International Journal of Research in Advent Technology, Vol.6, No.1, January 2018
E-ISSN: 2321-9637
Available online at www.ijrat.org

Performance Approach of AODV, DSR and DSDV Protocols IEEE 802.15.4 for vehicular networks Using NS2

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Abstract— Vehicular Ad-hoc Networks (VANETs) are the special class of Mobile Ad-hoc Networks (MANETs) with high mobility and frequent changes of topology. It is a type of highly dynamic wireless network that can be formed without the need for any pre-existing infrastructure which aims to improve the transportation system by integrating sensors, wireless networks, GPS, 2G and 3G technologies with the Ad-hoc networks. Due to higher mobility of nodes (vehicles), routing becomes the most challenging task in VANETs. A variety of research has been done on routing and several protocols have been proposed with their implementation. As VANET (Vehicular Ad-hoc Network) research field is growing very fast. It has to serve a wide range of applications under different scenarios (City, Highway). It has various challenges to adopt the protocols that can serve in different topology and scenario. The main objective of Vehicular Ad-hoc Networks is to build a robust network between mobile vehicles so that vehicles can talk to each other for the safety of human beings. This paper deals with the study of classification of different Ad Hoc routing protocols and their different routing techniques.

Keywords: VANET (Vehicular Ad-hoc Network), MANET (Mobile Ad-hoc Network), routing protocols, AODV, DSR, DSDV.

1. INTRODUCTION

A VANET or mobile adhoc network consists of dynamic wireless nodes that can communicate with other nodes through wireless links without any fixed infrastructure support [1]. Vehicular ad-hoc network are easier to organize than wired network are used in many applications, such measure ambient conditions in the environment, military, surveillance, seismic detection etc [2]. The ultimate objective of VANET is to offer solution that keeps a stability between the sensors through the network operation, despite the movable nodes and limited bandwidth and other resources constraints. According to dy-namic nature of Ad-hoc networks makes it enormously com-plicated and challenging mission to obtain accurate knowledge of the network state.

There are many routing protocols have been proposed for VANET, which fall into three major categories (Fig 1): table-driven approach (or proactive protocols), on-demand approach (or reactive protocols) and Hybrid. In our study we will focuses only in the two first categories. proactive routing protocol such as Dynamic Source Routing (DSR) [3], Dynamic Destination-sequenced Distance-Vector routing (DSDV) [4], Signal stability-based Adaptive routing (SSA) [5].

Proactive routing protocol has many desirable proprieties especially for applications that include little delay for route discovery. Also maintain routing tables that contains the information and the update for each node in the network to obtain a global optimal route for each destination. These protocols, however, consume significant amount of energy to periodically disseminate routing information, which could be a critical overhead for VANETs with limited battery power. In contrast, reactive initiate route discovery mechanism and maintenance mechanisms only when a route is actually required. The most prominent among existing reactive protocol are the ad-hoc On demand Distance vector AODV [6].

MANTES typically encompass of battery operated mobile de-vices that interconnects and exchange signals and information wirelessly which are logically resource intensive. The energy saving feature supports the life prolongation of all nodes concurrently. This objective can be achieved by minimizing the energy consumption at each communication call resulting from the even distribution of the energy consumption rate at each node.

To prolong lifetime of ad-hoc network, it is essential to lengthen each individual node life through minimizing the energy consumption for each communication request.

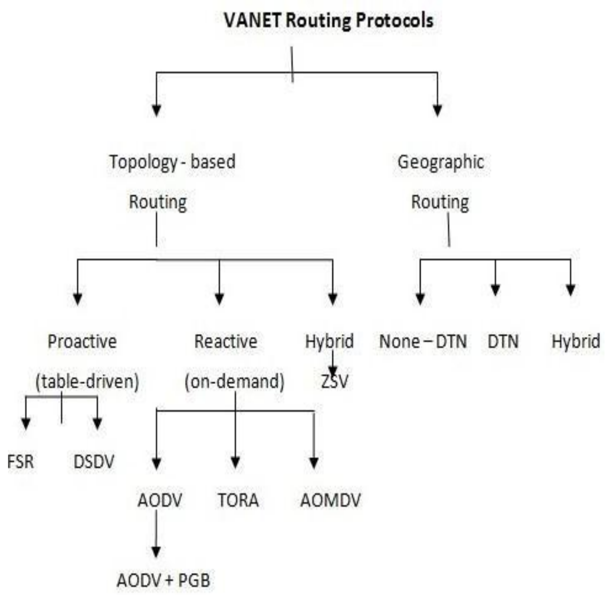
The breakdown of the paper is organized as follows: Section 2 present a brief description of the related works. The proto-col description and simulation environment is explained and discussed in section 3. The conclusion is presented in section 4.

2. LITERATURE SURVEY

In recent years, there are several studies and proposal works address not only to improve the energy storage but also prolong the networks lifetime. In this section we have analyzed three well known routing protocols for VANET, and we briefly mention the operational methods and major features of these protocols.

A. AODV

We started with the most widely used is the AODV, uses the destination sequence number (measure route only by the number of hops) to guarantee the freshness and loop freedom.



of the route [6], to minimizes the number of broadcasts by creating routes based on demand, which is not the case for DSDV. AODV has two steps: Route discovery as well as route maintenance mechanism. When a node needs to send data to another node which the root are not predefined. A source node initiate the root discovery phase to determine a new route whenever a transmission is needed. It broadcast Route Request (RREQ) to its neighbors [5]. When each node receives the RREQ, it update a reverse route to the source in the routing table. Each neighboring unicasts a route reply packet (RREP) which has an incremented the sequence number to the reverse route. It means that nodes reply to RREQ by RREP packet only if they have an active route towards destination. The source node restarts the discovery process to make a new route to the destination if they still require an open route to the destination concerned.

1) Advanced uses of AODV:

Because of its reactive nature, AODV can handle highly dynamic behavior of Vehicle Ad-hoc networks [5].

Used for both unicasts and multicasts using the flag in the packets.

2) Limitation of AODV:

Requirement on broadcast medium: The algorithm ex-pects/requires that the nodes in the broadcast medium can detect each others broadcasts

The routing info is always obtained on demand, including for common case traffic

B. DSR

Dynamic Source Routing (DSR): DSR is an simple efficient routing protocol proposed specifically for use in multi-hop mo-bile Ad-hoc network. like AODV is characterized by two main steps including route discovery and route maintenance [3], these two phase help node to continuously evaluate the best route to destination. We can distinguish two cases to reaching the destination. In the case a route is found, the source node uses this routing information to the destination. Otherwise,

node caches the packet and finds the routing informations to the destination by initiating the route discovery.

C. DSDV

Distance sequence vector DSDV [4], is a proactive routing protocol, which is a conventional modification of Bellmond-ford routing algorithm to calculate the shortest-path. DSDV proposed to be used in multi-hop mobile Ad-hoc networks. Each node maintains the routing table with all possible desti-nations within the network and the number of required hops to reach the destination is also maintained in the table. The sequence number is assigns for each destination to distinguish out stale routes and prevent routing loops. The stations periodi-cally transmit their routing tables to their immediate neighbors. A station also transmits its routing table if a significant change has occurred in its table from the last update sent. So, the update is both time-driven and event-driven. The routing table updates can be sent in two ways: a ”full dump” or an ”incremental” update.

1) Advanced uses of DSDV:
DSDV protocol guarantees loop free paths.
We can avoid extra traffic with incremental updates instead of full dump updates [4].

2) Limitation of DSDV:
It is difficult to maintain the routing table's advertisement for larger network. Each and every host in the network should maintain a routing table for advertising. But for larger network this would lead to overhead, which consumes more bandwidth.

DSDV doesn't support Multi path Routing.
To conclude this section, we have analyzed algorithms that most of scientist and researchers are interested in, trying to study them in details because in our research, we based our work on a comparative study on the strengths and weaknesses based on various factors including the accuracy, energy ef-ficiency, mobility and complexity for the rapidly emerging wireless networks. This study will guide researchers in the integration features of the solution of various protocols and create successful VANETs for their applications:

3. SIMULATION RESULTS AND ANALYSIS

In this section, we have described about the performance metrics and implementation details of all three previous study-ing protocols AODV, DSDV and DSR. The network consists of 100 nodes in a 100meter x 100meter rectangular field. We use the random waypoint as the mobility model. Constant bit rate (CBR) with 512 byte data packets is used. The source-destination pairs are spread randomly over the network. The MAC layer protocol is 802.11. The main parameters used in the simulations are summarized in table 1.

3.1 Performance Metrics

In the course of our evaluation and comparison of the three protocols, our primary focus was on Four(4) workloads performance metrics, namely: Packet Delivery Fraction (PDF),

TABLE I
COMPARISON OF DSDV, DSR AND AODV

Algorithms Priority	DSDV	DSR	AODV
Reactive	No	Yes	YES
Normalized throwghput with selfish nodes	Best performance	Worst	Better than DSR
Average end-to-end delay	Shortest	Highest	Modest
Network load balancing	Worst performance	Best performance	Modest
Energy consumption	Low	Highest	Modest
weighted path optimality	Best performance	Best than AODV	Next to DSR
Average packet delay with specific nodes	Lowest average packet delay	higher	Modest

average End-to-End Delay, Routing Overheads (ROH), and Average Energy Consumption per delivered packet.

Throughput: It is the measure of the number of packets or data successfully transmitted to their final destination via a communication link per unit time. It is measured in bits per second (bit/s or bps).

Packet delivery Fraction (PDF): measures the per-centage of data packets generated but nodes that are successfully delivered to the sink, expressed as:

(Total number of data packets successfully deliv-ered)/(Total number of data packets sent)x100%.

Average End-to-End delay: measure the average time it takes to route a data packet from the source node to the

S sink. It expressed as:

(Individual data packet latency)/
(total number of data packets delivered)

Energy Consumption per Delivered Packet: This mea-sures the energy expended per delivered data packet. It

expressed as [3]:

Energy expend by each node) number of
elivered data packets)

3.2 Analysis

In this section we detail the scenario for the three routing protocols are evaluated in different number of nodes.

1) Packet delivery fraction: Figure 2 depicts the pdf, the packet delivery ratio of DSR is better than AODV and DSDV with increasing in the number of nodes. We can explain the markedly decline of AODV beyond 200 nodes this decline in the

performance indicates that AODV cannot cope with excess generated traffic in the network. The second remarks about the good performance of DSR is due because the DSR protocol all known routers caches so probability of choosing stale route is less. it is very likely that during route discovery for some destination such as node D, a route for another nod A is found, recorded, and latter used form the cache, this strategy will ultimately save the network bandwidth, which leads to improve the performance of DSR protocol, especially when the number of nodes increase.

Energy consumption: The energy consumption by the three protocol are showed in fig 3, we can conclude that DSR and DSDV more efficient than AODV due to the high mobility of this latter also the energy consumption is found to be increasing with the increase in the number of nodes.

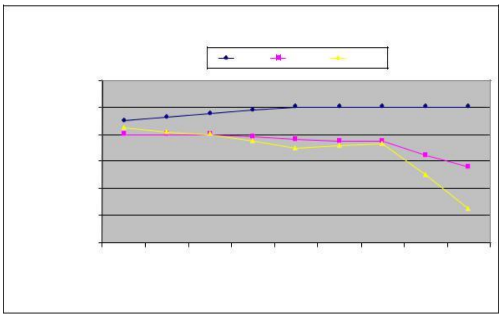


Fig. 2. Variation of PDR.

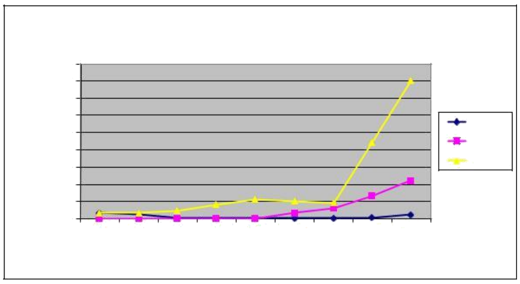


Fig. 3. Results of energy consumption

Average delay:
In our observation from fig 4 we see that the best average end-to-end delay is exhibited by DSR and DSDV protocols. We can easily observe that AODV is the worst protocol in terms of delay due to increase in the number of broken routes and the extra transmission of control messages used by AODV.
We can be noted also that the best overage End-to-End delay for DSDV protocol is less than both DSR and AODV.

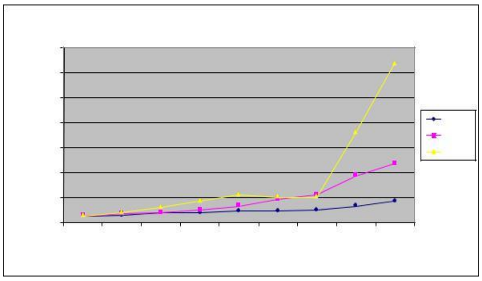


Fig. 4.routing overhead simulations results.

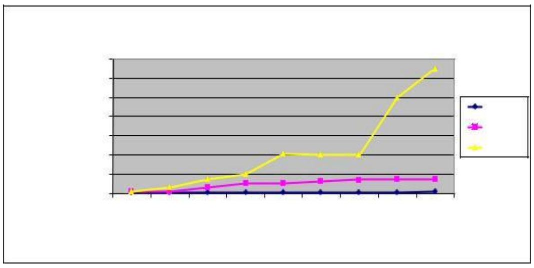


Fig. 5.Variation of end-to-end delay

3) Throughput: From figure 5 it is observed that AODV has lowest throughput in comparison with DSDV and DSR. This decline in the performance indicates that AODV cannot cope with excess generated in the network.

In our observation from fig 5 the AODV has lowest throughput in comparison with all the other two protocols considered. Since in AODV only the first arriving request packet (RREAQ) is answered therefor it leads to less no of replies (RREPs)

We can conclude this section with a key remarks is the influence of network size after the experiments study of the performance of AODV, DSDV and DSR protocols.

1) For AODV and DSDV the PDF start to decline quickly when the number of sensors grows beyond 200 sensors.
2) The performance of AODV and DSV not guaranteed for wide networks (big size).
3) The DSR protocol demonstrate a significant lower rout-ing overhead in comparing with

IV. CONCLUSION

This paper evaluated the performance of AODV, DSDV and DSR, routing protocols for VANET using NS2 simulator. Comparison was based on variety of performances metrics, namely energy consumption. From results reports in section 3 we calculated that DSR protocol is the best in terms of packet delivering ratio than other protocols making it suitable for highly mobile random networks. To conclude, we have analyzed algorithms that most of scientist and researchers are interested in, trying to study them in details because in our research, we based our work on a comparative study on the strengths and weaknesses based on various factors including the Average delay, energy efficiency, throughput and Packet delivery fraction for the rapidly emerging wireless networks. This study will guide researchers in the integration features of the solution of various protocols and create a successful mobile sensors senario for their applications.

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