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Intelligent Transportation Systen for Vehicular Ad-Hoc Networks Using Tora Pratocol

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Abstract: *Vehicular ad hoc networks (VANETs) are a one form of wireless networks. It is used for communication between vehicles on roads. The conventional routing protocols are suitable for mobile ad hoc networks (MANETs). But it's poorly in VANETs. As communication links break often happen in VANETs compare than in MANETs, the reliable routing is more difficult in the VANET. Research work has been done to the routing reliability of VANETs on highways. In this paper, we use the intelligent transportation system for VANETs using TORA protocol. The intelligent transportation system helps to capture the future positions of the vehicles and determines the reliable routes preemptively. This paper is the first to propose an intelligent transportation system gives reliable routing process. A new mechanism is developed to find the vehicles information from the source vehicle to the destination vehicle. Through the simulation results, that the proposed scheme significantly give good result compare than other literature survey. Here we are going to implement in application of Marine.*
Keywords*: Vehicular Ad-hoc Network (VANET), TORA, IEEE 802.11, Sensor, OBU, RSU.*

I. Introduction

Vehicular Ad hoc Network (VANET) are a subclass of Mobile Ad-hoc Network (MANET) where vehicles moving at high speed are the nodes which are used to exchange data in the network. In this environment vehicle can move anywhere, any direction with varying speed that make the frequent changes in the topology and mobility pattern of VANET network that present the key difference from the MANET [1,2,3]. Today all major vehicle manufacture companies and industries focus in this area for reducing communication issues in between vehicles [4]. Many researchers has given their contribution in in this area of research like CarNet, CarTALK 2000, DRIVE, FleetNet and COMCAR projects [5-10]. The performance of the routing protocol degrades with speed and size of the network, so designing of efficient routing protocols are always challenging in high mobility environment that is main characteristic of VANET.

In VANET network for exchanging data the entire mobile nodes behave as a router as well source and destination node. The DSDV (Destination-Sequenced Distance Vector) routing protocol is based on the Distributed Bellman-Ford algorithm. Each node in DSDV maintains a next-hop table, which it exchanges with its neighbors. The Dynamic Source Routing (DSR) protocol is based on secure routing method. In this algorithm the mobile node whose want to send data in network knows the complete path of destination and store that in route cache. The data packet carries the source path inthe packet header. Instead depending on the intermediate mobile node routing table information this protocol use the source routing path. So the path length in between source to destination node affects the routing overheads. The broken link in this protocol does not repair locally by route maintenance process that shows shortcoming of this protocol. It has two important phases, route discovery and route maintenance [11, 12]. AODV protocol combines the mechanisms of DSR and DSDV for routing. For each destination, AODV creates a routing table like DSDV and using mechanism of routing route maintenance and discovery as DSR. TORA is to limit control message propagation in the highly dynamic mobile computing environment.

In this paper we have evaluate routing performance of TORA routing protocol in VANET environment. The performance evaluation is based on the metric of packet, delivery ratio, end to end delay and Throughput of the network.

II. Protocol Overview

Routing is the process to transfer data packets from source to destinationalong best suitable route. In this paper topology-based routing protocols are studied.
Topology based routing approach can be further categorized into:-
1. Proactive (table-driven) routing protocols
2. Reactive (on-demand) routing protocols
1. Proactive (table-driven)

Proactive routing protocols are mostly based on shortest path algorithms. They maintain and update information on routing among all nodes of a given network at all times even if the paths are not currently being used. Thus, even if some paths are never used but updates regarding such paths are constantly broadcasted among nodes [4]. Route updates are periodically performed regardless of network load, bandwidth constraints, and network size which is oneof the main drawbacks of using this approach in VANETs.

1.1: Destination Sequence Distance Vector Routing (DSDV)

It is table driven routing scheme for ad-hoc mobile network based on classical Bellman Ford routing algorithm. Solving routing looping problem, increases convergence speed and reducing control overhead message was the main contribution of this algorithm. In DSDV nodes transmit update periodically to its neighbor node with the information of its routing table. DSDV routing protocol maintain a routing table that store cost metric for routing path, address of next hop up to the destination and the destination sequence number assigned by the destination node. Whenever the topology of the network changes, a new sequence number is necessary before the network reconverges and the node changed routing table information into event triggered style and send updates to its neighbor nodes. The “full dump” and “incremental update” is two ways in DSDV for sending information of routing table updates. As like name “full dump” the complete routing table is send in update message while incremental update contains only the entries with metric that have been changed since last update was sent .

This algorithm is suitable for small ad-hoc networks but the regularly updating routing table, less bandwidth and essentially requirement of new sequence number at the time of network topology change shows the shortcoming of this protocol and make it unsuitable for large and highly dynamic network environment like VANET.

2. Reactive Routing

On demand or reactive routing protocols were designed to overcome the overhead problem, that was created by proactive routing protocols, by maintaining only those routes that are currently active [6]. These protocols implement route determination on a demand or need basis and maintain only the routes that are currently in use, thereby reducing the load on the network when only a subset of available routes is in use at any time [7].

2.1: Temporally Ordered Routing Algorithm (TORA)

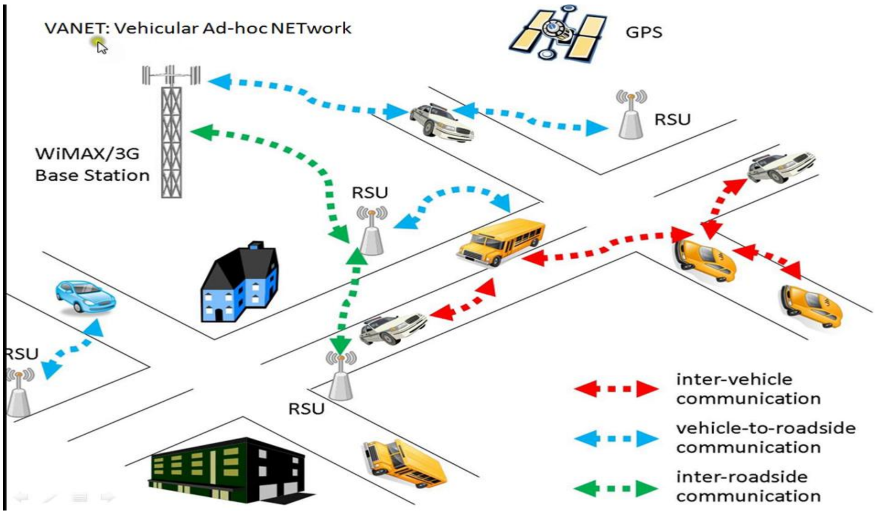
TORA belongs to the family of link reversal routing in which directed a cyclic graph is built which directs the flow of packets and ensures its reachability to all nodes. A node would construct the directed graph by broadcasting query packets. On receiving a query packet, if node has a downward link to destination it will broadcast a reply packet; otherwise it simply drops the packet. A node on receiving a reply packet will update its height only if the height of replied packet is minimum of other reply packets

The key design concepts of TORA is localization of control messages to vary small set of nodes near the occurrence of topology change. To accomplish this, nodes need to maintain the routing information about adjacent nodes. The protocol performs three basi functions

- Route creation
- Route maintenance
- Route ensure

III. Intelligent Transportation System

Here, Each vehicle is equipped with short range communication device and control nodes are placed in the insertion with traffic lights. Our proposal manages traffic information seeking to avoid accidents, although the information here is gathered from the vehicles themselves so no further infrastructure is needed.



This way, vehicles can exchange real-time information, and drivers can be informed about road traffic conditions and other travel-related information. The most challenging issue is potentially the high mobility and the frequent changes of the network topology. In VANETs, the network topology could vary when the vehicles change their velocities and/or lanes. These changes depend on the drivers and road situations and are normally not scheduled in advance. Embedded wireless devices are the main components of evolving cooperative active safety systems for vehicles. These systems, which rely on communication between vehicles, deliver warning messages to drivers and may even directly take control of the vehicle of such applications, including communication and detection of vehicle information are tightly coupled with physical dynamics of vehicles and drivers behaviour.

The types of possible actions and warnings in vehicle safety systems range from low-latency collision avoidance or warning systems to moderate-latency system that provide heads up information about possible dangers in the non-immediate path of the vehicle. The main differences of these systems are the sources and means of information dissemination and acquisition. In active safety systems, vehicles are required to be continuously aware of their neighbourhood of few hundred meters and monitor possible emergency information. This task can be achieved by frequent real time communication between vehicles over Temporally Ordered Routing Algorithm (TORA) channel. In addition to inter-vehicle communication; roadside devices may also assist vehicles in learning about their environment by delivering traffic signal or pedestrian related information at intersections. The main requirement of these active safety systems is the possibility of delivering real- time acquired information to and between vehicles at latencies of lower than few hundred milliseconds. Prototypes of such systems are being developed by many automotive manufacturers.

IV. Related Works

In this paper, we provide a comprehensive evaluation of mobility impact on the IEEE 802.11p MAC performance. The study evaluates basic performance metrics such as packet delivery ratio, throughput, and delay. An unfairness problem due to the relative speed is identified for both broadcast and unicast scenarios. We propose two dynamic contention window mechanisms to alleviate network performance degradation due to high mobility. The first scheme provides dynamic level of service priority via adaptation to the number of neighbouring nodes, while the second scheme provides service priority based on node relative speed.

During route creation and maintenance phases, nodes use high metric to establish a directed acyclic graph (DAG) rooted at destination.During the times of mobility the DAG is broken and route maintenance comes into picture to re-establish a DAG routed at the destination. Timing is an important factor for TORA because the high metric is dependent on the logic time of the link failure. TORA’s route erasure phase is essentially flooding a broadcast clear packet (CLR) throughout the network to rease invalid routes.

V. Stimulation Setup And Performance Metrics

5.1 Simulation Tool & Parameters

There are many network simulators available in the market but the most frequently used are OPNET, Qualnet, and NS2. OPNET and Qualnet both also best network simulators, but these are not opens source tools and having the more cost for purchasing for such kinds of education studies. Hence the best choice is to use the NS2 simulator which is completely free and open source tool for all kinds of network simulations and researches. There are many versions of NS2 available ranging from ns-2.26 to ns-2.35.

In our simulation work to evaluate the performance of original DSDV and TORA routing protocol we use the open network simulator NS-2 in its version 2.35. Nodes follow a random waypoint mobility model, traveling at a variety of speeds over a 1000 x 1000 meters area for 600 seconds of simulated time. We used same scenario for all protocols because of unique behaviour of each protocol to produce output.

5.2 Performance Metric

There are several performances metric at which routing protocols can be evaluated for network simulation [30]. We use the performance metrics in our simulation purpose are: Packet delivery ratio, Throughput and End to End delay.

Packet Delivery Ratio: It is calculated by dividing the number of packets received at the destination node by the total packets sends by the source node. It specifies the packet loss rate, which limits the maximum throughput of the network and the delivery ratio performance. The high packet delivery ratio presents better performance of a protocol.

Throughput: The throughput of the protocols can be defined as percentage of the packets received by the destination among the packets sent by the source. It is the amount of data per time unit that is delivered from one node to another via a communication link. The throughput is measured in bits per second. This metric show the total number of packets that have been successfully delivered to the destination nodes and throughput improves with increasing nodes density.

End to End delay: The total time for transmitting a packet from source to the destination node is known as end to end delay. The delay performance metric include the delays due to route discovery, packet propagation and sending time and the time of packet in queue.

VI. Stimulation Results

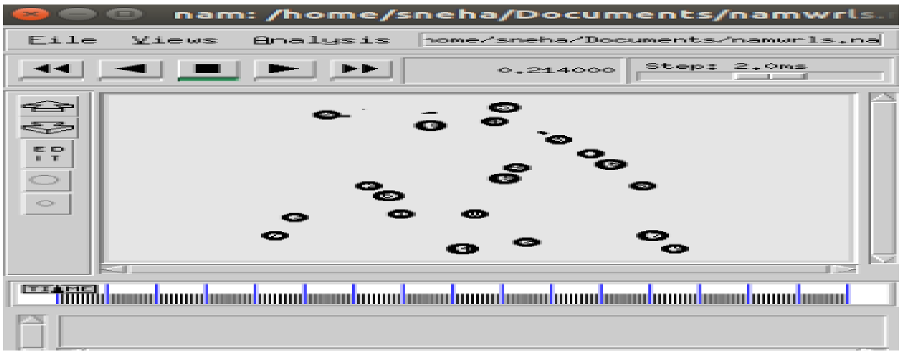


Fig 6.1: Output of creating 20 nodes in DSDV

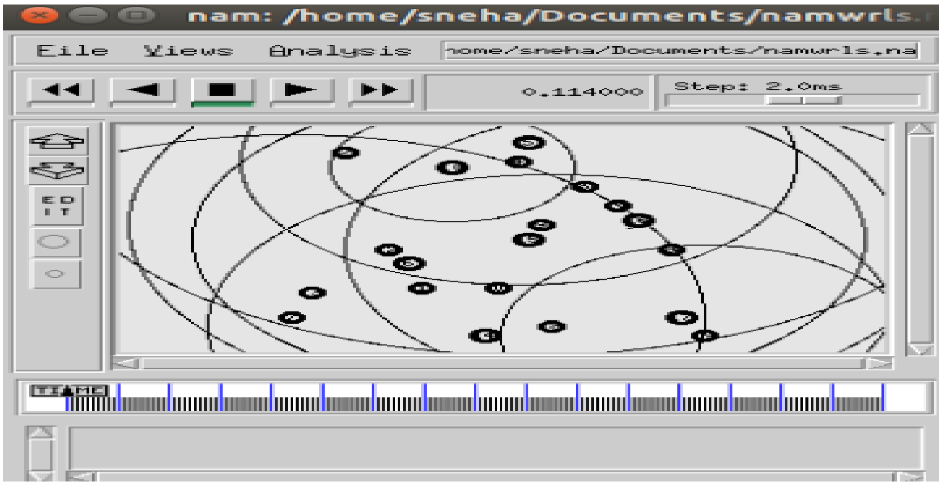


Fig 6.2:Packet transmission between 20 nodes of TORA protocol

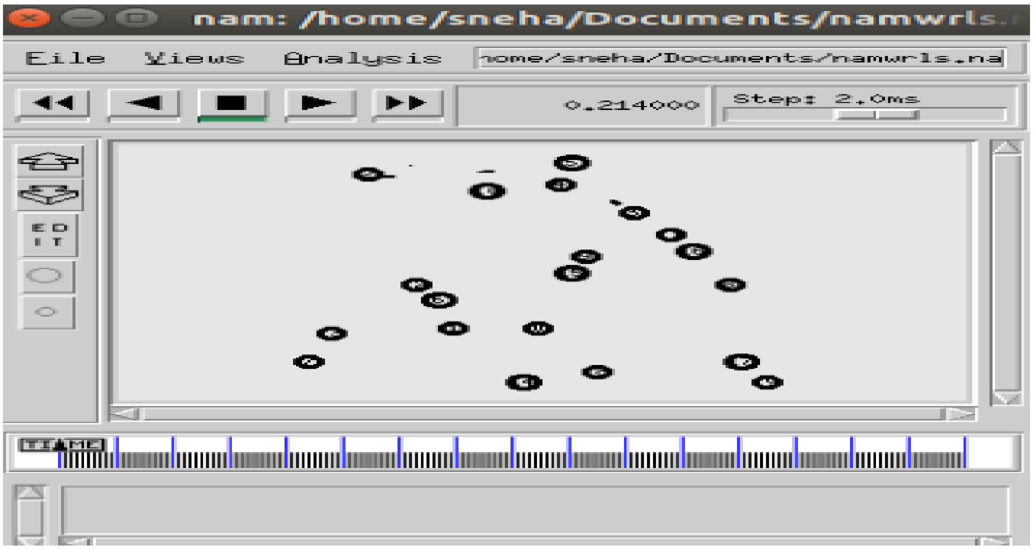


Fig 6.3:Creating 30 nodes for TORA protocol

VII. Conclusion

This paper aims at enabling accurate and efficient evaluation of emerging vehicular network applications such as Intelligent Transportation Systems (ITS). A distributed simulation platform that integrates transportation simulation and wireless network simulation is proposed and implemented, providing a user level simulation environment to evaluate the feasibility and performance limitations of VANETs in supporting ITS.

The proposed simulation platform facilitates the dynamic interaction between the two simulation domains, allowing runtime control of vehicles' behavior in the transportation simulation as they react in real time to information exchange in the simulated communication network The effectiveness of three representative VANET dynamic adaptation protocols in enhancing the application performance in scenarios with high vehicle density are compared in the case studies.

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