will provide Ad- Hoc Network connectivity to the passengers. Each vehicle is equipped with VANET device, will be a node in the Ad-Hoc network and can receive and relay others messages though the network. Road sign alarms, Collision warning and traffic view will give the driver to decide the best path along the way to reach the destination. There are also other services like multimedia and Internet connectivity facilities for passengers. Automatic parking and toll collection are other examples of VANET.

There are some similarities between VANETs and ad-hoc networks like short radio transmission range, self organization and low bandwidth, but on the other hand, there are a number of characteristics which differentiate VANET from MANET which are as follows:

1. Due to high speed of vehicles, network topology is always changing and there is a frequent disconnection in network when vehicle density is low.
2. In VANETs, the nodes are vehicles, so no energy (power) and computation constraints exist.
3. Vehicle speed is higher than speed of nodes in MANETs.

Overview of routing protocol

A routing protocol monitors the way that two communicable entities exchange information. It includes the procedure in establishing a route, forwarding data, and action in maintaining the route or recovering from routing failure [3]. Most of the routing protocols of VANET are same as that of the MANET routing protocols. VANET routing protocols can be classified into two types. One is topology-based and the other is geographic (position-based) based routing.

Topology- based Routing Protocols

These routing protocols use link information that exists in the network to perform packet forwarding and can be divided into proactive (table-driven) and reactive (on-demand) routing protocols.

(1) Proactive Routing Protocols: It carries the unique feature: the routing information such as the next forwarding hop is maintained in the background regardless of communication requests [4]. Packets which are used for control are constantly broadcast and flooded among nodes to maintain the paths or the link states between any pair of nodes even though some paths are never used. A table is maintained within the nodes such that each entry in the table indicates the next hop node toward a certain destination [5]. The advantage of the proactive routing protocols is that there is no discovery of route since route to the destination is maintained in the background and is always available lookup. Despite its good property of providing low latency for real-time applications, maintenance of unused paths takes a significant part of the available bandwidth, especially in highly mobile VANETs. DSDV is an example of this type of routing protocol.

(2) Reactive Routing Protocols: Based on the necessary for a node to communicate with another node, this routing protocol opens a route. It maintains only the routes that are currently in use, as a result reduces the burden on the network. It has a route discovery phase where query packets are flooded into the network in search of a path [6]. The phase completes after getting a route.

Geographic (Position-based) Routing

In geographic routing, the forwarding decision by a node is primarily made based on the position of a packets destination and the position of the nodes one-hop neighbors. The position of the destination is stored in the header of the packet by the source. The position of the nodes one-hop neighbors are obtained by the beacons sent periodically with random jitter [7]. Nodes that are within a nodes radio range will become neighbors of the node.

(a)AODV (Ad-hoc On-demand Distance Vector): By receiving a broadcast query (RREQ), each node records the address of the node sending the query in their routing table. This procedure of recording its previous hop is called backward learning [8]. By reaching the destination, a replay packet called as route replay (RREP) is then sent through the complete path obtained from backward learning to the source . At each stop of the path, the node would record its previous hop, thus establishing the forward path from the source to the destination. The flooding of query and sending of reply establishes a full duplex path. After the path has been established, it is maintained as long as the source uses it. The failure will be reported recursively to the source and will in turn trigger another query-response procedure to find a new route.

(b) DSR (Dynamic Source Routing): It uses source routing, that is, the source indicates in a data packet the sequence of intermediate nodes on the routing path [9]. In DSR, the query packet copies in its header the IDs of the intermediate nodes that it has traversed. The destination then retrieves the entire path of the query packet, and then uses it to respond to the source. As a result, the source can establish a path to the destination. If we allow the destination to send multiple route replies, the source node may receive and store multiple routes from the destination. An alternative route can be used when some link in the current route breaks. In a network with low mobility, this is advantageous over AODV since the alternative route can be tried before DSR initiates another food for route discovery.

(c) LAR (Location Aided Routing Protocol): In the above two routing protocols, flooding of RREQ packets is to be done to get a route/ path from a source node (S) to the destination node (D), which will create a problem of broadcast storm. This problem was addressed by Young and Vaidya [10] and they proposed the LAR routing protocol where flooding is done in a limited area. Basically, it employs the concept of partial flooding to reduce the route discovery overhead. It utilizes the location information of destination that can be obtained from GPS. Since route discovery is now limited to a reduced search space, RREQ packet is propagated to a limited number of nodes in the network which results in a reduced route discovery overhead. Readers are advised to refer [11] for complete details of LAR protocol. The main difference between the above two protocols and LAR is that LAR utilizes the positional information of nodes to reduce the route discovery overhead [12] .

(d) IAODV (Improved AODV): Proposed IAODV is defined as "Limited Source Routing up to two hops with Backup route between Source node and Destination node". IAODV protocol combines routing mechanism of DSR and AOMDV protocol in to basic AODV protocol. The proposed IAODV protocol can ensures giving timely and accurate information to driver in V2V data dissemination compare to AODV protocol in city scenario. Proposed method is divided into two sub parts as change in route discovery mechanism and route maintenance mechanism. During the route discovery mechanism of IAODV protocol route request phase is modified for limited source routing up to two hops and route reply phase is modified to create backup route between source and destination node. Route maintenance mechanism is modified such a way that if primary route is failed then source node uses the backup route for transmission of data and if backup route itself failed then new route discovery procedure is performed.

ADVANTAGES

- In DSR , an alternative route can be used when some link in the current route breaks.
- In a network with low mobility, this is advantageous over AODV since the alternative route can be tried before DSR initiates another food for route discovery.
- In the AODV and DSR protocols, flooding of RREQ packets is to be done to get a route/ path from a source node (S) to the destination node (D), which will create a problem of broadcast storm.
- This problem was addressed by Young and Vaidya. they proposed the LAR routing protocol where flooding is done in a limited area.

III. SIMULATION

A Simulation Environment

Using NS 2.35 and VANET, the Simulation environment is set up. The NS 2.35 is Chosen because it is an open source simulator and Event driven based simulation environment used Both C++ and tcl scripts. For data transmission in MAC layer protocol IEEE 802.11 is used.

TABLE I
SIMULATION PARAMETERS

Parameter	Value
Simulation time	2,6,8,10 Second
Simulator	NS 2.35
Antenna model	Omni directional antenna
Radio Propagation Model	Two Ray Ground
Interface Queue Type	Priority Queue
MAC Type	IEEE 802.11
Routing Number of vehicles	AODV, IAODV,DSR, LAR 50
Mobility of Vehicles	40 km/hr

B Performance Metrics

Various performance metrics are available to check the Performance of routing protocols. In our study, we Have selected routing overhead, PDR, Throughput.

Packet delivery Ratio:
The ratio of data packets received by the destination node to

the data packet sent by the source node is defined as the packet delivery ratio.

Packet Delivery Ratio = (Total Received) * 100/ (Total Sent Packets)

Throughput:
Throughput is ratio of total number of received bits upon total time. It is measured in Kbps.

Routing Overhead:
Routing overhead is defined as the ratio of the total transmitted control packets upon the total data packets delivered to the destinations.

End to end delay:
Average time delay is the time delay for send data packet from the source node to the destination node. Total time difference over the total number of packet received is dividing with single packet send and received time (which was stored before) give the average end-to-end delay for the received packets.

Average End to End Delay= (time packet received – time packet sent)/total no. of packet received

Average number of Hop Count:
It is the number of vehicles running between source and destination and it signifies error in the network. Time to Live (TTL) is decided on the basis of Hop Count, which helps in avoiding the congestion in the network.

Simulation Results
In this section we present our simulation efforts of AODV, IAODV, DSR and LAR routing protocol with different Parameters for 2, 4, 6, 8 and 10 sec for 50 nodes.

50 node (2 sec)				
Parameters	AODV	IAODV	DSR	LAR
Delay	614.82	72.43	668.69	5.45
Energy	16.3	16.35	19.87	12.62
PDR	0.8974	0.453	0.8974	0.9091
Throughput	35.43	41.51	35.44	5.04
RoutingOverhead	0.359	3.78	8.75	7.3

50 node (4 sec)				
Parameters	AODV	IAODV	DSR	LAR
Delay	603.52	67.33	614.47	8.08
Energy	16.39	16.48	19.96	12.86
PDR	0.9518	0.6562	0.9518	0.9795
Throughput	39.94	47.3	39.94	59.77
RoutingOverhead	0.81	2.19	19.75	0.586

50 node (6 sec)				
Parameters	AODV	IAODV	DSR	LAR
Delay	592.77	65.6	599.48	8.26
Energy	16.48	16.61	20.06	13.13
PDR	0.9686	0.7494	0.9686	0.9774
Throughput	41.2	49.61	41.2	78.72
RoutingOver-head	1.267	1.75	30.87	0.581

50 node (8 sec)				
Parameters	AODV	IAODV	DSR	LAR
Delay	587.47	64.76	591.25	8.26
Energy	16.57	16.73	20.15	13.37
PDR	0.9768	0.8032	0.9768	0.9902
Throughput	42.15	50.53	42.15	88.21
RoutingOverhead	1.728	1.527	42.12	0.462

50 node (10 sec)				
Parameters	AODV	IAODV	DSR	LAR
Delay	584.51	64.25	587.06	8.56
Energy	16.67	16.85	20.24	13.63
PDR	0.9816	0.8374	0.9816	0.9915
Throughput	42.66	51.18	42.66	93.73
RoutingOverhead	2.18	1.404	53.25	0.567

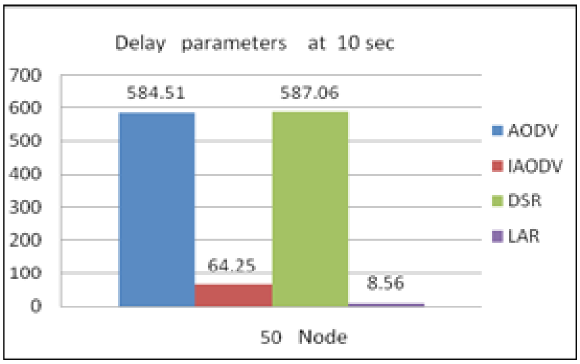

Figure 1: Comparison of delay of routing protocols with 50 node

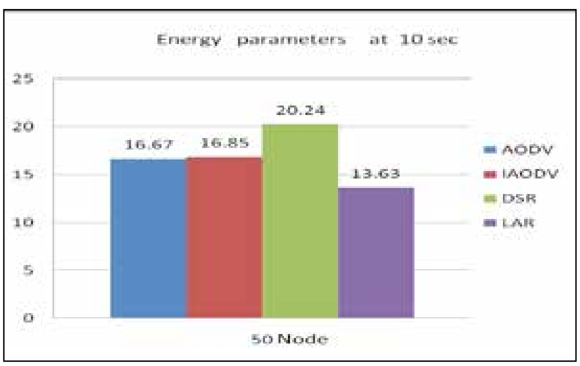

Figure 2: Comparison of energy of routing protocols with 50 node

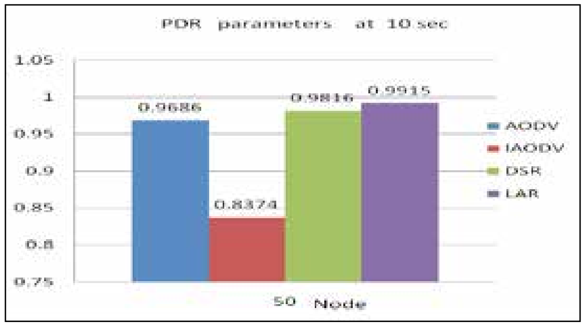

Figure 3: Comparison of PDR of routing protocols with 50 node

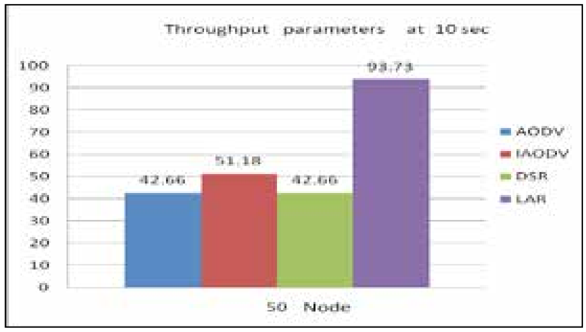

Figure 4: Comparison of Throughput of routing protocols with 50 node

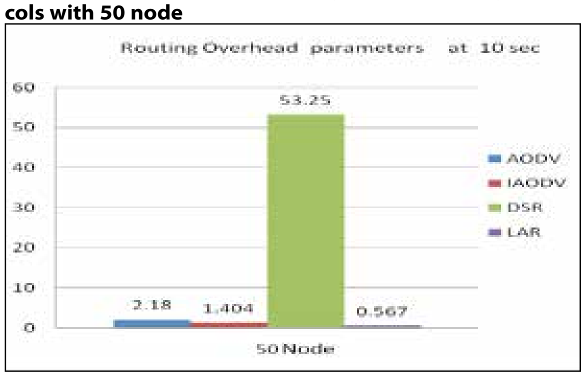

Figure 5: Comparison of RoutingOverhead of routing protocols with 50 node

IV. CONCLUSION

Selection of suitable routing protocol depends on various conditions of traffic. Proposed IAODV protocol provides timely and accurate information in V2V data dissemination to achieve safe and efficient transportation compare to AODV protocol. we have study a different routing protocol like AODV, DSR, DSDV, and LAR routing protocols for VANET scenario. LAR performs better than AODV and DSR and DSDV.

Future work can be carried out on analyzing performance of exiting protocols and improves parameters like throughput, PDR, delay, and routing overhead, Performances can also be analyzed on other metrics like NRL etc.

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