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PERFOMANCE EVALUATION OF TWO IMPORTANT PROTOCOLS FOR INTER-NAVAL COMMUNICATION (AODV AND DSDV) WITH DARS SIMULATOR: A CASE STUDY OF THE SEAPORT OF VLORA

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Abstract

The aim of this paper is to use simulations to evaluate the performance of two existing protocols, AODV (ad hoc on-demand distance vector routing) and DSDV (Destination-sequenced Distance-Vector routing). However, they are designed for use in mobile ad hoc networks (MANET) and for increasing the effective point to point (ship to ship) communication. Simulations will be performed with the DARS simulator. The simulation result shows that when the number of nodes increased and consequently the distance between nodes narrows, there is an improvement in the communication process and a "Message Transmission Successful’. In fact, routing in these networks is based on a simple and intuitive approach. Thus, this approach shows that the retransmission of the packets by each node allows propagation through the network.

Keywords: DARS, AODV, DSDV, MANET, Ad Hoc

Introduction

Effective communications between vehicles can be increased using effective routing protocols. Hence, it takes into account the specificity of the roads where these vehicles passes. New applications of mobile communications require improved quality and reliability of the communication protocols between the vehicles (E.Hoxha, E.Cipi, March 2015). In ship to ship communication, they were noted problems and situations such as problems of broadcasting for satellite systems and wireless networks. Thus, this has resulted to the use of new protocols in inter-naval communication. Furthermore, served mobile ad-hoc communication are convenient because it offers alternative communication path and infrastructure without the need of coverage from base stations (E.Hoxha, E.Cipi, March 2015).

Many protocols have been proposed to integrate cellular and Ad-Hoc networks. Most of the research in this area tries to improve throughput, coverage extension, and load balancing of cellular networks (K. RahimiZadeh, M. Dehghan, S. Ali Hosseininezhad and A. Dehghani, Feb. 2008). They also attempt to decrease the transmission power of nodes using a combination of Ad-Hoc and cellular networks. Wireless ad-hoc and sensor networks are limited because the energy nodes are strongly dependent on their batteries. Consequently, the goal of the routing protocol is to achieve minimum time communication with minimal consumption of network resources.

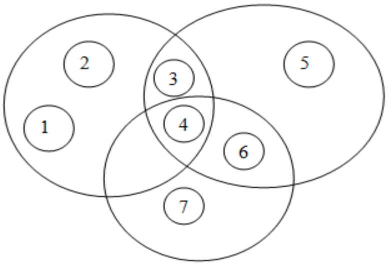


Figure 1. Diagram of routing protocol

An ad-hoc network is relatively mobile compared to a wired network. Hence, it makes this kind of network dynamic. This creates many challenging research issues since the objectives of how routing should take place is often unclear. Thus, one type of wireless ad hoc network is the mobile ad hoc network (MANET).

A MANET is an autonomous collection of mobile users who communicates over a relative bandwidth constrained wireless links. Since the nodes are mobile, the network topology may change rapidly and unpredictably over time.

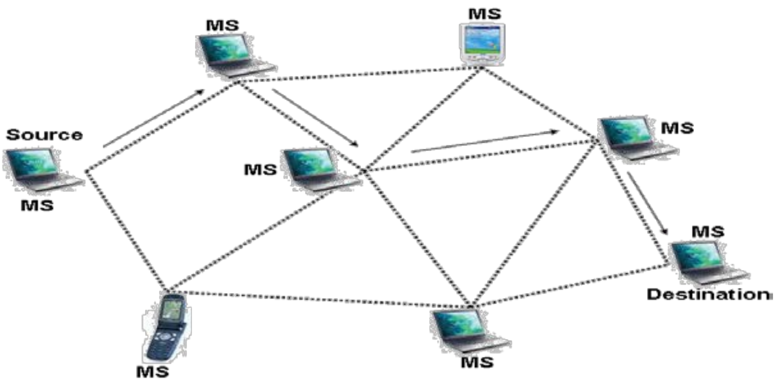


Figure 2. Diagram of a MANET topology

Energy management in MANETs is the basis on which routing protocols are improved to attain energy efficiency. The choice of the routing protocol affects each of the dimensions along which energy is consumed, such as transmission, battery, as well as devices and processor energy. These dimensions are discussed in detail in the remaining part of the section. Along with these schemes, there is also a description of the energy cost metrics which measures the amount of energy saved using different path selection schemes.

As I emphasized above, the purpose of this paper is to use simulations to evaluate the performance of two existing protocols, AODV (ad hoc on-demand distance vector routing) and DSDV (Destination-sequenced Distance-Vector routing). However, they are designed for use in mobile ad hoc networks (MANET). Simulations will be performed with the DARS simulator. Then, this would be compared with the results that we will get later through the use of our proposed protocol known as the InterNavComm protocol.

Firstly, we will talk about the methodology and research methods for two routing protocols i.e. AODV and DSDV.

Furthermore, we will talk about DARS simulator, and the various methods of adding a new protocol on the areas of this simulator.

Finally, we will present simulations and the results obtained from simulations, for both routing protocols which were mentioned above.

The Methods and Methodology of Research

Simulation, comparison, and the statistical analysis methods of performance, usually configure the advantage of this paper.

The simplest method of transmission service is the discharge or flood method. However, its advantages can be seen from its simplicity and ability to reach the goal.

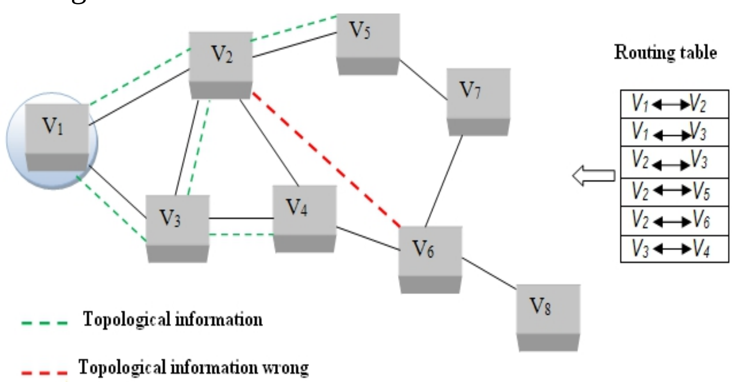


Figure 3. Network Topology/topological information

In an ad-hoc network, the network topology changes dynamically due to the movement of mobile hosts. These kinds of topologies generate control packages over the application layer. Hence, through them, we will understand the information on the network topology. Also, it manages to increase traffic control across the network. (E. Hoxha, June 2013)

AODV

AODV (L.R.Ford Jr. And D.R.Fulkerson,1962) is a reactive routing protocol instead of proactive. It minimizes the number of broadcasts by creating routes based on demand, which is not the case for DSDV. When any source node wants to send a packet to a destination, it broadcasts a route request (RREQ) packet. The neighboring nodes in turn broadcast the packet to their neighbors, and the process continues until the packet reaches the destination. During the process of forwarding the route request, intermediate nodes records the address of the neighbour from which the first copy of the broadcast packet was received. This record is stored in their route tables, which helps in establishing a reverse path. If additional copies of the same RREQ are later received, these packets are then discarded. The reply is sent using the reverse path. For route maintenance, when a source node moves, it can reinitiate a route discovery process. If any intermediate node moves within a particular route, the neighbor of the drifted node can detect the link failure and sends a link failure notification to its upstream neighbor. This process continues until the failure notification reaches the source node. Based on the received information, the source might decide to re-initiate the route discovery phase.

DSDV

Destination-Sequenced Distance-Vector (DSDV) routing which was explained in J. Jubin and J. Tornow (1987) was based on the classic routing mechanism of Bellman-Ford. (L.R.Ford Jr. And D.R.Fulkerson,1962)

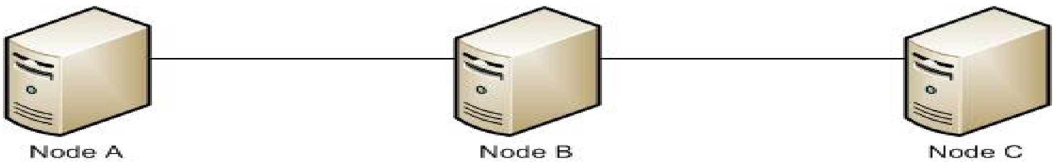


Figure 4. Communication node to node

DSDV was developed by C. Perkins and P. Bhagwat in 1994. The idea was to resolve the problem of cycle (loop) routing. Each entry in the routing table contains a serial number which exists if a link is present; otherwise, a random number is used (E.Royer, Ch.K.Toh, Aprile 1999).

Each mobile node in the network maintains a routing table by which all possible directions within the network and the number of hops are registered. The numbers listed routers help in avoiding the formation of cycles (loops) routing.

To reduce the bit large amount potential of network traffic that can generate update, routing update can employ two types of packages.

For example, in this simple network, node A table would be as follows (wiki):

Destination	**Next Hop**	**Number of Hops**	**Serial Numbers**	**Time set**
A	A	0	A 46	001000
B	B	1	B 36	001200
C	B	2	C 28	001500

The first package is known as 'full dump'. This type of packet carries all the routing information and requests data units for network protocols (E.Royer, Ch.K.Toh, Aprile 1999).

The second types of packets are small incremental packets used to transmit only information that has changed since the last 'full dump'. Each of these broadcasters can fit into NPDU standard measure, reducing the amount of generated traffic. The new router Broadcast contains the destination address, the number of hops to reach the destination, and the serial number to get information about the destination.

DARS (Dynamic Ad-Hoc Routing Simulator)

DARS was designed to facilitate the understanding of Mobile Ad-Hoc Networks. DARS will allow users to perform different scenarios, apply different communication protocols, and study the network behavior. However, the simulator gives both textual and graphical representation of the routing simulation (user guide).

DARS main goals consist of three (3) parts:

1. Create a user friendly and appealing scenario.
2. Have the ability to apply different protocols to a scenario.
3. Keep track of network events and displays them to the user.

The simulator has unique features to facilitate the operation of protocols with the user friendly environment. The simulator uses animation to show the current state in which simulator is working. The simulator is developed in Java with a GUI (user guide).

Adding a New Protocol

DARS is designed to easily accept the addition of new routing protocols. Therefore, adding a protocol can be divided into three major steps.

1. Updating the Node Factory

2. Extending the Node Class
3. Creating a Protocol Dialog Box

ICON Satellite Systems

ICON Satellite Systems has created an integrated mission architecture which enables various services to fulfill the needs of the market. This architecture consists of three main parts: the user segment, the space segment, and the terrestrial segment.

- The user segment consists of all ships within the ICON Satellite Systems terminals.
- The space segment consists of Inmarsat and ICON Satellite Systems.
- Finally, the terrestrial segment includes services for Icon Center Satellite Systems, as well as the interface of Inmarsat.

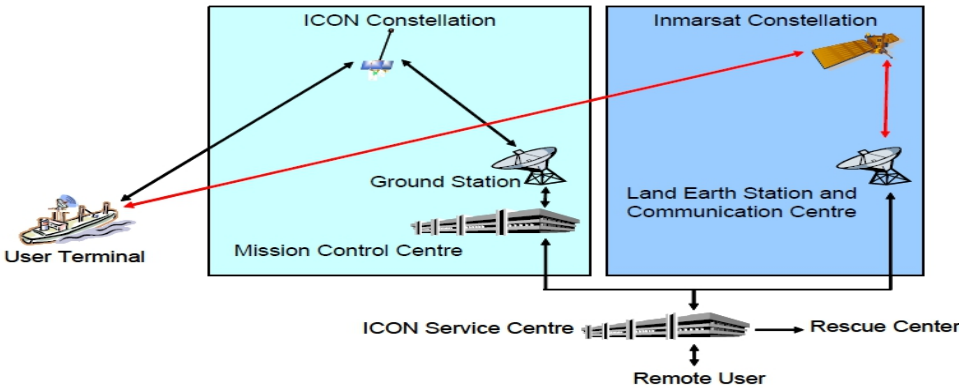


Figure 5. ICON Satellite Systems

Vessel Monitoring & Two-Way Messaging

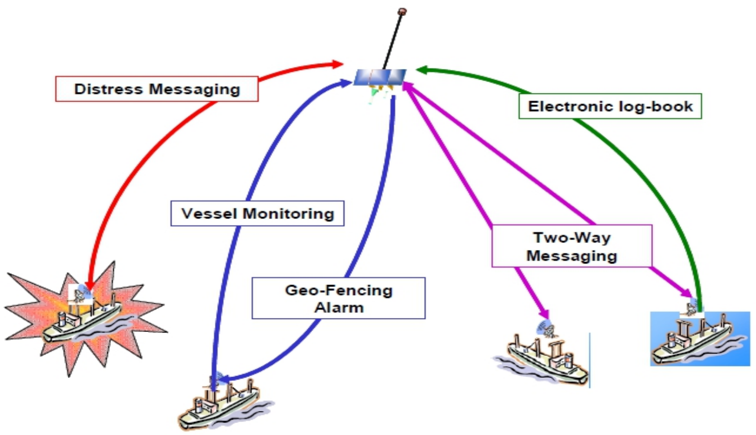


Figure 6. Vessel Monitoring & Two-Way Messaging Systems

Vessel Monitoring

At regular intervals, the vessel monitoring system automatically transfers the safe navigation of the vehicle and the identification of the data for the ICON Satellite Systems' Service Center.

Then, the data are subsequently distributed by the ICON system through customized reports to end users who are authorized. However, this includes the national fishing agencies and the fleet managers.

This monitoring of the vessels, drafts the rules for the monitoring and controlling of maritime activities.

Figure 7. Vessel Monitoring at the Seaport of Vlora, Albania

Two-Way Messaging

Two-way messages can simultaneously perform the exchanges ship-to-ship and ship-to-shore.

Two-way messages of ship-to-ship provides an easy communication, comfort, and safe inter-ship without disrupting routine operations.

Two-way messages ship-to-shore enables the terminal users to communicate with a user on land through the ICON Service Center Satellite Systems.

Two-way messages allows communication between geographically remote users. Also, it offers enhanced communication for the Coast Guard and fisheries agencies.

Fig.8 Two-Way Messaging at the Seaport of Vlora, Albania

Simulation

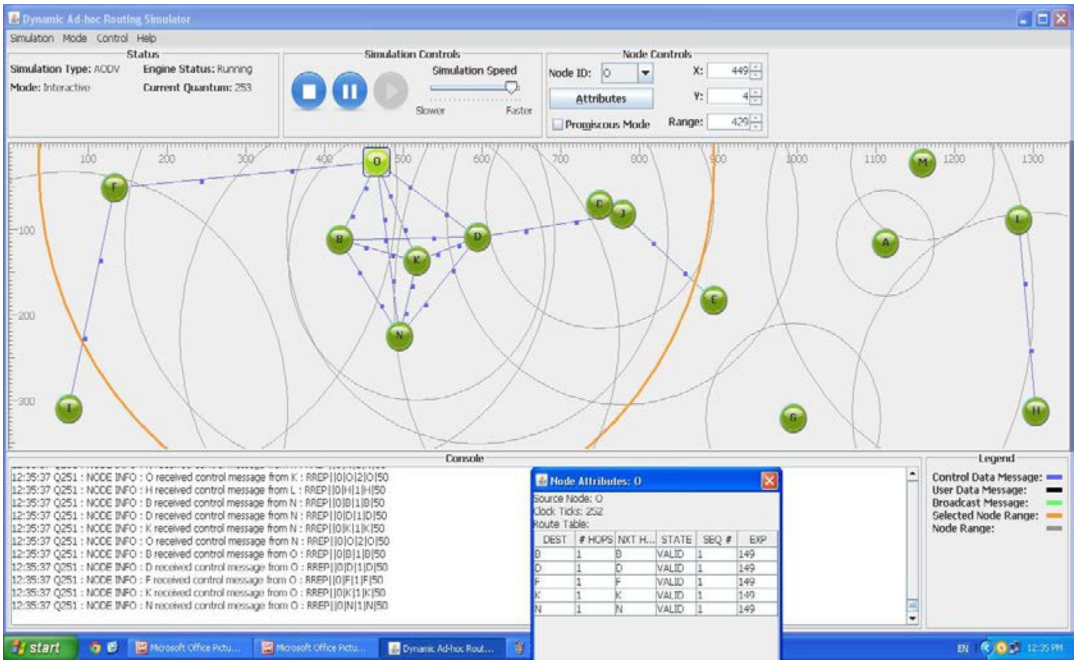
For all the nodes, we can get from simulator the following node attributes: DEST,# HOPS, NXT HOP, SEQ#, INST TI.., as shown in the figure below:

Node Attributes: R

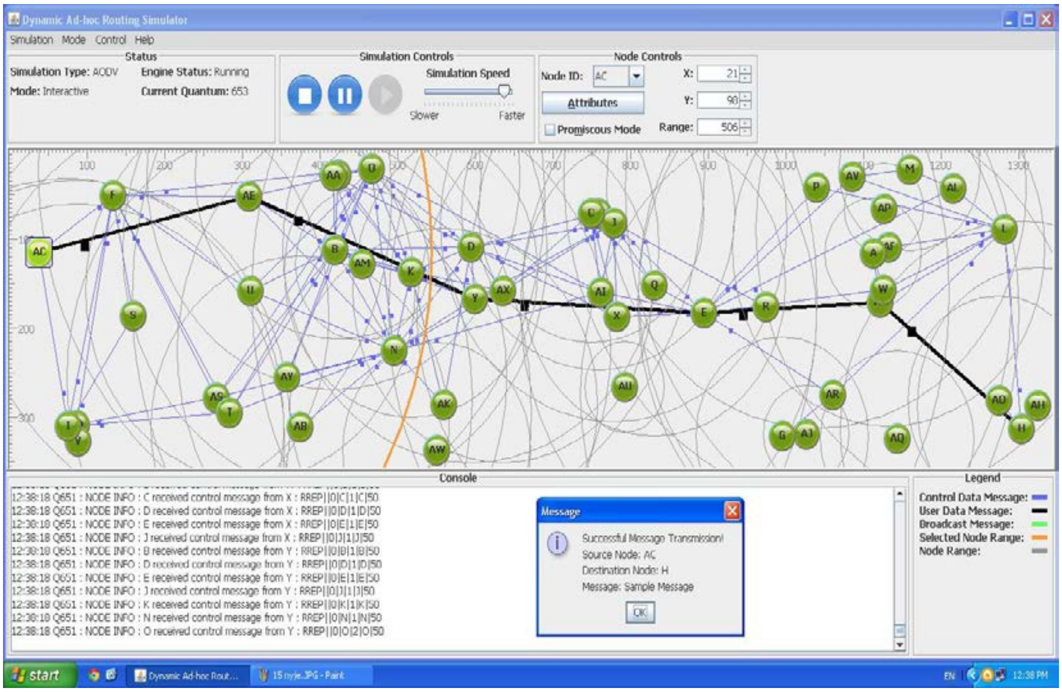
Source Node: R
Clock Ticks: 192
Route Table:

DEST	# HOPS	NXT HOP	SEQ #	INST TI...
AA	3	AQ	159	192
AB	4	AF	160	192
AC	4	AF	147	192
AD	3	AQ	141	192
AE	4	AF	170	192
AF	1	AF	169	192
AG	1	AG	127	192
AH	2	AQ	45	184
AI	2	BR	36	192

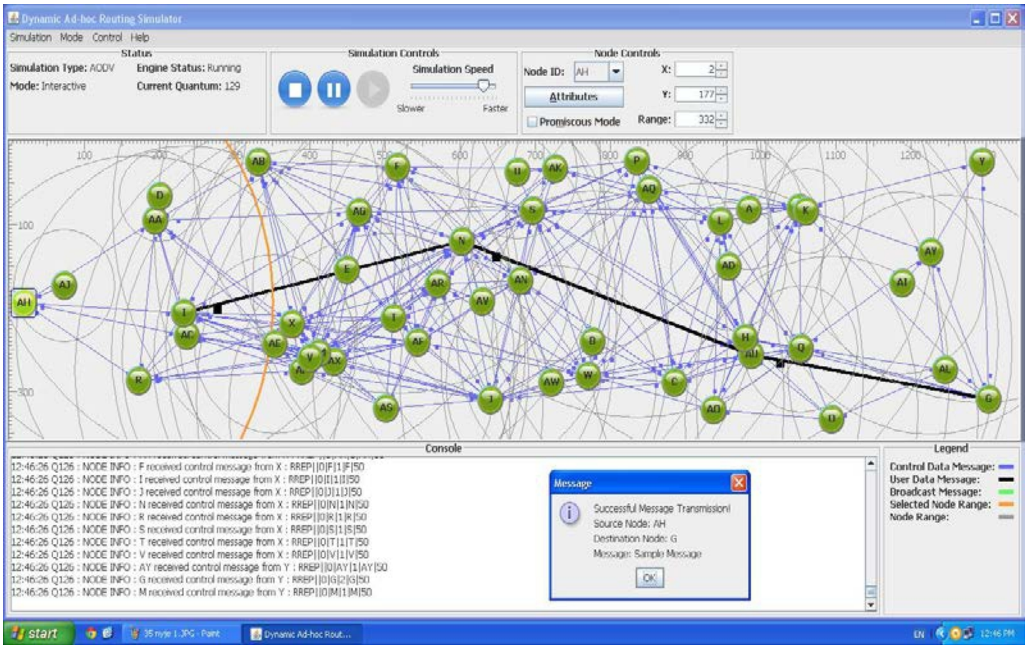
Table1: Simulation Parameters



15 node, AODV

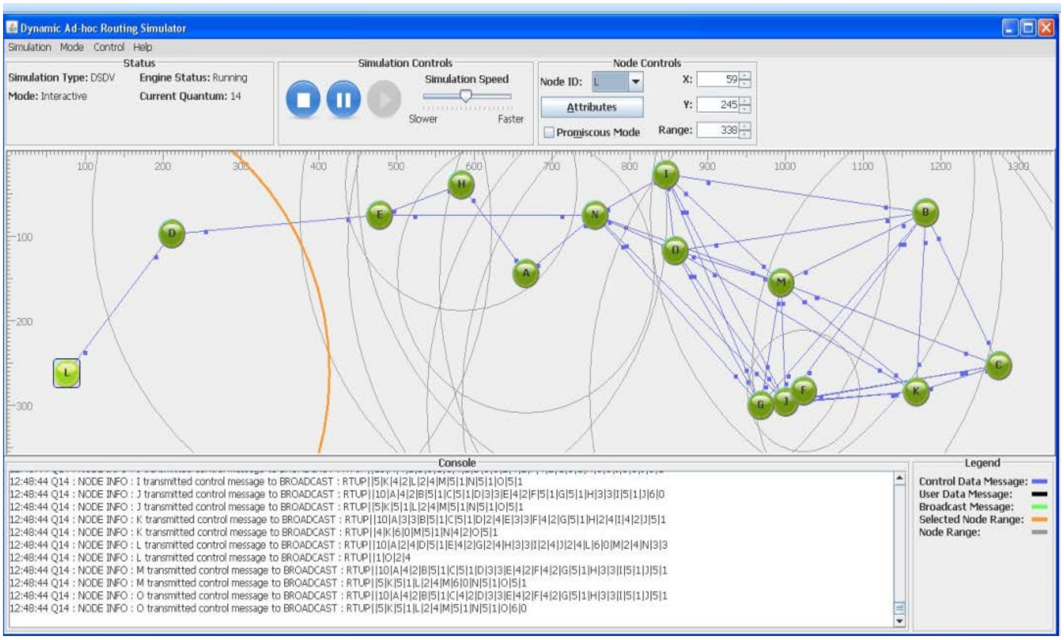


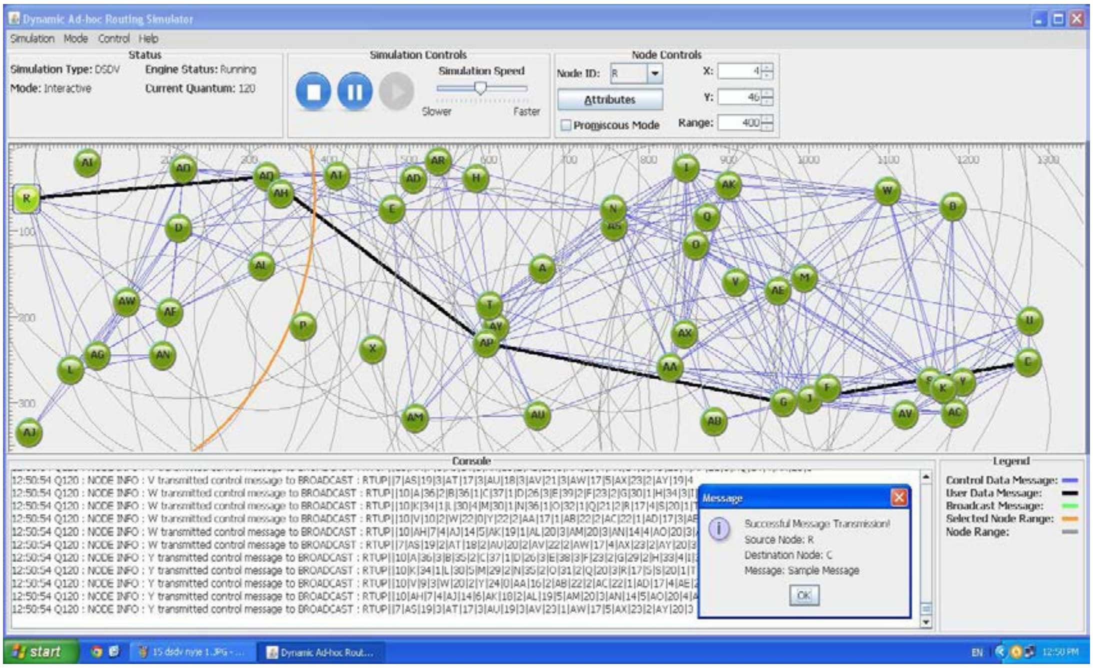
35 node, AODV



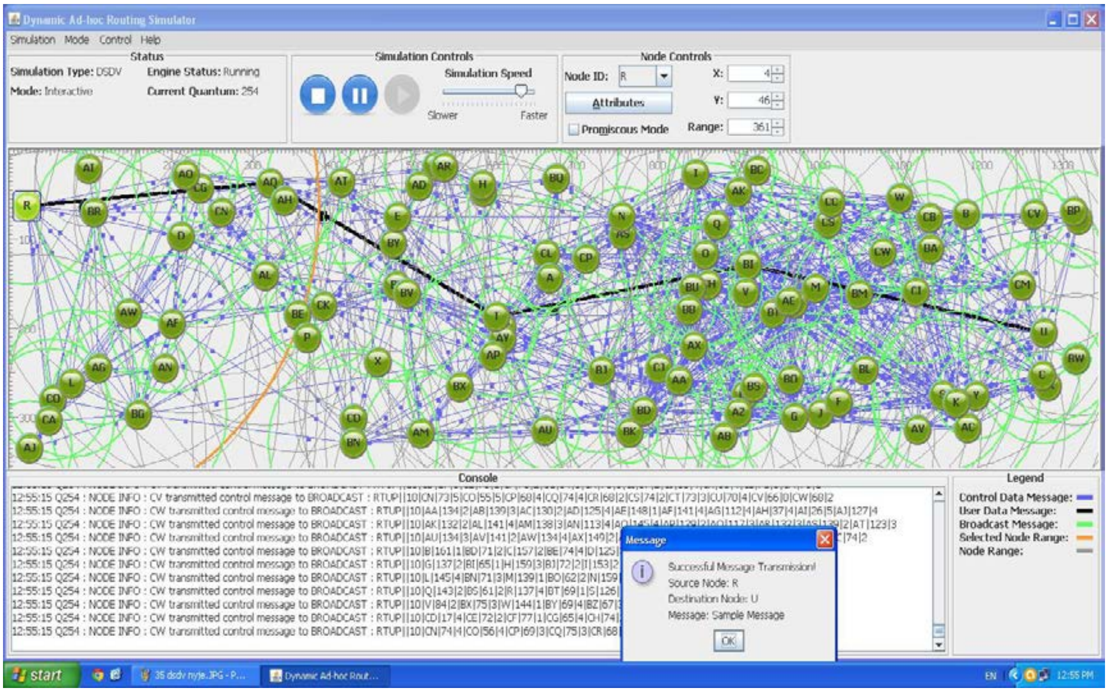
50 node, AODV

15 node, DSDV

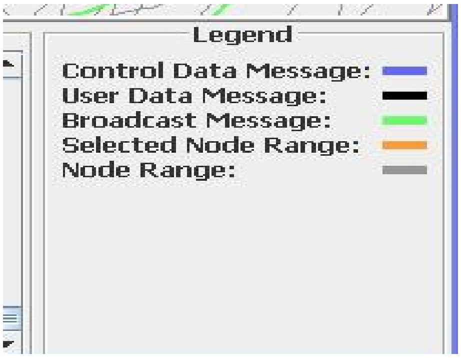




35 node, DSDV



50 node, DSDV



As presented above, the legend will help one to understand the line with different colors in the simulations.

Results and Conclusion

In this paper, I presented only 6 of all the simulations performed out. Also, we noticed during all these simulations that when the number of nodes increased and the distance between nodes narrows, there was an improvement in the communication process. Hence, there was "Message Transmission Successful’.

In conclusion, a good routing algorithm may help in avoiding congestion on all lines. Effective communication between vehicles increases the use of effective routing protocols. Also, the challenge of all protocols gears towards its scalability and effectiveness.

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