MULTICASTING TECHNIQUE FOR VEHICULAR AD HOC NETWORK

Dissertation submitted in fulfilment of the requirements for the Degree of

MASTER OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING

By

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PROPOSED TOPIC : To propose improvement in broadcasting technique for path establishment in VANET to reduce packet overhead.

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Sr.No.	Parameter	Rating (out of 10)
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5	Social Applicability: Project work intends to solve a practical problem.	7.00
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ABSTRACT

The mobile ad hoc network is the self configuring type of network in which no central controller is present. The vehicular ad hoc network is the type of ad hoc network in which vehicles move freely and communicate with each other. In vehicular ad hoc networks two type of communication is possible, i.e. vehicle to vehicle and vehicle to infrastructure communication. In vehicle to infrastructure communication, vehicles communicate with road side units and in V2V communication vehicles communicate with each other.

In vehicle to vehicle communication, shortest and reliable path will be established for communication. As vehicle nodes have higher mobility due which some prediction based technique are proposed in previous times for path establishment. Among proposed prediction based techniques, location audit routing is proposed which is based location is estimated and routing can be done in the network. In this work, improvement will be proposed in LAR technique for efficient path establishment between source to destination. This will leads to reduce delay and improve network throughput.

Keywords: *Vehicular Ad Hoc Network, Throughput, Delay, Packet loss, LAR, AODV, Root nodes*

DECLARATION STATEMENT

I hereby declare that the research work reported in the dissertation entitled "MULTICASTING TECHNIQUE FOR VEHICULAR AD HOC NETWORK" in partial fulfilment of the requirement for the award of Degree for Master of Technology in Computer Science and Engineering at Lovely Professional University, Phagwara, Punjab is an authentic work carried out under supervision of my research supervisor Ms. Shilpa Sharma. I have not submitted this work elsewhere for any degree or diploma.

I understand that the work presented herewith is in direct compliance with Lovely Professional University's Policy on plagiarism, intellectual property rights, and highest standards of moral and ethical conduct. Therefore, to the best of my knowledge, the content of this dissertation represents authentic and honest research effort conducted, in its entirety, by me. I am fully responsible for the contents of my dissertation work.

Signature of Candidate

Arshdeep kaur

SUPERVISOR'S CERTIFICATE

This is to certify that the work reported in the M.Tech Dissertation entitled "**MULTICASTING TECHNIQUE FOR VEHICULAR AD HOC NETWORK"**, submitted by **Arshdeep Kaur** at **Lovely Professional University, Phagwara, India** is a bonafide record of his / her original work carried out under my supervision. This work has not been submitted elsewhere for any other degree.

Signature Of Supervisor
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Date

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   Date: _____

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Chapter 1

INTRODUCTION

One of the main areas of research investigations of communication among the vehicles and road side units are the Vehicular Ad-hoc Networks (VANETS). In this system every one of the vehicles and components of roadside infrastructure are associated with each other without requiring the hidden framework, send and get data and give cautioning about current traffic situation. [5]. In today's period, used Wi-Fi IEEE 802.11 based innovation is by and large used for deploying VANETs. Each vehicle associated with the remote system interface it can be used either 802.11b or 802.11g. They are the two benchmarks for access to media.

These standards are broadly useful measures and they don't fit appropriately the necessities of high dynamic network, for example, VANETs. In this circumstance, Dedicated-short-range communication has been proposed as the correspondence standard for VANET. It is used as a platform for those phases where short medium range communication services are offered at low latency and high information rate. IEEE 802.11 standard suggests that vehicles communicate inside a confined range while moving[6].These sorts of systems are exceptionally ideal designs protocols remembering the ultimate objective to increase the effective data packet exchange, and reduce the transmission time and network utilization. [8].

Vehicle-to-vehicle and vehicle-to-roadside communication architecture exists in VANETs to provide road safety, navigation and other roadside services. VANETs are the important part of Intelligent Transportation Systems (ITS) framework. We can also refer VANETs as the intelligent transportation networks. Some of the features of VANETs are the nodes that exists in the network are highly moveable and because of the high mobility, network topology also changes very rapidly. Network size is unbounded. When the data is compromised, the whole system suffers. Privacy, mobility, network scalability are the main challenges in VANETs.

1.1 V2V Communication: In this communication organization with respect to the C2C-CC reference design together there is the progression in heterogeneous

communication innovation between the vehicles. The vehicular systems possibly have two sorts of communication situations: car to car communication and other is car to infrastructure situation. There are large numbers of hot spots along the road. Such problem areas can operate individually at home or office by the assistance of web access provider or integrated operated.

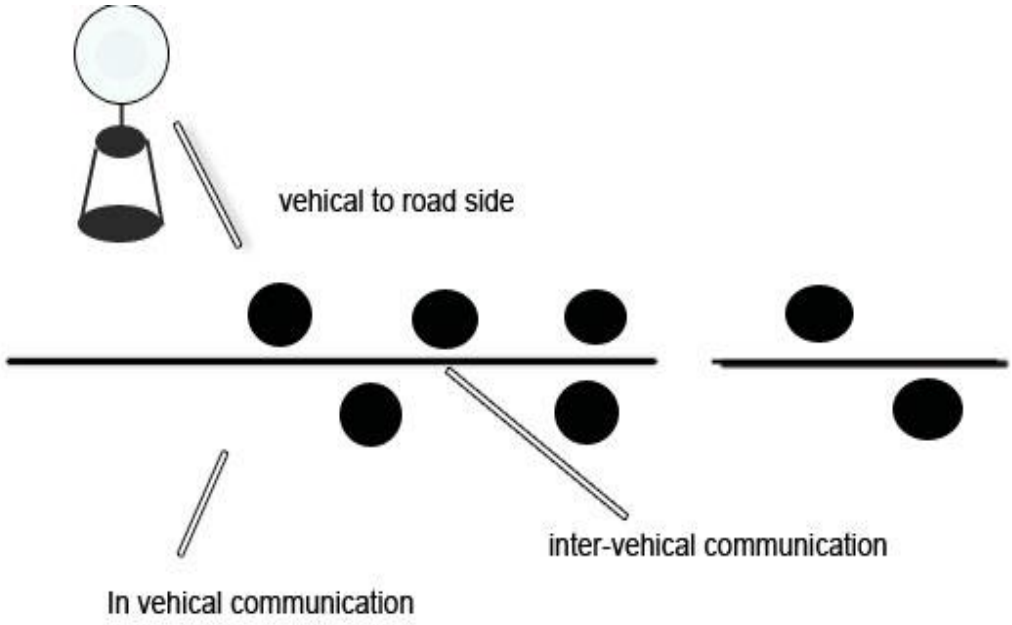


Figure 1.1: V2V Communication

Vehicles can communicate with various vehicles particularly without communication infrastructure, each of the vehicles participate and forward data for each other [9]. Combination of these deployment cases is furthermore possible. Later on, models for intelligent transportation framework consider each one of the vehicles acting as active nodes that are responsible of collecting and sending the critical information. Each one of the vehicles would have the ability to gather and process data by method for intelligent sensor and to exchange data with various nodes in global communication framework. It can be categorized into three parts:-

- In-vehicle communication
- Vehicle to road side/vehicle to infrastructure side communication
- Inter vehicle communication

1.1.1 In-vehicle communication: In-vehicle communication can be used to exchange the data between different components like vehicles. This framework generally is

used as a piece of modern vehicles that are available in today's period. Primarily the application areas for in-vehicle communication can be recognized into two sections: in the vehicle network of sensor, actuator and controller and second is high rate multi-media communication for comfort applications for example passenger entertainment. [8].

1.1.2 Vehicle to roadside communication: In vehicle to road side communication is similarly called a vehicle to infrastructure communication. In this time vehicles convey from the vehicle to a fixed infrastructure. This correspondence in the two forms is unidirectional or bidirectional fixed infrastructure [10]. Broadcast system supports the unidirectional exchange of data from broadcast station to the vehicle. In this framework the whole vehicle communicate point to point with the base station or access point. Base station makes an organizing the communication by using the physical synchronization and medium access. Base station adjusts the unnecessary load and gives the access control in legitimate channel. Furthermore the bidirectional innovations partition into the cell phone system and small range system. Existing cell framework like GMS and UTMS make the data required infrastructure always accessible. The small local area yet can give high information rates effortlessly. Depending upon the kind of air interface and infrastructure, the range in which VRC is possible shifts from several meters for remote (wireless) local area technologies to many kilometres for public radio systems.

1.2 Characteristics of Vehicular Network: Vehicular systems have some exceptional lead and attributes which help them separate themselves from other different type of networks. As compared to other different type of network vehicular systems have extraordinary and attractive components which are as per the following:

- **Unlimited transmission power:** In the ad-hoc devices power issue is major constrained. While on account of this network, nodes/vehicle give consistent energy for computing and correspondence of devices.

- **Computational limit very high:** Operating vehicles can afford the cost of computing, communication and detecting abilities.

- **Predictable mobility:** In the mobile ad-hoc network where it is difficult to anticipate the vehicle portability, vehicles have very predictable developments that are restricted to roadways. Roadways data is frequently accessible from positioning system and guide based technologies, for example, GPS. It portrays the normal speed, current speed and direction the future position of vehicle can also be found by them.

- **High portability:** The working of vehicular systems is to a great degree element as are their designs. If the example of highway is taken, where relative speed of up to 300 Km/h may happen while thickness 1-2 vehicle in 1 Km on opposite side where relative speed up to 60 Km/h and thickness of nodes high particularly in rush hours [11].

- **Partitioned network:** vehicular system will be frequently partitioned and dynamic nature of movement may bring vehicle gaps in sparsely populated scenarios in several isolated clusters of nodes (hubs).

- **Network topology and connectivity:** In the vehicular system, the situations are changing from area to area. The vehicles move and change their position always in the dynamic situations. Network topology changes as often as possible as the connection between the hubs connect and disconnect very easily. The system associated highly relies on the two variables; the range of wireless connections and the portion of member vehicles, where only a fraction of vehicle on the road could be equipped with wireless interfaces.[8].

1.3 VANETs Applications: VANETs applications situations have amazingly tremendous learning and planning stage thus they can be incredibly troublesome. This may likewise transform into extremely nasty job.

They are ordered into in a manner that arrangement of protocols will work for applications from a given class. The advantages of arranging them are as per the following:

- Develop a couple of application models to represent extensive number of uses with similar properties belonging to same class for application reproduction and approvals.
- Identification of key execution measurements relevant to each recognized applications class, as benchmarks. This is accomplished for assessing whether planned application system can meet basic prerequisites ordered by application classes or not.
- Create a networking protocol stacks for every class of applications, with the thought of enhancing reusability of regular mechanistic modules or networking protocols.

1.4 LAR Protocol: The vehicular communications are made to be more challenging due to the fact that there are various characteristics of the location based routing protocols. The networks are divided into three broad categories which are cellular, ad hoc and hybrid. Infotainment which includes latest new, or the information of the locality, is supported by the cellular network. The vehicle to infrastructure model is the basis of this category. A wide range of vehicular applications are supported by the present infrastructure. There is however, still a need of a fixed infrastructure deployment due eliminate the drawbacks found.

The ad hoc networks which do not require any prior infrastructure help in reducing the drawbacks identified. This is more prominent in the vehicle to vehicle communication. However, due to the network partitioning, routing link failures as well as the rapid topology changes, the network faces many challenges. The access points are deployed along the road in the network as a solution to the problems notified. In networks where there is no issue regarding the energy consumption also, this solution is opted.

In the case of hybrid communication, there is a centralized architecture based cellular network in which the traffic information is gathered from the road with the help of access points. The acquired information is processed by the access points and is used by the drivers as per the requirement. In the traditional routing protocols, the performance of the network is degraded by the dynamic nature of the vehicular communication, the high speed of the vehicles as well as their mobility.

The issues of the mobile ad hoc network are highlighted by the traditional ad hoc routing protocols. These are applicable for the MANETs due to the fact that they lack the high mobility and dynamic nature which is present in vehicular communication. The position-based routing protocols have proved to be more prominent for the highly dynamic and mobile networks.

In the figure below, there is a need to distinguish a route from S to D. For this reason a route request is sent to the neighbours by the node S. The B and C nodes are the neighbours and so when they receive the route request they send it to all the other nodes present in the network. The route request is forwarded by the node X when it receives it from B. When node C send the similar route request to node X, the request is discarded.

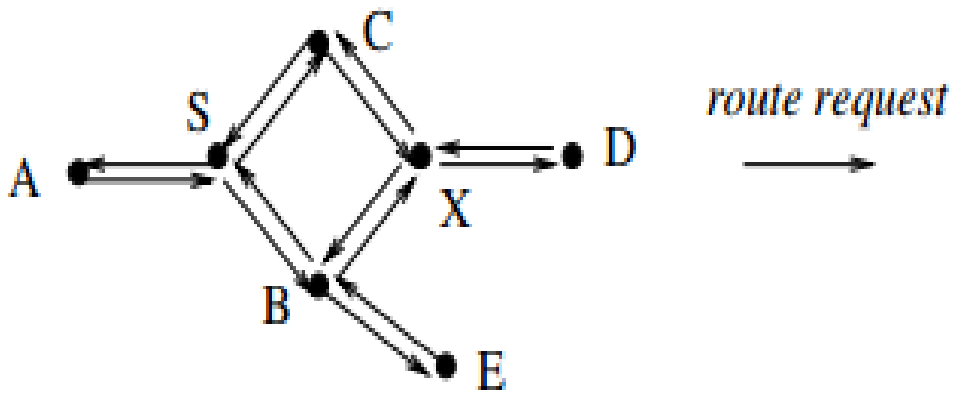


Figure 1.2: Illustration of flooding Algorithm

The route request packet holds the path which is followed by the request when it is forwarded to various nodes in the network. The flooding algorithm is used here along with the confirmation that the destination provided is reachable from the sender node. Keeping in consideration all such things, the route request message is sent. A route reply message is sent back to the sender, once the route request is received. The path is followed which is achieved by reversing the path which was followed by the route request provided to D.

There is a chance that there is no route request message received by the destination. This can be possible for reasons such as the sender is far enough or the route requests are not found due to errors in the transmission. The route discovery should start from

the beginning in such cases. This is the reason that the timeout is provided to every request sent by the sender.

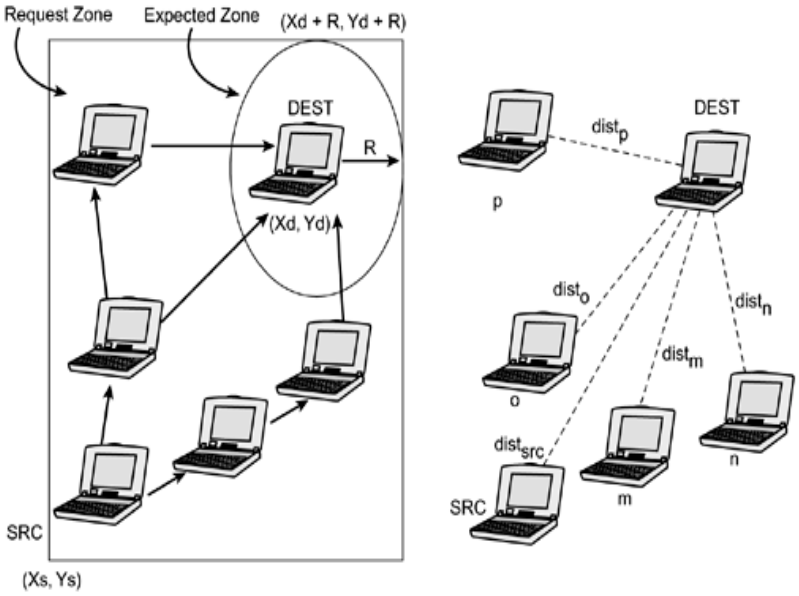
If within a certain time interval provided by the sender the route reply is not achieved, the new route discovery begins. The sequence number used here is completely different from the one provided earlier. The multiple receptions of a similar route request are to be identified once the route reply is not received and there is need to identify a new route. The previously assigned sequence numbers are to be recalled for this purpose.

The timeout conditions occur when the route reply is lost from the destination or the route request is not at all received. When the sender node S identifies that any already used route node to node D is broken, the route discovery gets started. It is also possible when there is no knowledge about the route to destination path by the source. The node S realized that the route is broken in the implementation.

The route is accepted to be utilized at certain instant of time. To a particular route when the packets are sent by the node S, a route error message is returned by the node on that path. Route discovery is initiated for the destination when the node S receives a route error message. It should be taken care that the route request is sent to every node which is in reach from the node S when the algorithm is used which basically means that all the nodes in the network must be sent the request.

The number of nodes which receive the route requests that are propagated, attempt to decrease the number of nodes. The flagging traffic is reduced by the LAR by limiting the scan for another route to a smaller request zone. The expected zone and the request zone are the two different concepts of LAR.

The first assumption involves the presence of advance knowledge of the destination location as well as the velocity. The expected zone is defined on the basis of the location and velocity. The smallest rectangle which holds the location of the sender and the expected zone is known as the request zone. The request zone is mentioned by the LAR in the route request message. The request zone however does not hold the information about the node which receives the request message. This results in discarding the packet. The propagation of the route request message is given restricted boundaries due to this which is named as a LAR1 method.



(a) Concepts of request zone and expected zone in LAR **(b)** consideration of route physical distance.

Figure 1.3: Location Aided Routing

The flagging traffic is reduced by the LAR by limiting the scan for another route to a smaller request zone.

1.4.1 Disadvantages of LAR: For the purpose of location tracking as well as navigation, the positioning information of vehicles is used. GPS usage for instance is very commons in cars which helps in providing drivers the required information which helps them to navigate in foreign lands. The military as well as the defence fields also use these systems. The availability of GPS is not present in all the situations or areas. There are chances of errors in the positional information also. It is not mandatory for all the future coming devices to have GPS receivers within them. There will be heterogeneous devices further existing for communication. The location based routing is thus not possible for such situations and the operations will also fail. There will be problems identified in routing due to the positional errors occurring in the network. If the data is routed on the basis of location information only, the communication performance will be affected in terms of signal strength, power life as well as connectivity information. The positional information of the destination node is not pre-existing in the source. All in all, earlier and advance data about the positional data of the destination node may not be promptly accessible at the source.

Chapter 2

REVIEW OF LITERATURE

Literature review contains the literature of all the research papers that are studied to get the complete knowledge about the research topic and to find the research gap. Literature review includes the research papers that are related to various techniques and methods.

M.S.Kakkasageri et al. [1] represent a paper on mobile ad-hoc network define the several challenges due to inherent characteristics of the network for example node mobility, reliability and their scarce resources etc. In this paper define the agent based multicast routing scheme in the (MANETs). It can use the static and mobile agents. Different scheme operates in different sequences like indentifies the reliable nodes and made connection between the reliable nodes. Construct a backbone for multicasting using the reliable nodes and intermediate nodes. There are so many cluster members that join to the backbone network**.** Five types of agents are used in the scheme route manger agent, network initiation agent, network management agent, multicast initiation agent and multicast management agent. In the simulation of this network scenario to test operation effectiveness in term of performance parameters such as packet delivery ratio, control overheads and group reliability. In this paper also compared scheme ABMRS performs better than MAODV. ABMRS offers reliable and adaptable multicast services and also support component based software development.

Rakesh Kumar and Mayank Dav et al. [2] represent a paper based on the VANET vehicular ad-hoc networks in wireless network environment. This is accomplished for the intelligent transportation framework. The applications display in VANET is based upon the data push communication model. Here the data is spread to set the vehicles. There are different sorts of VANET applications and their communication protocol needs a legitimate review on the premise of officially existing reviews. This paper chiefly characterizes the VANET applications in the light of different broadcasting data dissemination protocols. They are reviewed independently and their crucial

qualities are uncovered. Toward the end of this examination of considerable number of conventions is odne and the outcomes are accessed.

Amiour med tahar, Bilami azeddine et al. [3] represent a paper on VANET vehicular ad-hoc network where vehicles like car, bus, truck can be expected as the hubs of the network. As of late, the inter-vehicle communication got to be distinctly expanding a subject of much logical research with the end goal of driver's comfort and safety. The VANETs routing protocol have an awesome outcome as the AODV is standout among the most popular routing protocol and is also dedicated to ad-hoc network. It can utilize the flooding techniques for finding the goals and possibly cause an overhead in the network. To beat this issue, the multi point relay algorithm is utilized as a part of AODV protocol so as to decrease the number of messages communicated during the flooding techniques. In the ns2 simulation conducted using parameters that approximate the reality such as freeway topology, dynamic mobility with high speed and high traffic density. This simulation shows the extended AODV using MPR decrease the heap and performance better than the standard in case of AODVM using MPR reduces the load and perform superior to the standard in event of traffic with low and high speeds.

Rakesh Kumar, Mayank Dave et al. [4] represents a paper on vehicular ad-hoc network is subclass of mobile ad-hoc network which gives a recognized for intelligent transport system (ITS). As per the study it is extremely important to utilize the ITS with the assistance of VANET routing protocol. In paper also investigate the advantage and disadvantages, applications of various routing protocols for vehicular ad-hoc networks. This paper also talks about the inspiration behind the designed and traces the evolution of this routing protocol. Finally this paper likewise demonstrates the tabular comparison with different routing protocols for VANET.

Aswathy M and Tripti et al. [5] that the vehicular ad-hoc networks are special kind of mobile ad-hoc networks (MANETs). This paper defines the vehicles on road as nodes of network. With the help of VANET, there are many applications which are used as an intelligent transportation system. The dynamic network architectures and node movement characteristics differentiate VANETs from other kind of ad-hoc networks. The dynamic change in topology shortens the effective time of routing.

Routing in the VANET is a very challenging task. AODV (ad-hoc on demand distance vector) is mostly used in the topology based routing protocol for VANET. During the process of route discovery process, AODV broadcasts route request message (RREQ). It creates many unused routes between a source and destination node. The main aim of this paper is to improve the performance of AODV by enhancing the existing protocol by creating stable clusters and performing routing by cluster head and gateway nodes.

Muddassar Farooq and Gianni A. Di Caro et al. [6] speak to a paper on properties and survey the principle case of network routing algorithm from base up configuration has been inspired by aggregate conduct of social bugs such as ants and bees. This class of bio-inspired routing algorithms incorporate a generally extensive number of algorithms mostly developed during a year ago and most of the part is inspired by ant colony behaviour. It represent the dominant part of occasion of swarm intelligence algorithm for routing. The attributes acquired by the natural framework of motivation normally engage this algorithm with qualities, for example, autonomy, self-organization, adaptively, robustness and scalability not necessary properties to manage the difficulties of present and upcoming generation networks. In this paper additionally demonstrate the distinct classes of wired and wireless networks for every class talk about the features of ant and bee colony inspired algorithm. This paper also characterizes the different and unmistakable components and examines the general upsides and downsides in relationship to the state of the art.

Patil V.P et al. [7] represent a paper on vehicular ad-hoc network. This is a kind of mobile ad-hoc network where hubs are compelled to move along the road. In the VANET every one of the devices communicates with the assistance of radio devices. The communication is finished with each other and along with the road side units called the base stations. Vehicular networks expect to make the driving knowledge protected, effective and pleasant. Vehicle traffic blockage is reflected as delays while travelling. It additionally has various negative impacts and makes a major problem in the general public. There are such a variety of methods which have been proposed to take care of such an issue. This paper recommends more inventive way to deal with manage this traffic congestion issue. This is finished by utilizing the features of Vehicular Ad-hoc Networks (VANET) as an answer. This framework is produced and

tested by utilizing the AODV protocol on ad-hoc mobile network to manage the issue of vehicle traffic congestion in vehicular network. Traffic congestion can be measured on the patterns for example, packets broadcast, and percentage of packet delivered and percentage of traffic diverted and overhead to deal with the issue of data traffic in the network. The principle simulations demonstrate the domain of vehicle traffic congestion in which VANET is shown.

Jerome Haerri et al. [8] represent a paper on vehicular ad-hoc network (VANET) is a case of MANETs that build up wireless association between all the diverse vehicles. In the VANET routing protocol and other systems must be adjusted to vehicular particular capacities and prerequistics. In the past research routing execution is significantly needed to the accessibility and dependability to the wireless connections, this procedure does not give the precise outcome to measure this issue utilized the VANETs. In the routing algorithm as of now been analyzed and compare in the past simulations and comparison have almost always been done by random motion. But we play out these outcomes on the realistic urban vehicular situations. In his paper we evaluate AODV and OLSR performance in realistic urban situations. This paper likewise concentrated the diverse protocols under the changing measurements. For example, node mobility and vehicle density with different traffic rates. In this paper additionally demonstrate the clustering impacts created by cars aggregating at junctions have remarkable impacts on evaluation and execution measurements. The principle goal is to provide a qualitative evaluation of the applicability of protocols in various vehicular networks.

Reena Dadhich et al.[9] represents a paper in on VANETs vehicular ad-hoc networks have been recently attracting an increasing attention from both research and industry communities. VANET technology is distinguished from mobile ad hoc networks (MANET) and wireless sensor networks (WSN) by large scale deployed autonomous nodes with abundant exterior assisted information, high mobility with an organized with constrained pattern, change in frequency, topology leading to frequent network fragmentation with varying drivers behaviour factors. This paper also introduces the realistic vehicular mobility model and evaluates the performance of following routing protocols: AODV, DSR and TORA. It also introduce the different highway scenarios, characterized by the mobility, load and size of the network also be

simulated. Result indicates that the reactive routing protocol performance which is suitable for VANET scenarios in term of packet delivery ratio, routing load and end to end delay.

Jason J. Haas and Yih-Chun Hu et al.[10] represent a paper based on the performance measurements obtained from simulations of the (VANETs) vehicular ad-hoc networks. These simulations use as input traces of vehicle movements that have been generated by traffic simulators which is based on the traffic model theory. In this paper mainly work based on the actual large scale recordings of vehicle movements. To our knowledge, no one has published any work on actual large scale recording of vehicle movements. In order to enable analysis on this scale, we have developed a new VANET simulator which handles more vehicle than ns2. To enable us simulator and present results of cross validation between ns2 and our simulator showing the both simulation produce result that are statistically the same. This simulator use to analyze the proposed authentication mechanism, which relies on ECDSA signatures comparing it to broadcast authentication using TESLA. In this paper perform our evaluations using real vehicle mobility. Our comparison shows its strength and weakness for each of these authentication schemes in terms of the resulting reception rates and latency of broadcast packets.

Josiane Nzouonta, Neeraj Rajgure et al. [11] represents a paper based on routing protocols called RBVT, road based using vehicular traffic information routing which is based on the existing routing protocol in city based vehicular ad-hoc networks (VANETs). RBVT protocols leverage real time traffic information to create road based paths consisting of successions of road intersection and high probability, network connectivity among all the systems. In this paper use the geographical forwarding is used to send the packets between intersection paths, reducing the sensitivity within the paths to individual node movements. In the dense network high contention and optimize the forwarding using a distributed receiver based election of next hops, it is based on the multi-criteria prioritization function taking into account non-uniform radio propagation. This paper designs the reactive protocol RBVT-R and proactive protocol RBVT-P and compared them against Manet's protocols like AODV, OLSR, and GPRS. Other protocol representative is like VANET. In the simulation result shows that in the urban settings shows that RBVT-R protocol best in

term of delivery rate, with up to 40% increase compared to some existing protocols. In the protocol terms of average delay, RBVT-P performs best and 85% decreased as compared to other protocols.

Vishnu Kumar Sharmal and Dr. Sarita Singh Bhadauria et al. [12] represent a paper on power control in mobile ad-hoc network connectivity and avoid network partition and also provide power efficient operations. In this paper purpose congestion and power control techniques based on agent in mobile ad-hoc network. The mobile agent from source starts forwarding the data packets through the path which has minimum cost and congestion. The status of every node is composed and finally it is delivered to destination node. In the power control method all the nodes select the nodes based on the power level. The node with maximum energy level are select as listening node, it is always on active mode on the other hand non listening node which awake in periodic manner. If the nodes getting the data packet is not wakeful after packet sent to destination through the listening node. In the simulation result show the projected techniques provides most proficient congestion and power controls.

Salim M.Zaki et al. [13] represent a paper on location based service is used in vehicular ad-hoc network to locate node position before the start of any communication. The existing location services proposed for VANET do not distribute the load on multi servers and some of do not consider stable nodes for selecting location servers. In the paper use the grey model of accuracy to define nodes locations is affected by the nodes acceleration in the VANET. In this paper purpose the technique of vehicular quorum prediction based on location service protocol which was mainly designed for urban area topology and which utilized nodes information such as distance to intersection centre point and speed in selecting stable location servers. Formation of quorum of location servers was done by main location server by nominating some other nodes located at the intersection based on their moving directions. It is used for distribute the load on multi servers and fault tolerance. Hybrid of grey prediction model and alpha beta gamma filter was adopted in the VQPLS to accurately predict the next position of nodes that were moving away from the intersection. GP-ABGF mitigated effects of VANET nodes acceleration and irregular update time interval on gray prediction model accuracy. Prediction algorithm also filtered the noise data and produced accurate location of destination and

overcome the problem of outdated location with other protocols in reducing overhead of control packets and high delivery of packets to destination and it reduce the end to end delay for routing packets.

Bilal Mustafa Umar Raja et al. [14] Vehicular ad-hoc network (VANET) is a other class of mobile ad-hoc network provide wireless communication between the different vehicle and also provide communication vehicle to road side equipments. The communication channel between the vehicles is used for safety, comfort and for entertainment purpose. Mainly the communication between the vehicles depends upon the how better the routing takes place in the network. Routing of data depends on the routing protocols being used in network. In this paper also study the different ad-hoc routing protocols for VANET. The main aim of this paper to identify which ad-hoc routing method has better performance in highly mobile environment of VANET. To measure the performance of routing protocol in VANET considers two different scenarios like city and highway. The selected protocols were evaluated through simulation in term of performance metrics for example throughput and packet drop. In the simulation of this paper use the MATLAB to plot the graphs to compare the results of selected routing protocols with each other. After all compute the output from each scenario to clearly present the difference in results. In the result shows that better performance in form of high throughput and low packet drop as compare to AODV and GPSR in the city environment while GPRS show better performance as compared to AODV in both highway and city environment of VANET. Based on the results of performance metrics in different environment of VANET, position based routing method of VANET outperformed the traditional ad-hoc topology based routing. However, it is hard to provide any universal routing protocol that can deal with all the various environments of VANET. The selection of single routing protocol is hard in VANET because the protocol performance depends on vehicle speed, driving environment etc. That may vary from one environment to network to another.

Jonathan Ledy, Herve Boeglen et al. [15] represents a paper on V-AODV a version of AODV (ad-hoc on demand distance vector) especially created for vehicular ad-hoc networks (VANETs). In the V-AODV is designed for complex cross layered metric based on delay from node to node and bit error rate coming from the physical layer. This paper implemented on the ns2 simulator taking in account a realistic

environment tool called communication ray tracer. In the results of this papers shows that basic propagation models not suitable in ns2 because it not more suitable for VANET. This paper show that using the routing metric based on delay and BER the first parameter is more relevant in terms of QoS.

Cristina Rico Garcia, Andreas Lehner et al. [16] represents a paper on efficient design and reliable broadcast MAC layers for wireless mobile ad-hoc networks (MANET) especially high user speeds are allowed is a current challenge. Despite the absence of infrastructure would permit channel allocation, awareness techniques allow a certain channel assignment. In this paper design the MAC layer protocol designed for broadcast MANETs called COMB cell based orientation- aware MANET Broadcast. In the technique of COMB allow the realization of collision free transmission, high speed is supported and no handshake is required. COMB is based on the localization aware cross layer dimensioned CDMA cell and it use the SOTDMA protocol as intra cell scheme.

Jamal Toutouh, Jose Garcia-Nieto et al. [17] represents a paper on advance technologies gave rise to the emergence of vehicular ad hoc networks (VANETs)**.** In this type of scenarios has limited coverage of Wi-Fi and high mobility of nodes generated frequent topology with the changes and fragmentations? For this reason there is no central manager entity, routing packets through the network is challenging task. Therefore, efficient routing strategy is crucial to deploy VANETs. This work deals with optimal parameter setting the OLSR a well known mobile ad-hoc network routing protocol, by defining an optimization problem. This way, a series of representative Meta heuristic algorithms are studied in this article in order to find automatically optimal configurations of this routing protocol. On other side realistic VANET scenarios have been defined to accurately evaluate the performance of the network under our automatically optimized OLSR. In the experiment define OLSR configurations result in better QoS than the standard then several human experts making it amenable for utilization in VANETs configurations.

Shetali Zeadally, Ray Hunt et al. [18] represents a paper on recent advances in hardware, software and communication technologies are enabling the design and implementation of a whole range of different type of networks that are being deployed

in various environment. VANET is latest area of research where define the standardization and development because it has tremendous potential to improve vehicle and road safety, traffic efficiency and convenience as well as comfort to both drivers and passengers. In the recent research efforts have placed a strong emphasis on novel VANET design architecture and implementation. A lot of research on VANET has focused on specific area including routing, broadcasting, quality of service (QoS) and security. Some of recent research result in wireless access standards for VANETs and describe some of the recent VANET trials and deployments in the US and Japan. In this paper simulation of VANET brief define the some benefits and limitations. Finally outline some of VANET research challenges that still need to be addressed to enable the deployment and widespread adoption of scalable, reliable, robust and secure VANET architecture, protocols, technologies and services.

Josiane Nzouonta, Neeraj Rajgure et al. [19] represents a paper on classes of routing protocols which is used in VANET it also called the road based using vehicular traffic routing. In this paper use the scenario which is based on the road paths consisting of successions of road intersections that have with high probability network connectivity among them. Geographical forwarding is used to transfer packets between intersection on the path and reducing the path sensitivity to individual node movements. In the network with high concentration optimize the forwarding using a distributed recover-based election of next hops based on the multi criterion prioritization function that takes non uniform propagation into account. According to this paper designed and implemented reactive protocols RBVT-P and compare them with protocol representative of mobile ad-hoc networks and VANETs. In the simulation of urban setting show up to a 40% increase compared with some existing protocols. In terms of average delay, RBVT-P performs best with a as an 85% decrease compared with the other protocols.

Yoshitaka Ohtaki et al. [20] represents a paper ant based routing algorithm. In this paper describe the researchers because they are more robust, reliable and scalable than other conventional routing algorithm. In this protocol do not involve extra message exchanges to maintain paths when network topology changes they are more suitable for mobile ad-hoc network where all the nodes moves dynamically and topology

changes frequently. Assume the number of nodes increase also increases in the number of nodes. In the existing algorithm have poor scalability. In this paper purpose scalable ant based routing algorithm that keeps the overhead low while keeping paths short. In the algorithm using the multistep time to live scheme is an effective message migration scheme and efficient scheme foe updating the probability of packet forwarding. In the experiment of simulation confirmed that proposed algorithm can establish shorter paths then the conventional ant based algorithm with the same signalling overhead.

Young-Bae Ko and Nitin H. Vaidya et al. [21] introduced a mobile ad hoc network consists of wireless hosts that may move often. Movement of hosts results in a change in routes, requiring some mechanism for determining new routes. Several routing protocols have already been proposed for ad hoc networks. This paper suggests an approach to utilize location information (for instance, obtained using the global positioning system) to improve performance of routing protocols for ad hoc networks. By using location information, the proposed Location-Aided Routing (LAR) protocols limit the search for a new route to a smaller "request zone" of the ad hoc network. This results in a significant reduction in the number of routing messages. We present two algorithms to determine the request zone, and also suggest potential optimizations to our algorithms.

Mohammad A. Mikki et al. [22] introduces a Mobile Ad-Hoc Network (MANET) is a collection of wireless mobile nodes forming a temporary network without using any centralized access point, infrastructure, and centralized administration. In this paper we introduce an Energy Efficient Location Aided Routing (EELAR) Protocol for MANETs that is based on the Location Aided Routing (LAR). EELAR makes significant reduction in the energy consumption of the mobile nodes batteries by limiting the area of discovering a new route to a smaller zone. Thus, a control packet overhead is significantly reduced. In EELAR a reference wireless base station is used and the network's circular area centred at the base station is divided into six equal sub-areas. At route discovery instead of flooding control packets to the whole network area, they are flooded to only the sub-area of the destination mobile node. The base station stores locations of the mobile nodes in a position table. To show the efficiency of the proposed protocol they present simulations using NS-2. Simulation results

show that EELAR protocol makes an improvement in control packet overhead and delivery ratio compared to AODV, LAR, and DSR protocols.

Weiwei Dong et al. [23] displayed that Vehicular ad hoc network (VANET) is encountering the frequent connection breakage and low packet delivery rate, which challenges routing protocols. To deal with this problem, a Geographic Opportunistic Routing protocol based on Link state and forwarding quality inside nodes (LF-GOR) is proposed. Initially the technique to puts forward a hybrid approach of filtering and prioritizing to decide a candidate nodes set of the sending node in LFGOR, which considers position data as well as link state and node's forwarding quality thoroughly. In the light of candidate nodes set, a flexible opportunistic forwarding strategy is intended to include numerous neighbours of the sending node into the local forwarding. Consequently, LF-GOR enhances the quality and reliability of transmission, and lessens the end-to-end delay brought by the timer-based scheduling mode of various ordinary opportunistic routing protocols. At long last, a corelation between LF-GOR and existing protocols is exhibited in the simulation. Relating comes out exhibit that LF-GOR has the higher packet delivery rate and throughput, as well as the acceptable delay. LF-GOR enhances the transmission reliability and lessens the delay. The simulation comes about additionally with the result that in a highly dynamic network, the packet delivery rate of LF-GOR is 12% higher, the throughput is 1.8kbps higher and the end-to-end delay is 0.029s lower than that of GyTAR.

Daxin Tian et al. [24] suggested that epidemic routing has developed as a promising candidate for giving message dissemination technique in vehicular ad hoc networks. In this paper, a novel model is displayed to access the limit of epidemic routing in vehicular networks with considering the traffic signal control as a huge and important factor in urban territory. The survey uncovers that epidemic routing can act diversely in various traffic signal control situations, where messages can be sent by vehicles crossing through the junctions from various bearings and directions. The simulation comes about demonstrate the exactness of the model. In this paper, a novel model is proposed to access the limit of epidemic routing in sparse urban vehicular networks where the traffic lights in the crossing points are considered. The strategies individually investigate the delay cost in road sections and crossing points. The

logical outcome and simulation result demonstrate the exactness of the model. Additionally, the dynamic programming algorithm is received when an attempt is made to access the limit of epidemic routing in the entire networks. Using this algorithm one can gather that the speediest path and the entire delay with input distinctive unique parameters, for instance, the length of road sections L, the duration of light cycle T, and so forth.

Nikita Mangla et al. [25] suggested that Vehicular Ad hoc Networks (VA NETs) permit the vehicles to outline a self-sorted network without the necessity for a lasting foundation. Routing in VANETs is a very undertaking task as a result of the high mobility and high density of mobile nodes. Position-based routing protocols, which are for the most part based on greedy routing, are more suited to highly dynamic and mobile network. A convergence of the scientific mainstream researchers is to configure network oriented position-based routing protocols, and this has brought about in a high number of algorithms, distinctive in approach and executed and each suited just to specific applications. In spite of the fact that there are many, however very few positions based algorithms have really been embraced for business purposes. In this paper, the paper reviews conditions of art position based routing protocols beforehand used as a part of VANETs, present open research difficulties and conceivable future course. The paper additionally sketched out the guidelines issues which must be solved for this class of routing protocols and even presented the answer for the specific problem. The paper will also present an algorithm for position based routing at Road Intersection in VANETs. The protocols are also compared with respect to the next proposed routing protocols and accordingly aim at implementing the following characteristics that are obstacle awareness, street awareness, no bottleneck and no full path selection.

Thomas Paulin et al. [26] presented that In contention-based algorithms this next neighbor selection is distributed, where potential next hop candidates delay their forwarding attempt in a way that the candidate with the largest progress to the goal forwards the message first; different candidates cancel their scheduled retransmissions then. This novel principle unfortunately, depends on a consistent timing and the absence of transmission failures, which can't be expected in vehicular networks based on IEEE 802.11. This paper illustrates how the re-requesting of channel get to

attempts through the 802.11 MAC layer and the transmission errors brought about by frame collisions affect delivery rate and communication overhead. A counter-intuitive finding is that the delivery rate of contention-based forwarding increases under fading conditions (i.e. higher frame errors), however at the cost of packet duplication and in this way higher overhead. Without fading, duplication is low, yet more end-to-end delivery failures happen. In this paper, the reasons for this behavior analytically are explained and illustrated it in simulations. Besides, a randomized contention-based routing algorithm is proposed that balances the trade-off between high end-to-end delivery and low overhead superior to the deterministic algorithm and demonstrates a significant performance increase independent of whether fading or frame collisions are present.

Antonio Fonseca et al. [27] recommended that in the most recent years many routing protocols proposals have been made considering the specific VANET features. From the various propositions that surfaced, the protocols based on the vehicles positions were seen to be the most satisfactory to VANETs on account of their versatility to taking care of node positions variety. In this audit the existing position-based routing protocols will be overviewed. Not at all the distinctive reviews the technique will emphasize on their appropriateness to various situations. The strategy begins by portraying the vehicular network environment, in particular the urban and the highway situations. From that point, topology based protocols are contrasted with position-based protocols and to the last diversely used methods and their execution are subjectively accessed to various measurements. The diverse position-based routing proposals recommendations are depicted including a pseudo-code specification, and a comparison is made in light of alternate points of view. To finish up, the essential compels to urban and highway situations are portrayed and the versatility of each protocol to each of the situation is assessed.

Fan Li et al. [28] recommended that the Vehicular Ad Hoc Network (VANET) is a rising new innovation incorporating ad hoc network, wireless LAN (WLAN) and cellular technology to fulfill intelligent inter-vehicle communications and enhance the road traffic security and proficiency. VANETs are recognanized from various types of ad hoc networks by their hybrid network architectures, node movement characteristics, and new application circumstances. Subsequently, VANETs represent

various extraordinary networking research challenges, and the outline of an successful routing protocol for VANETs is great degree essential. In this article, the research challenge of routing in VANETs and study recent routing protocols and related mobility models for VANETs. In spite of the fact that routing in VANETs has gotten expanding consideration in the wireless network community recently as a relatively new region, there are still a large number of difficulties that have not been precisely explored. For instance, security is likewise an significant problem for routing in VANETs, because various applications will influence crucial choices and illegal altering can have destroying outcomes. The qualities of VANETs make the safe routing issue more difficult and novel than it is in other communication networks.

Kevin C. Leey et al. [29] proposed a couple of improvements for instance, GPCR which uses the idea of intersection nodes to control the next road segments that packets should follow. The idea of intersection nodes itself is likewise dangerous to keep up in an dynamic urban environment. In this paper, GpsrJ+ is depicted that further enhances the packet delivery ratio of GPCR with negligible change by predicting which road segment its neighboring intersection node will forward packets onto. GpsrJ+ varies from GPCR in that choices about which road segment to return which require not to be made by intersection hubs. Additionally, GpsrJ+ does not need an costly planarization technique since it uses the regular planar element of urban maps. Therefore, GpsrJ+ lessens the hop count used a part of the edge mode by as much as 200% compared to GPSR. It in this way permit geographic routing arrangements to come back to the greedy mode quicker. Future works envelope the three regions. Initially is the arrangement to develop GpsrJ+ with the objective that it can make expectations past one intersection. Second, to enhance the delivery ratio advance, one arrangement to fuse the expectation in the greedy mode and moreover in the border mode by detecting if the furthest node of the junction node lies on a same road segment as the furthest node of the present forwarding hub. Third, one arrangement to run GpsrJ+ on sensible and realistic city maps that are really grids. Realistic roads follow a more unpredictable direction; along these lines, a straightforward line direction condition won’t be adequate to characterize a road segment.

Mohamed Nabil and Abdelmajid Hajami et al. [30] proposed that VANET is a vehicular ad hoc network on highway with high dynamicity of the network. This high dynamicity occurs due to the changing lane and the overtaking of vehicles over each other. They observed that for any position based routing protocol, global topology information is not required. It uses only the local information of nodes that within the transmission range of any forwarding node. Due to this restriction, it gives the low overhead of their creation and maintenance. The local information about the physical location of the nodes can be provided by the global positioning system, if vehicular nodes are equipped with the GPS receiver. Therefore the absolute geographic positions of the vehicles vary continuously as well as their relative positions, because the vehicles do not travel all at the same speed and at the same direction movement. In this paper, they adapt the location aided routing protocol for inter vehicle communication in as highway environment. In this paper, they improved the LAR protocol in a way to increase the lifetime of route between the source and destination. The intelligent driver model with lane changing (IDM_LC) based on VanetMobiSim tool is used to generate the realistic mobility traces.

Chapter 3

PRESENT WORK

This chapter deals with how the problem is formulated, which research methodology we will apply to get the desired output. The main objectives of the study are also discussed in this chapter.

3.1 PROBLEM FORMULATION:

The vehicular ad hoc network is the self configuring type of network in which vehicle to vehicle and vehicle to infrastructure type of communication is available. The most common type of communication is V2V communication which to inform the vehicles about the current traffic conditions in the area. The mainly problem exists in this type of communication because the network topology can change in small amount of time. Due to fast network topology change and increase of node density in the area, the delay will be increased in the V2V communication. To reduce delay in the network, the enhancement will be proposed in traditional AODV protocol. The IAODV protocol is the enhancement in the AODV protocol and IAODV protocol is based on backup path concept. The IAODV reduce chances of link failure and reduce delay in the network. In this work, we will further enhance IAODV protocol to reduce delay in the network. The enhancement will be based on location aided routing in VANET.

3.2 OBJECTIVES:

1. To study and analyze various routing protocols for V2V routing in VANET

2. To establish the best path from source to destination based on root node selection in the network through multicasting

3. To propose existing LAR algorithm and improved LAR technique and compare results in terms of various parameters

4. To propose enhancement in AODV protocol to reduce delay and packet loss in V2V communication in results of higher throughput

3.3 Research Methodology:

In the vehicular ad hoc network, vehicle to vehicle and vehicle to infrastructure communication is available for communication. To vehicle to vehicle communication is available to exchange important information between vehicles. To establish path between various vehicles various routing protocols had been proposed which are of reactive and proactive type. The reactive routing protocols had remarkable performance in VANETS which use the broadcasting technique for path establishment. The broadcasting technique will increase delay in the network and network resource consumption increase at steady rate. To reduce delay in the network, the technique of multicasting had been proposed. The following are various assumptions of the proposed technique

1. The network will be deployed with the fixed number of nodes and roads structure already defined
2. Every node are responsible to maintain the table of its adjacent nodes
3. Some nodes in the network are predefined as root nodes for multicasting nodes

In the proposed technique, in the whole network we define some nodes which are root nodes, under these root nodes we will defines the leaf nodes.

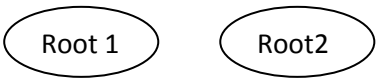


Figure 3.1: Root node define in the network

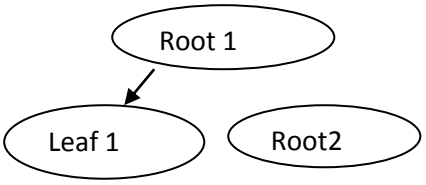


Figure 3.2: New node join the network

The leaf node comes under which root that will be decided by prediction based technique for multicasting. The new node that join the network comes under the root node 1 on the basis of distance and time formula using the predication based

technique. Let us suppose the leaf node moves and comes in the range of root node 2 and then leaf node 1 will join the root node 2. The leaf node will come under which root node it will be decided on the basis of distance formula. The threshold distance will be defined when distance will be greater the threshold value, then handoff takes place.

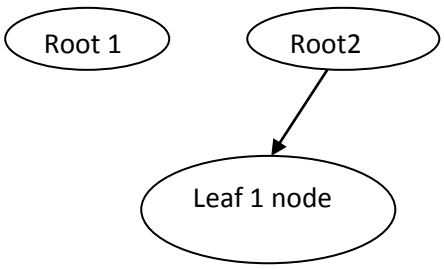


Figure 3.3: Leaf node join the root2

The Root nodes are responsible to maintain the tree on the basis of distance between the nodes. The root nodes can maintain routing table and in this routing table information about their leaf nodes are stored. The root nodes can send the stored information to RSU's and before requesting for the path to destination.

The source node communicates with the RSU and RSU give information about the leaf node for path establishment. The source node send route request packets to only those root nodes, which have access to desired leaf node

3.3.1 Algorithm For the optimal Path

Set M Mobile Node's

Set S sender and R receiver

Node Routing = AODV

Set Route

{

If (route from S to R found)

{

Check number of route;

If (route => 1) //means alternative route exist in network

{

Search nearest neighbouring nodes

Establish path through root nodes

Send route acknowledge of route establishment through root node

}

Else {root unreachable}

}

{

New root node formation;

{

Source node start sending data to destination through root node

{

Increment-Q;

Store incoming data;

}

Receiver receives data from I node;

Send ACK to sender S;

}

}

}

That was the algorithm which gives us the idea that how the path establishment should be done. This gives us the information that how new nodes are set or moves. This is done on the basis of distance and velocity.

3.3.2 Flowchart:

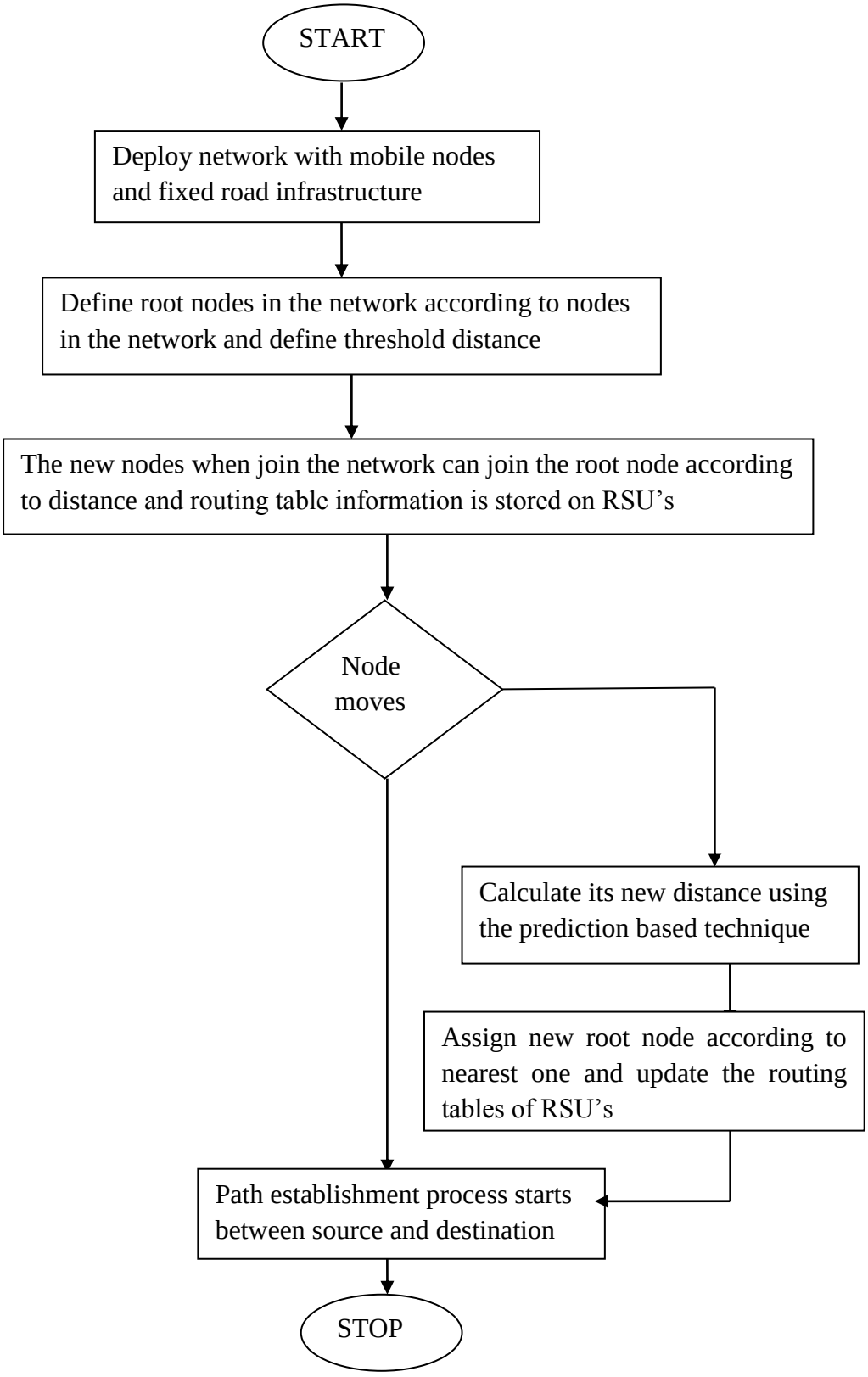


Figure 3.4: Work flow diagram

Chapter 4

RESULTS AND DISCUSSION

This Chapter deals with the final results of the proposed technique and comparison between proposed and existing technique.

4.1 Tool Used: The simulation is the technique which is applied to analyze the performance of the model which you have developed when actually it is implemented in the real time environment. The simulators are of two type, the first type of event based simulator and second type is time based simulators. The network simulator version two is the event based simulator in which created events are trigger on the defined amount of time. The Network simulator is the simulator which is used to simulate the network models. The network simulator has various version and latest version is NS2-2.35 which is best compatible with ubuntu 12.04. The networks simulator version 2 is the linux based simulator which run on various of linux like fedora, red hat etc. The Ns2 is the complex architecture in which tool commands language is used for the front end and for the backend C++ is used as programming language. The performance analysis tools are used with Ns2 and these tools are xgraph, ngraphs etc. The tool command language and C++ when used parallel it is called object oriented tool commands language. The NS2 is the only simulator which provides both type of text based and animation based simulation. When the object oriented language is executed it gave two outputs, the first output is the .tr file which is called trace file in which output of text based simulation is saved, and second file is .nam file which provides animation based simulation. The xgraph tool takes the input of the trace files and generates the line graphs through which we can analyze network performance in terms of throughput, delay, bandwidth consumption etc. To analyze the network performance C++ scripts are created and main trace file is given as input which gave numeric results in terms of throughput, delay, bandwidth consumption etc. The NS2 is the widely used simulator because it is the only simulator which provides both type of text based and animation based simulations.

4.2 Experimental Results:

Here are some pictures that show us how the network is deployed and how nodes moves and communicate with each other.

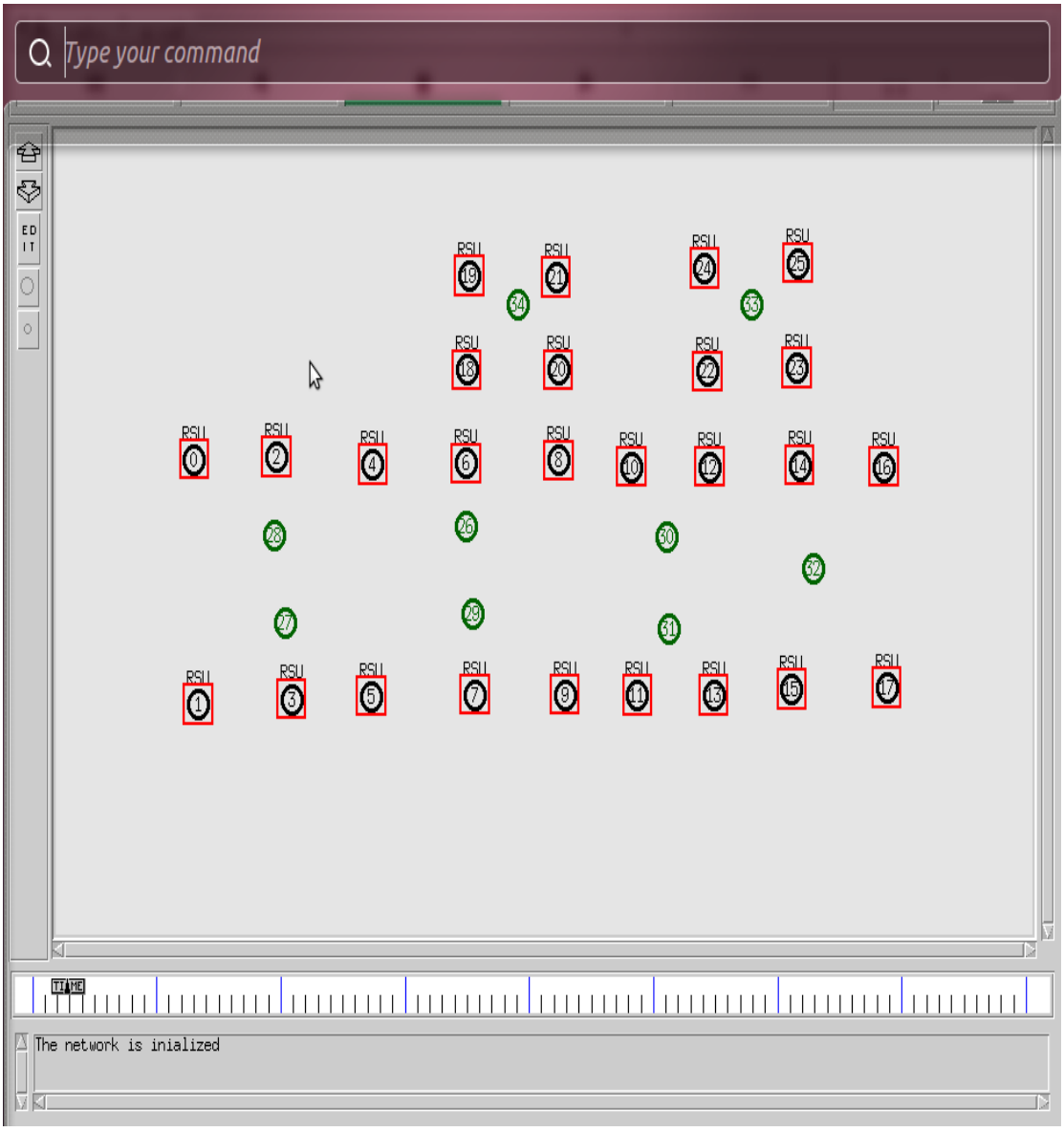


Figure 4.1: Deploying the network

As illustrated in the figure, a finite number of sensor nodes are placed in the vehicular ad hoc network. Also, there is a presence of finite number of vehicles in this network.

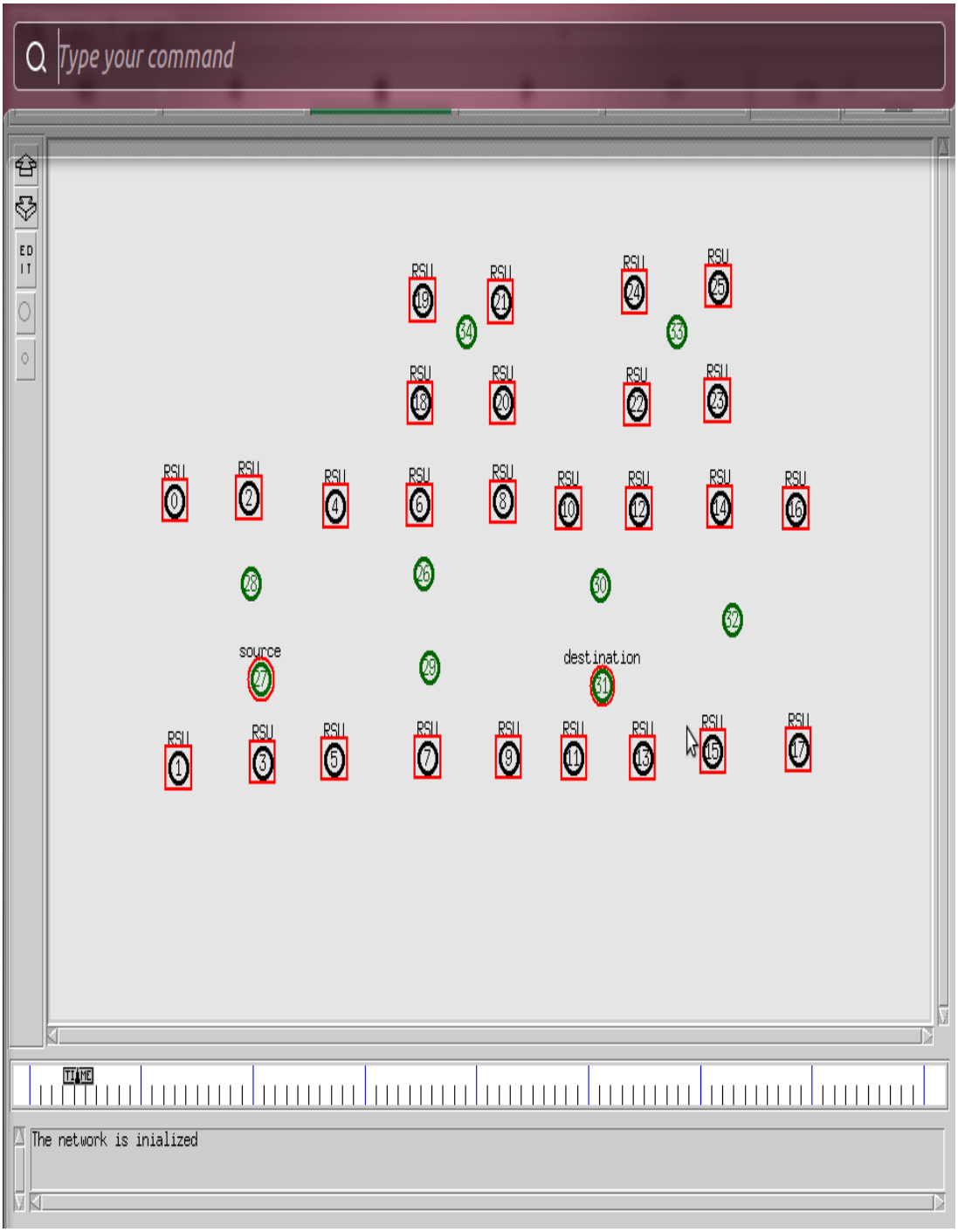


Figure 4.2: Declare the source and destination nodes

As shown in the figure, vehicle to vehicle communication is seen in the network. Another type of communication seen in this network is the vehicle to road side units. In the vehicle to vehicle communication, the source as well as the destination nodes is defined.

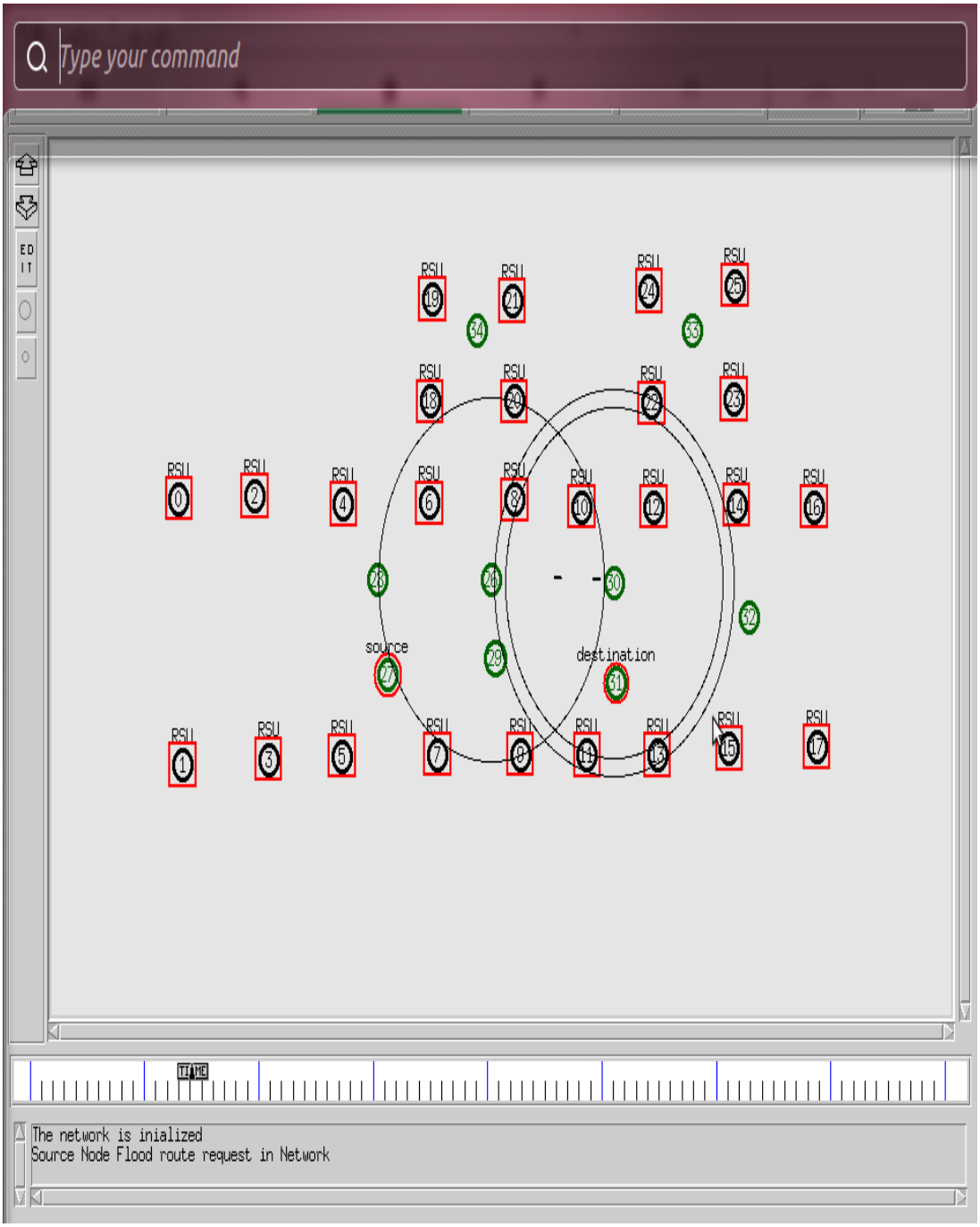


Figure 4.3: Route request packet flooding

As shown in the figure, there is the beginning of the establishment process. The route request packets are flooded by the source node present in the network. The reply is received from the adjacent nodes which are in direct range of the destination. The reply is sent to the destination using the route reply packets.

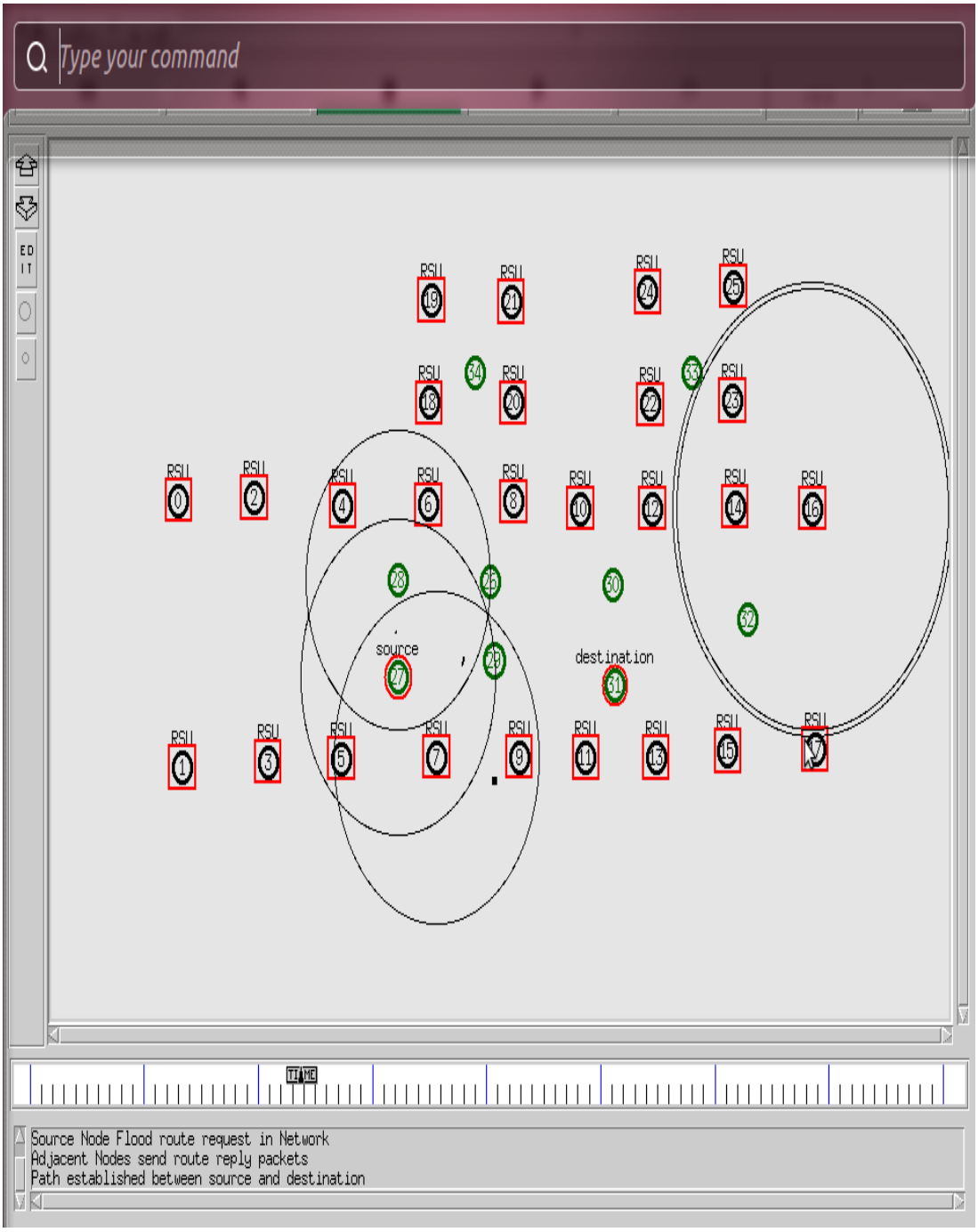


Figure 4.4: Request reply for packets

As illustrated in the figure, the source nodes as well as the destination node are defined in the network. The route request packets are flood by the source node for the establishment of path to the destination. The reply is sent back with the route reply packets by the adjacent nodes present with the destination.

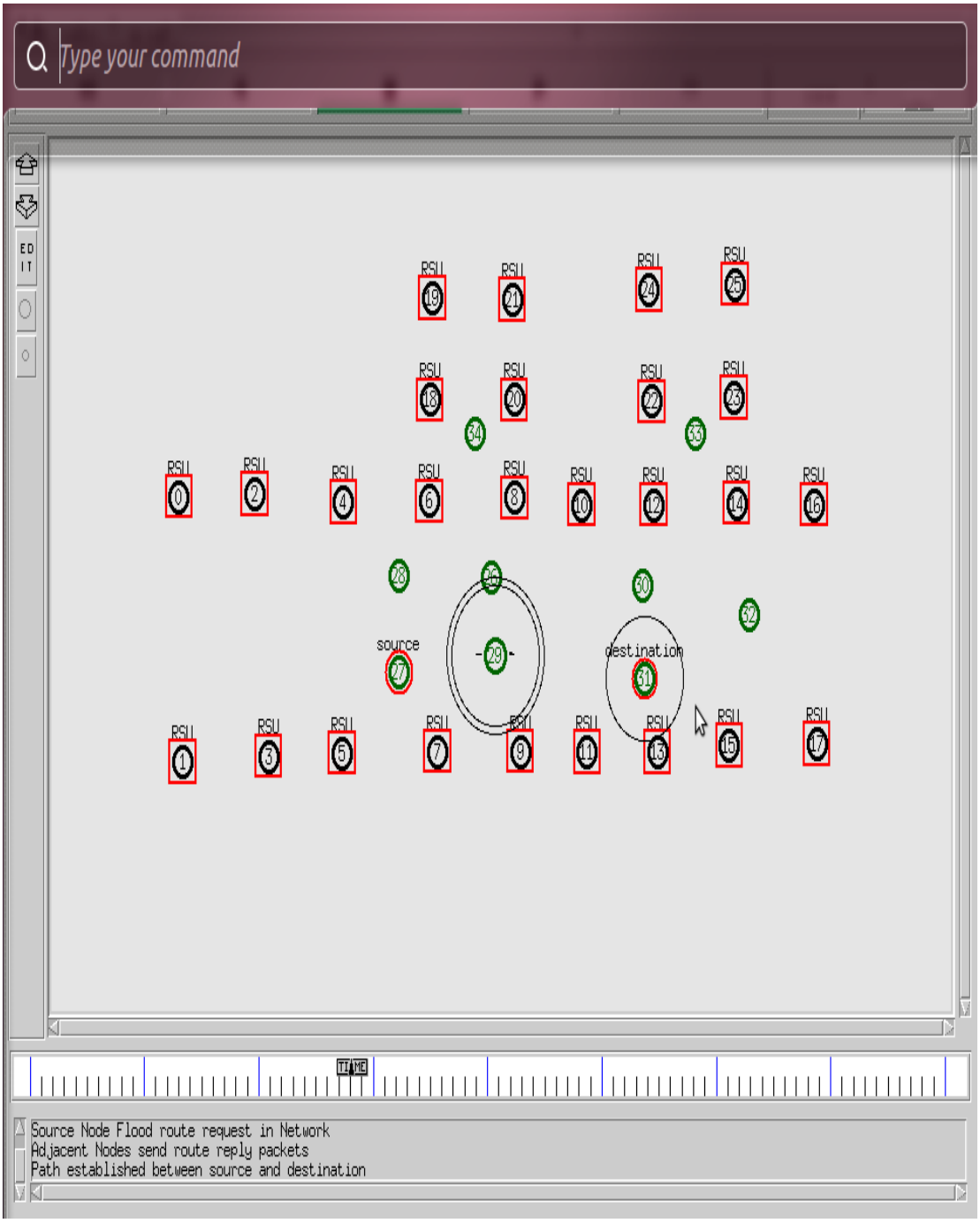


Figure 4.5: Beginning of communication

As shown in the figure, the network defines the source and destination nodes. The path establishment is done by the reactive routing protocol to the destination. The source node begins sending data packets to the destination when there is an availability of the shortest and reliable path in the network.

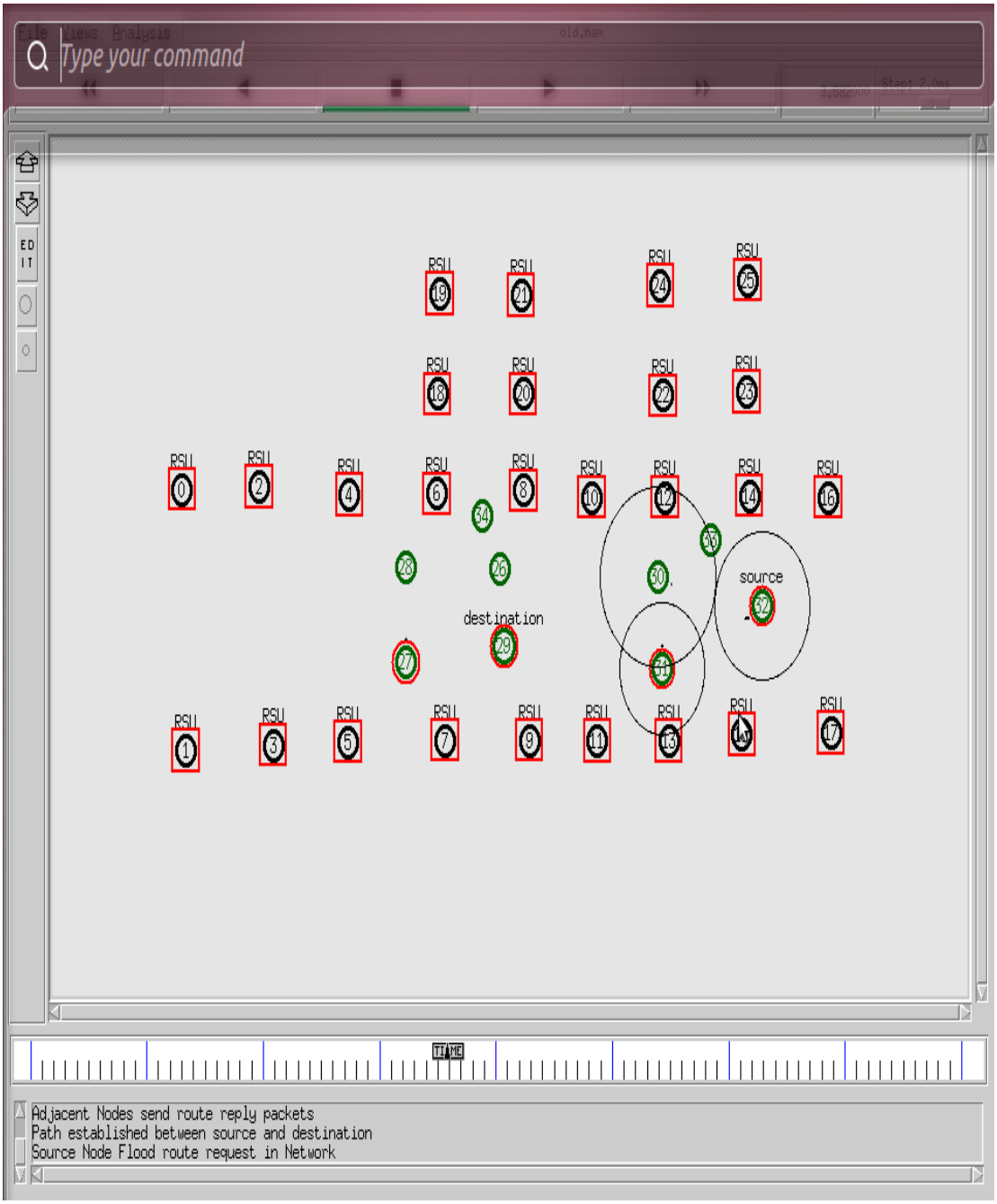


Figure 4.6: Continuation in communication

As shown in the figure, the network defines the source and destination nodes. The path establishment is done by the reactive routing protocol to the destination. The mobility of the vehicular adhoc nodes is higher in this network and the source as well destination nodes continue the communication while moving.

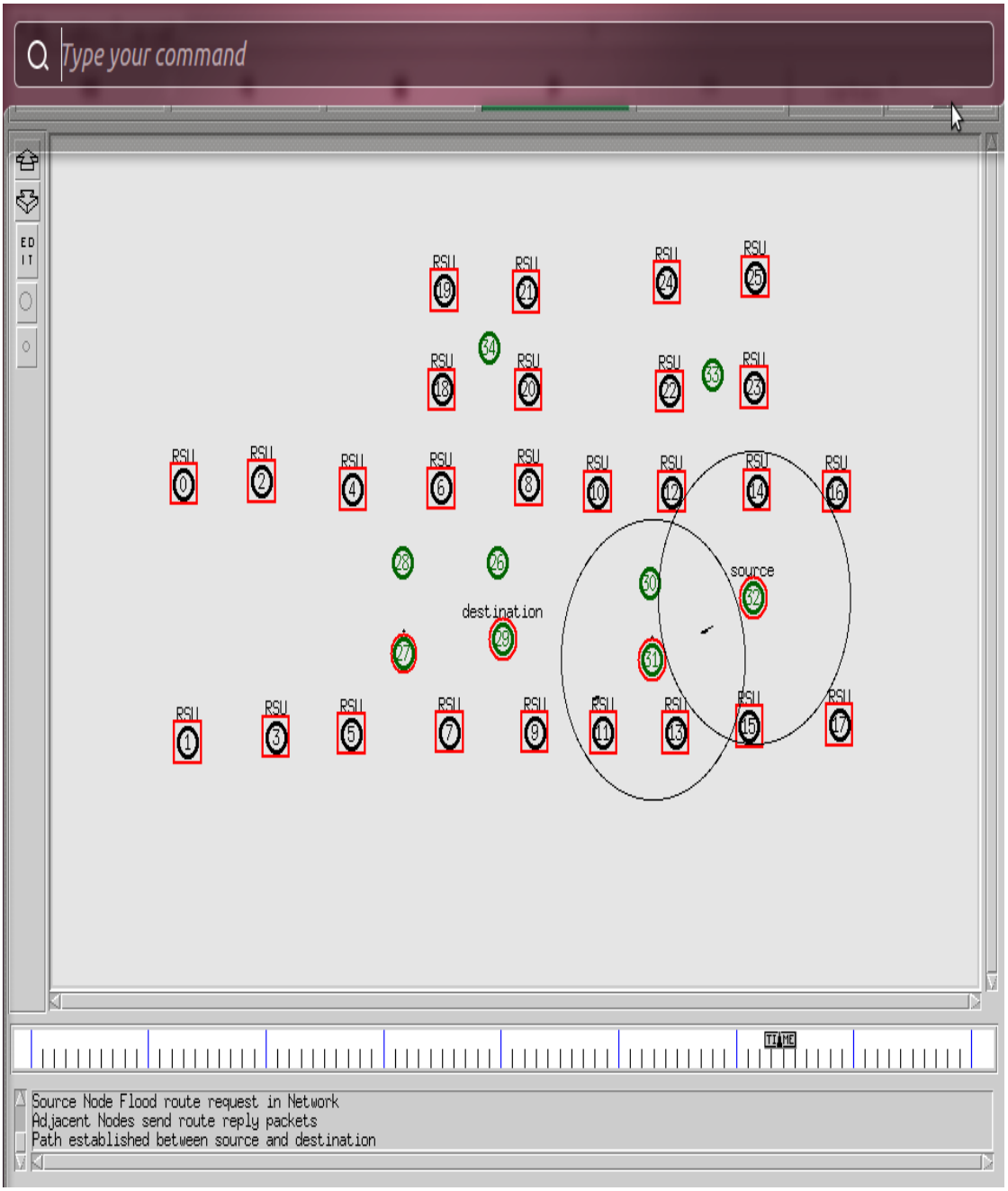


Figure 4.7: Change in source and destination

As shown in the figure, the source nodes as well as the destination node are defined in the network. The route request packets are flood by the source node for the establishment of path to the destination. The reply is sent back with the route reply packets by the adjacent nodes present with the destination. The hop count and sequence number are used to define the shortest path in between the source and the destination.

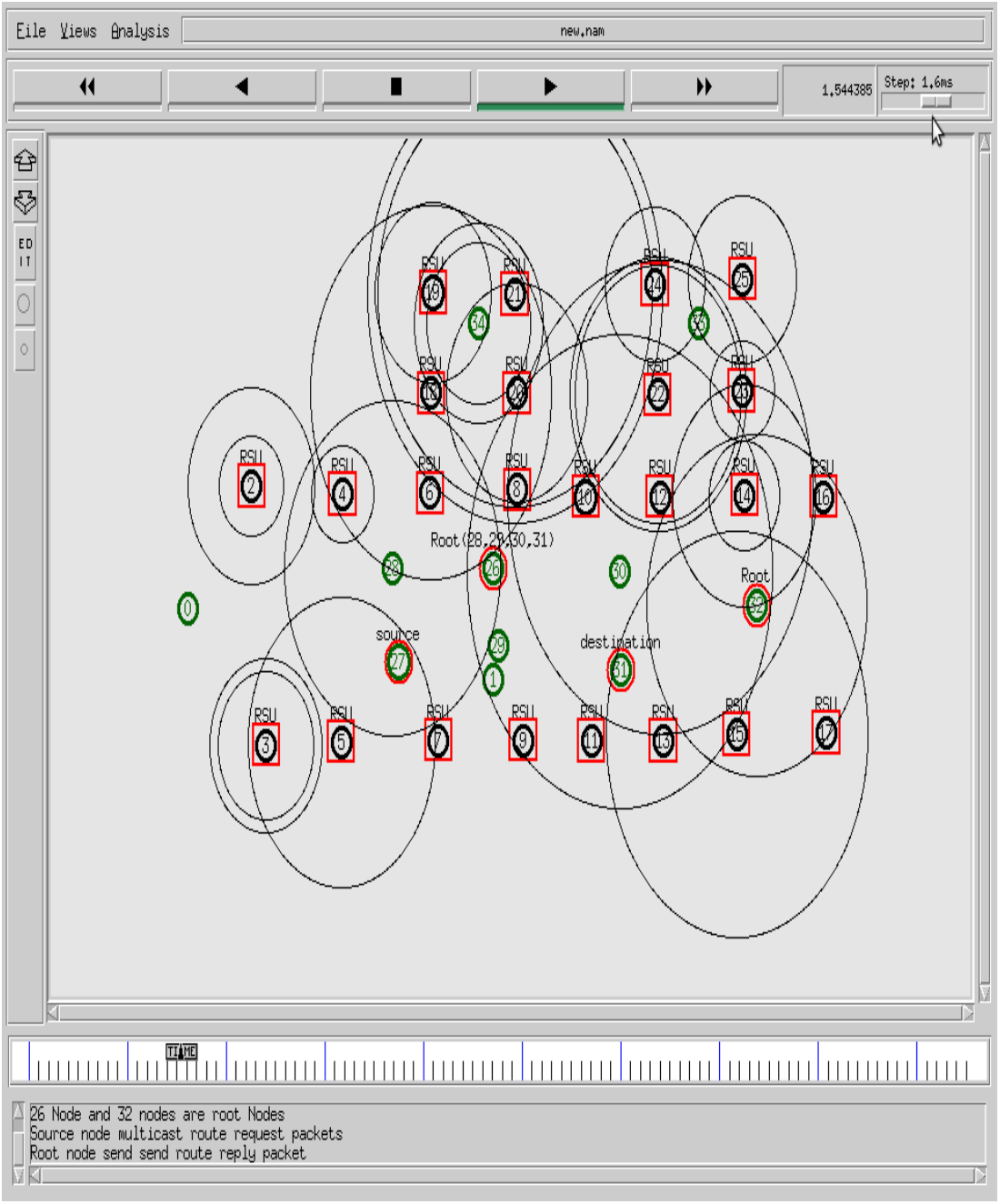


Figure 4.8: Defining the network

As shown in the figure, in the network the source and destination nodes are defined. There are some root nodes present in the proposed technique. They are responsible for establishing the path in between the source and destination. There are leaf nodes present along with the root node which are identified as 28, 29, 30 and 31.

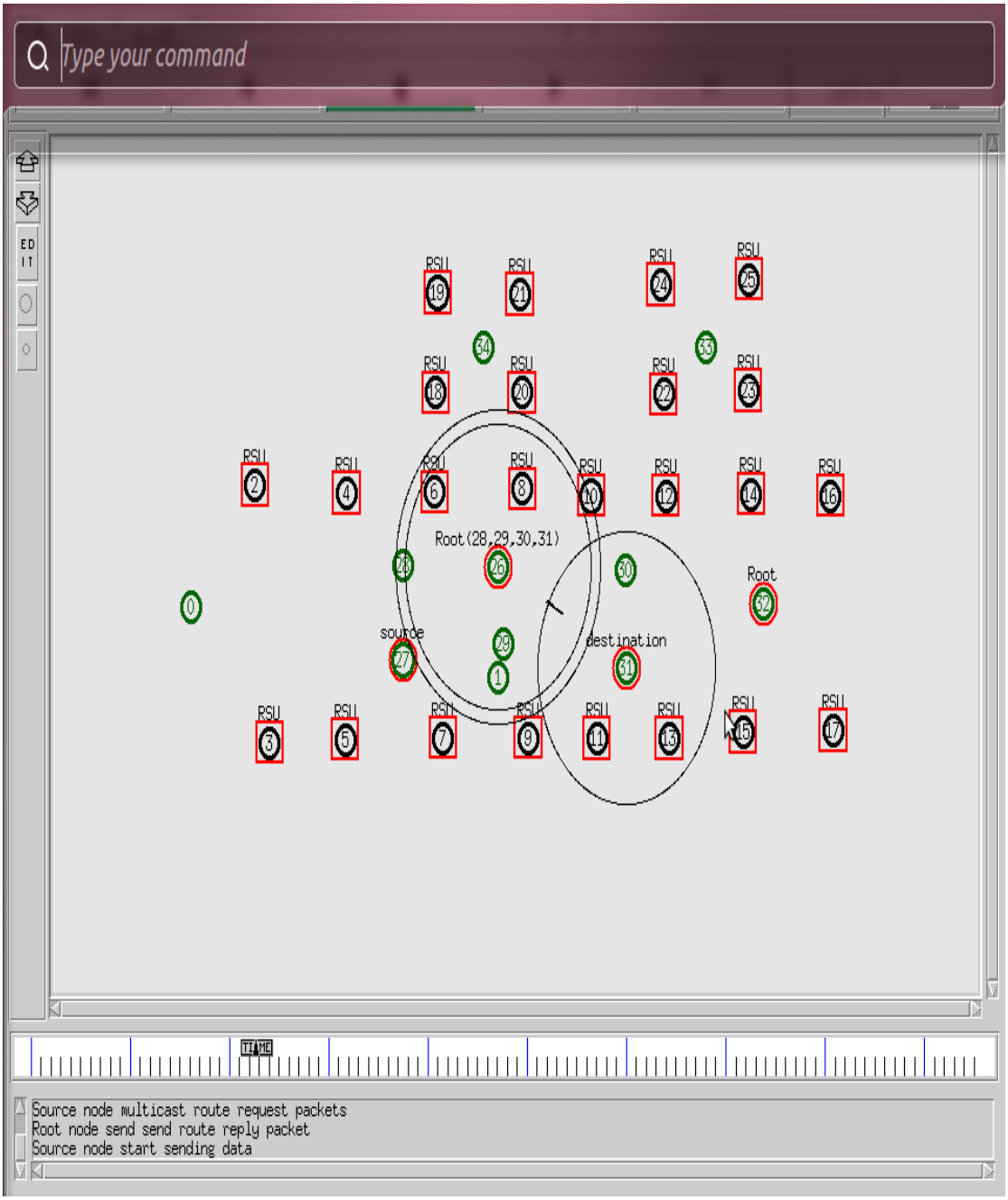


Figure 4.9: Establishment of path

As illustrated in the figure, along with the root nodes, the source and destination nodes are defined. A route request packet is sent to the root node for establishing the path to the destination. The root node replies back to the source node. Using the root node the source node begins to send the data to the destination node.

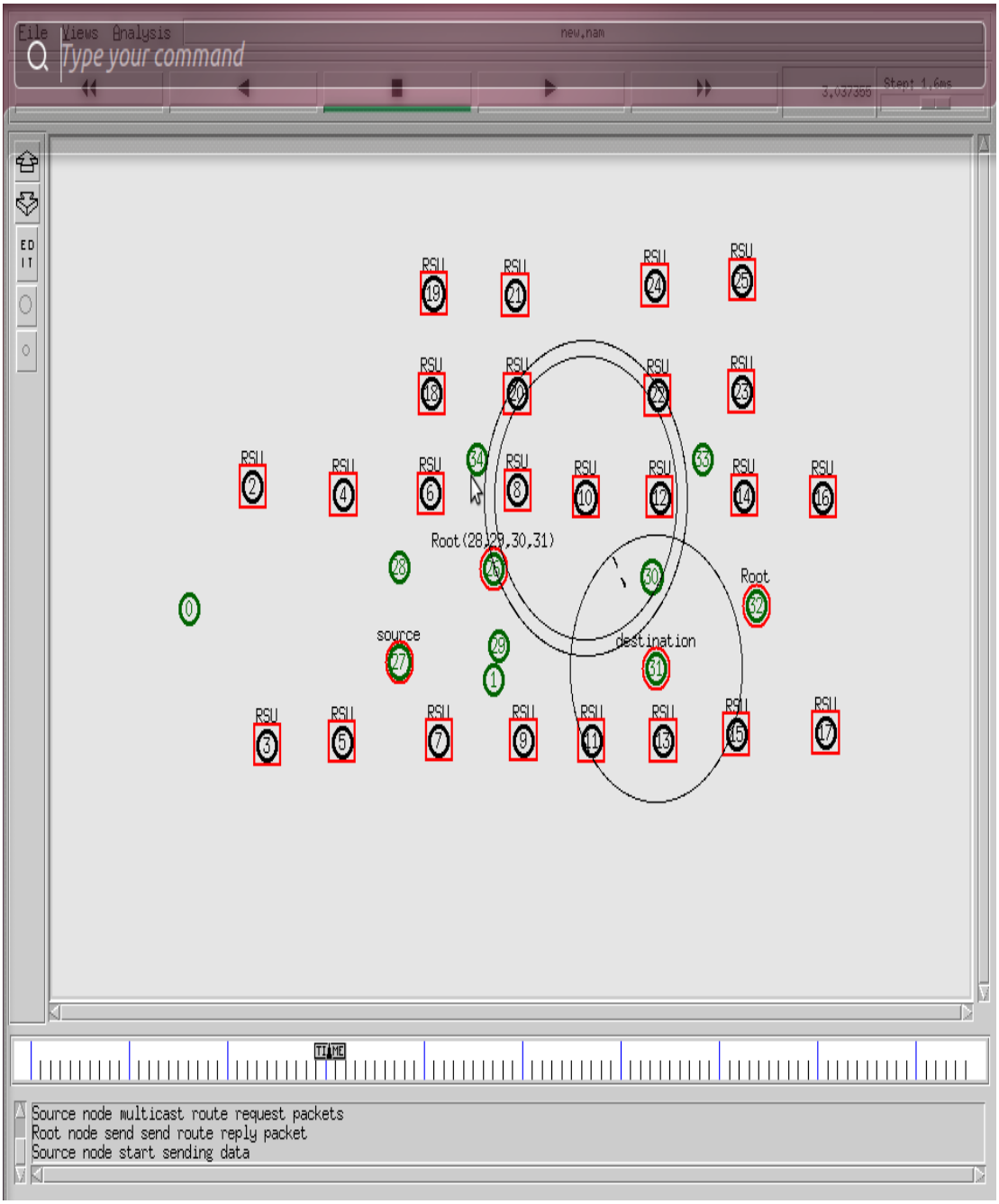


Figure 4.10: Continuation of communication

As shown in the figure, in the network the source and destination nodes are defined. There are some root nodes present in the proposed technique. They are responsible for establishing the path in between the source and destination. Communication continues even when the nodes start moving in the network.

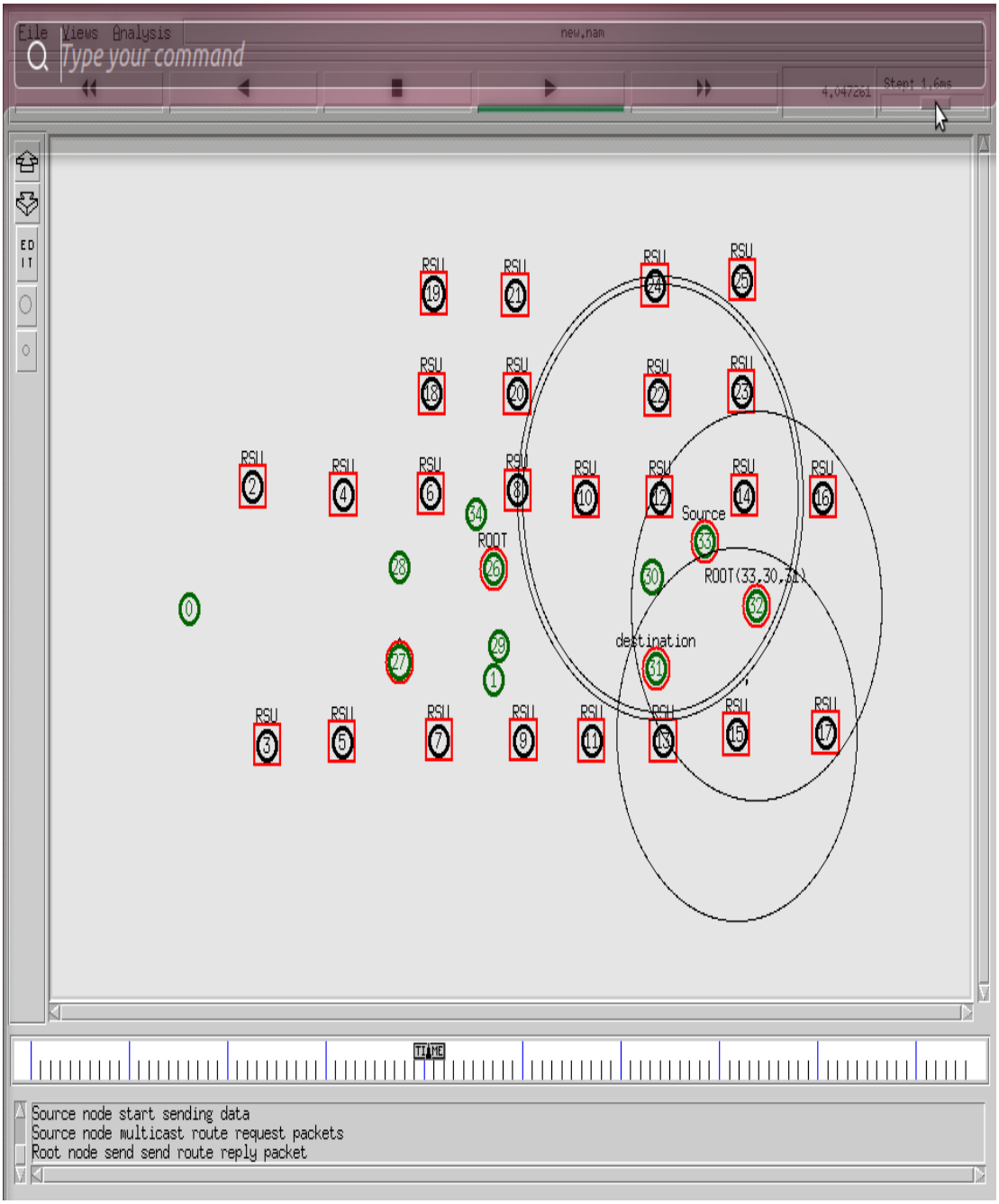


Figure 4.11: New leaf node

As shown in the figure, there is a higher mobility of nodes in the vehicular ad hoc networks. There are some nodes which are not in the range of the old root node. In the range of an old root node, a new leaf node comes in the range. This is similar to the new root node which had leaf nodes which were identified as 33, 30, 31.

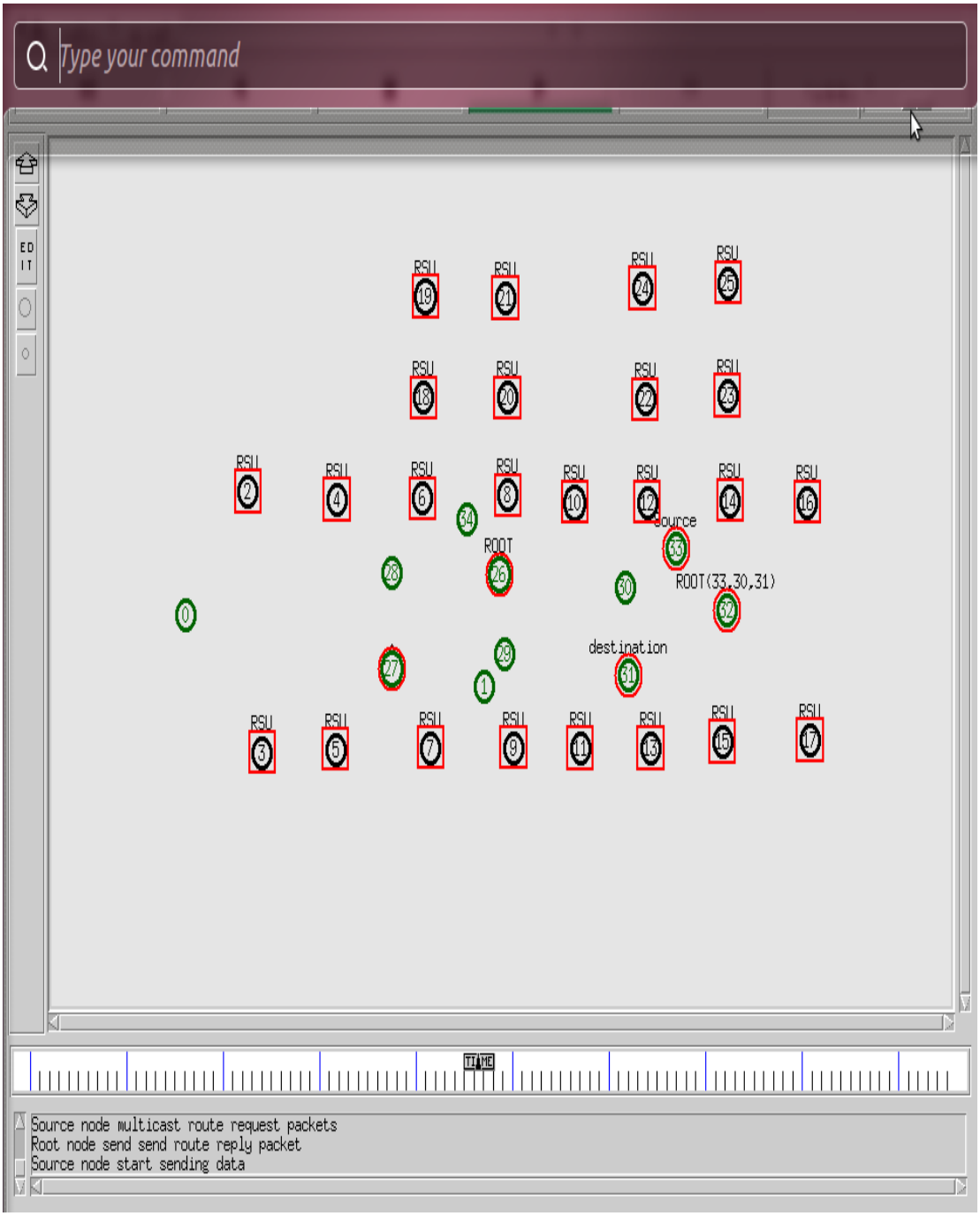


Figure 4.12: Process for path esstablishment

As shown in the figure, in the network the source and destination nodes are defined. Towards the root node the route request packets are sent by the source node. There is a path defined to the destination nodes from the root node. Using the root node also the data packets are sent to the destination node by the source node.

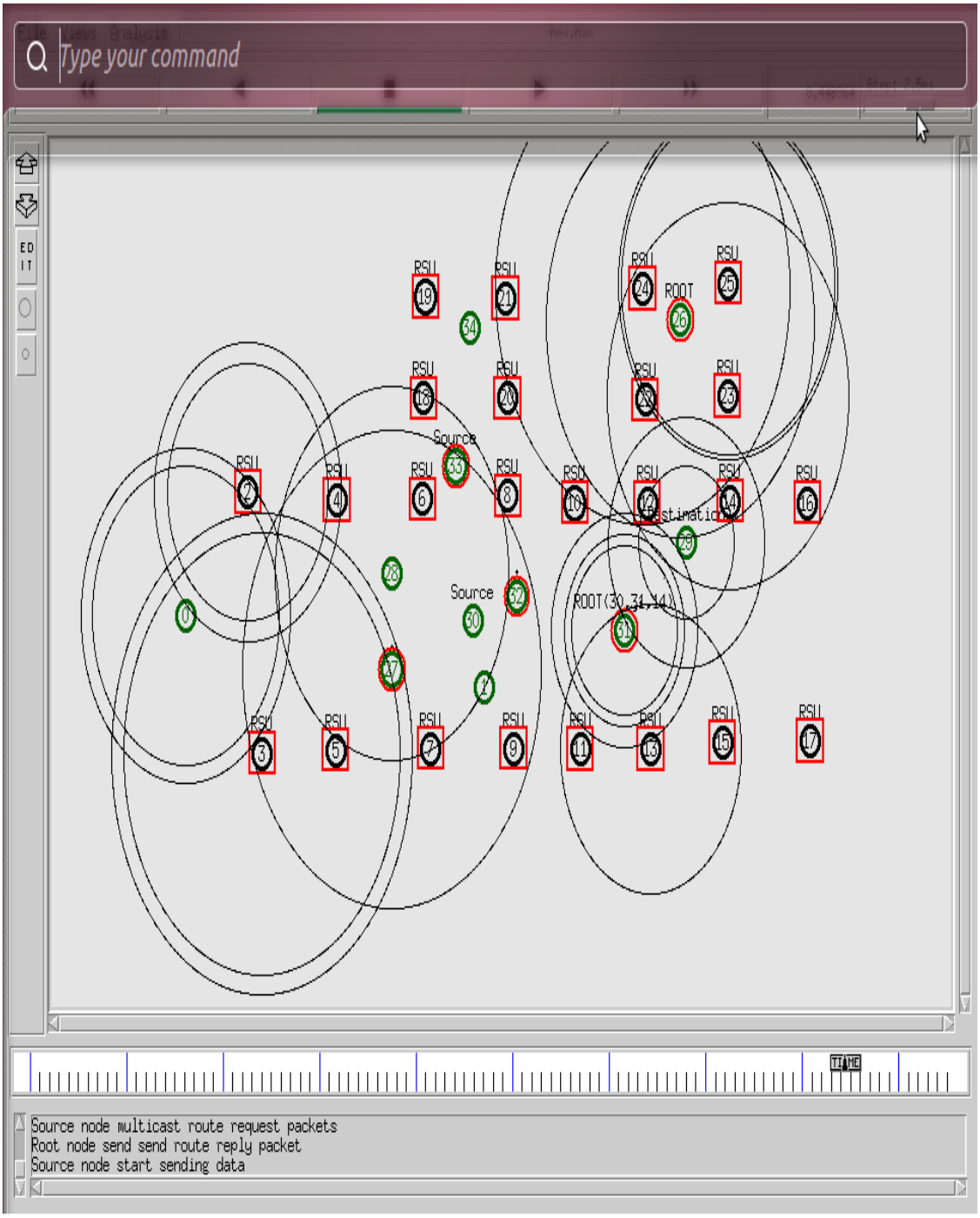


Figure 4.13: Discovering path within the nodes

As shown in figure, in the network the source and destination nodes are defined. Towards the root node the route request packets are sent by the source node. The path is established by the source node to the destination node which is through the root node.

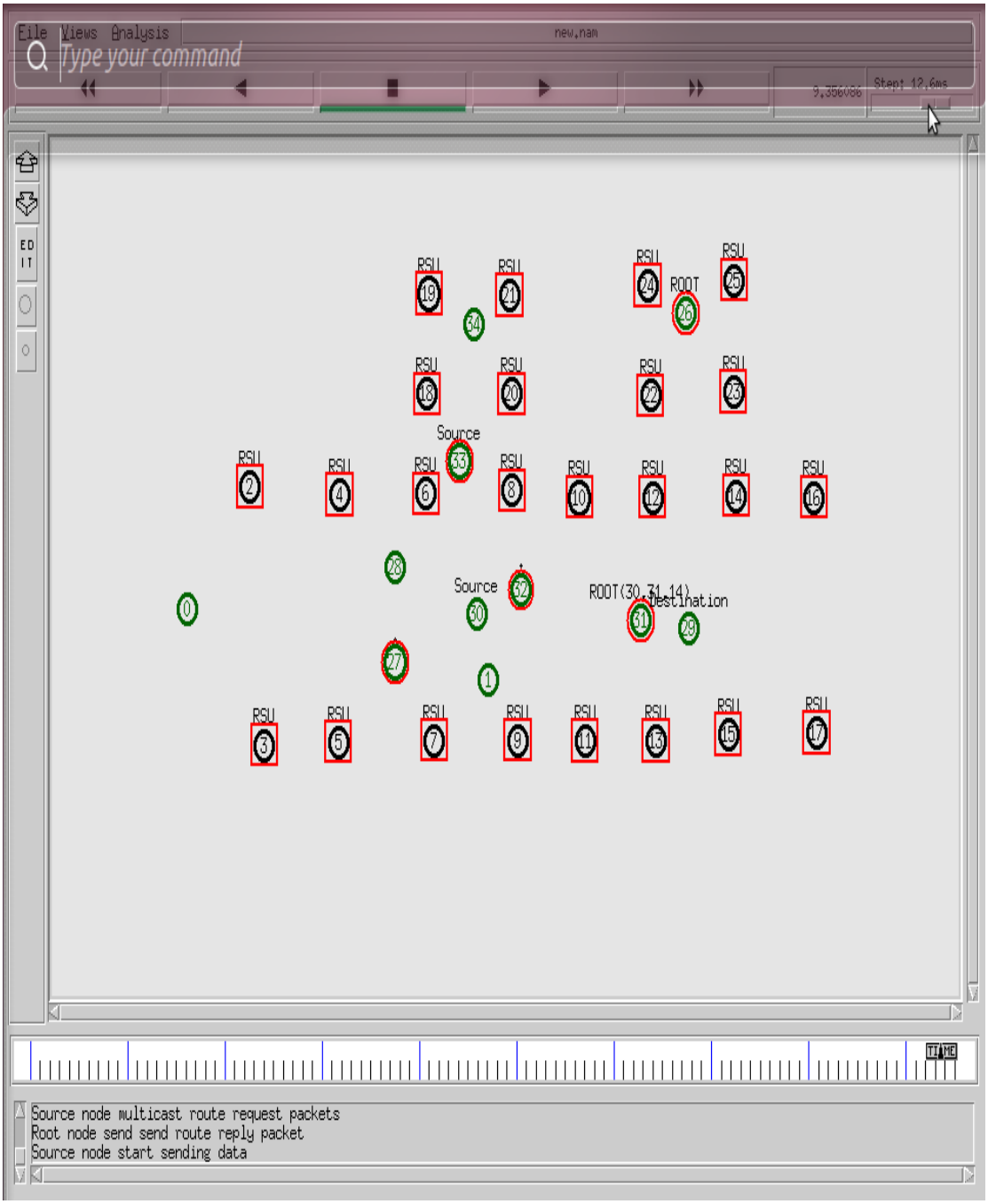


Figure 4.14: Formation of root nodes

As shown in figure, there are finite numbers of smart cars in the simulation. There are chances that the root nodes are not in the range of any node. In this situation for the path establishment in between the source and destination, the root nodes are automatically formed in the network.

4.3 Comparison With Existing Technique:

There are some features that are compared with the existing technique. There are 3 features that are compared. First one is throughput and the other two are delay and packet loss.

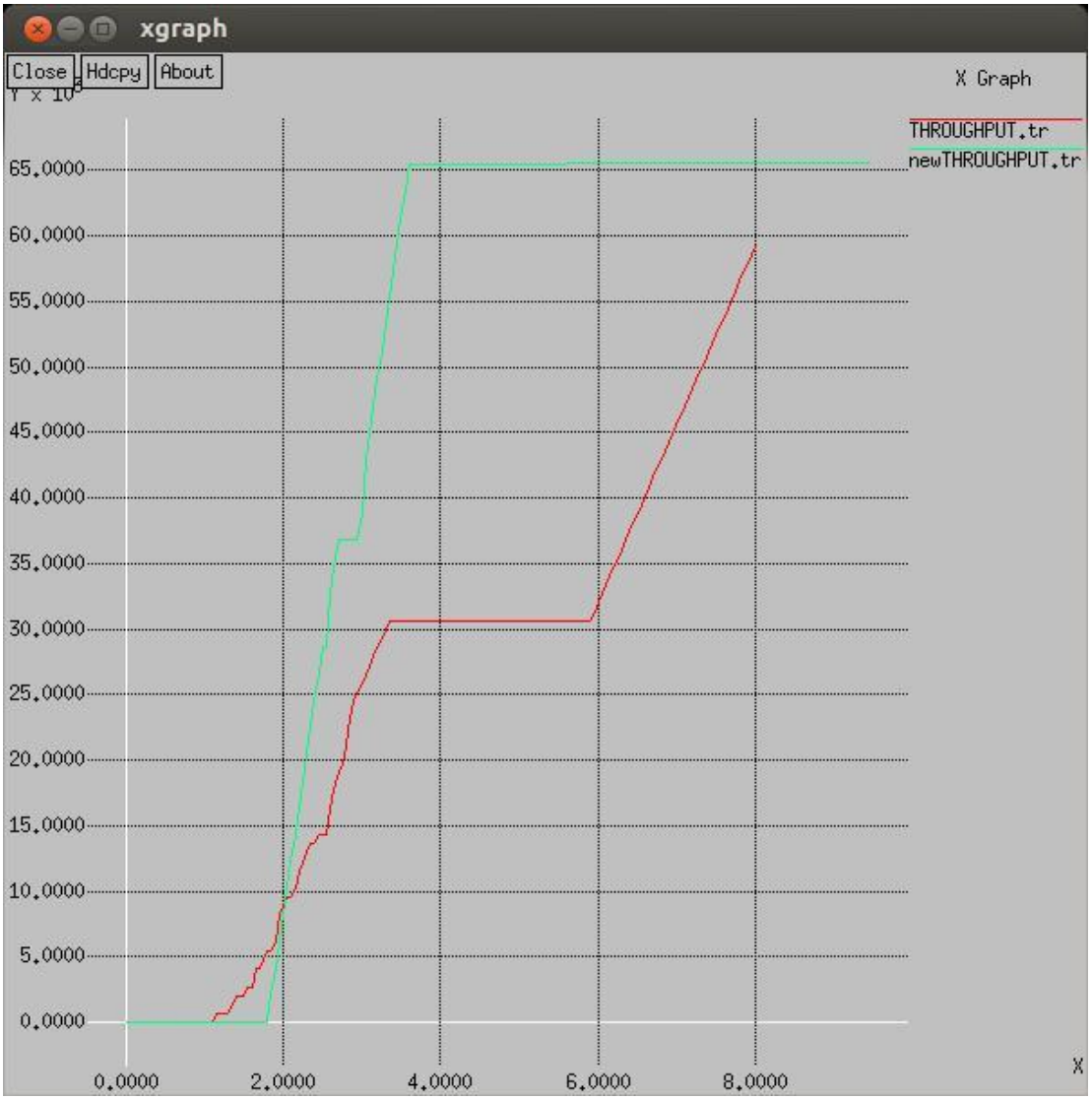


Fig 4.15: Throughput

As shown in figure, for the purpose of establishing a path the broadcasting technique is used. Also the multicasting technique is applied by the proposed algorithm in the network. Due to this reason, the throughput of the network is increased as illustrated in the figure.

Table 1: Throughput Comparison of AODV with E-AODV

Time	(AODV) Existing Algorithm	(E-AODV) Proposed Algorithm
2 seconds	8 Packets	10 Packets
4 Seconds	32 packets	60 packets
6 seconds	35 packets	66 packets
8 packets	58 packets	68 packets

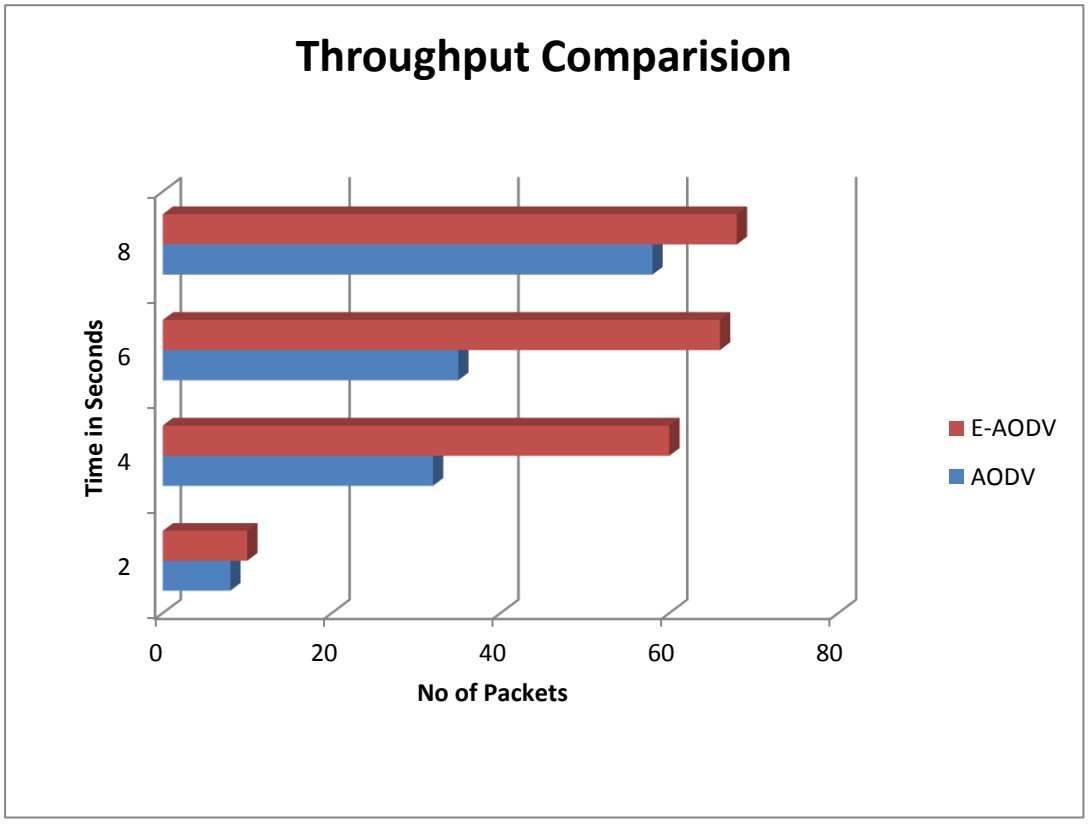


Figure 4.15.1: Throughput Comparison

Here in the comparison, in E-AODV more number of packets are reached at the destination than the number of packets that were received at the destination in case of AODV. Number of packets received are compared in terms of time interval. That is how many number of packets are received in particular amount of time.

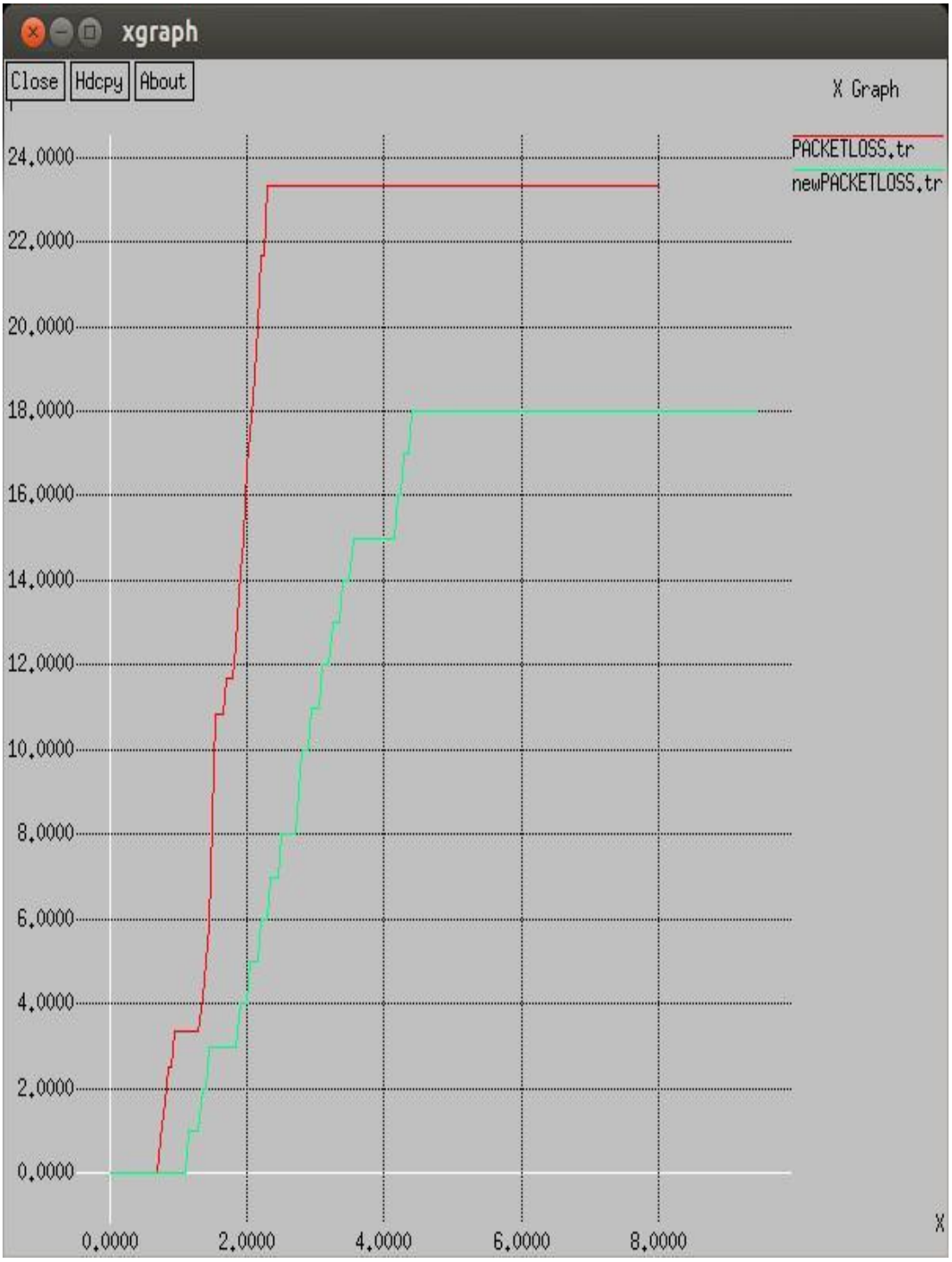


Figure 4.16: Packet loss

As shown in the figure, packet loss criteria are used to compare the old as well as the new proposed technique. The packet loss is found to be less in the new proposed technique than the already existing technique.

Table 2: Packet loss Comparison

Time	(AODV) Existing Algorithm	(E-AODV) Proposed Algorithm
2 seconds	14 Packets	4 Packets
4 seconds	23 Packets	15 Packets
6 seconds	24 Packets	18 Packets
8 Seconds	26 Packets	19 Packets

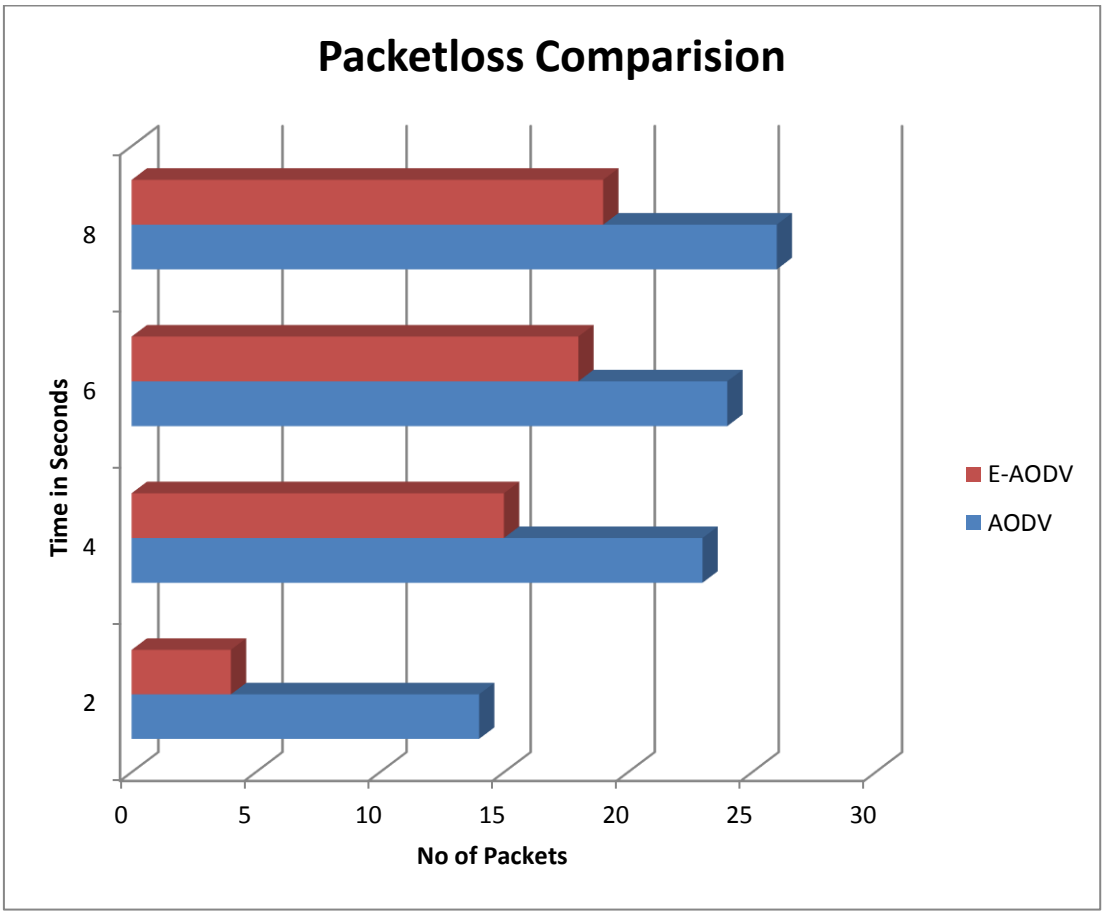


Figure 4.16.1: Packet loss Comparison

As shown in the graph when we use the proposed algorithm, less number of packets will be lost than the number of packets that were lost while using the existing technique.

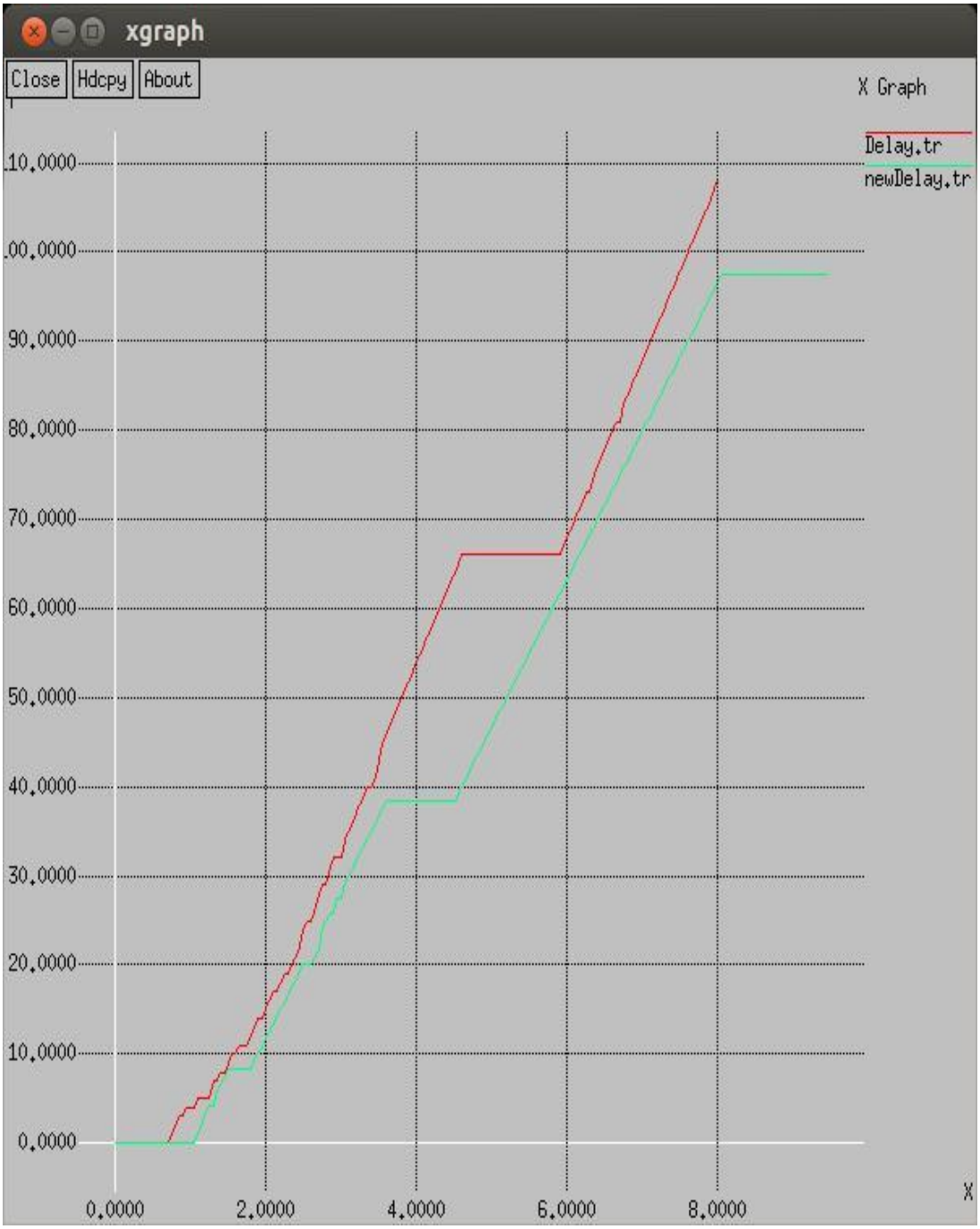


Figure 4.17: Delay

As shown in figure, the delay criteria are used for comparing the proposed and the already existing techniques. There is a reduction in the delay in the new proposed technique when compared to already existing technique. This is due to the use of multicasting approach which is used for path establishment.

Table 3: Delay Comparison

Time	(AODV) Existing Algorithm	(E-AODV) Proposed Algorithm
2 Seconds	10 Packets	9 Packets
4 Seconds	53 Packets	32 Packets
6 Seconds	66 Packets	68 Packets
8 Seconds	120 Packets	100 Packets

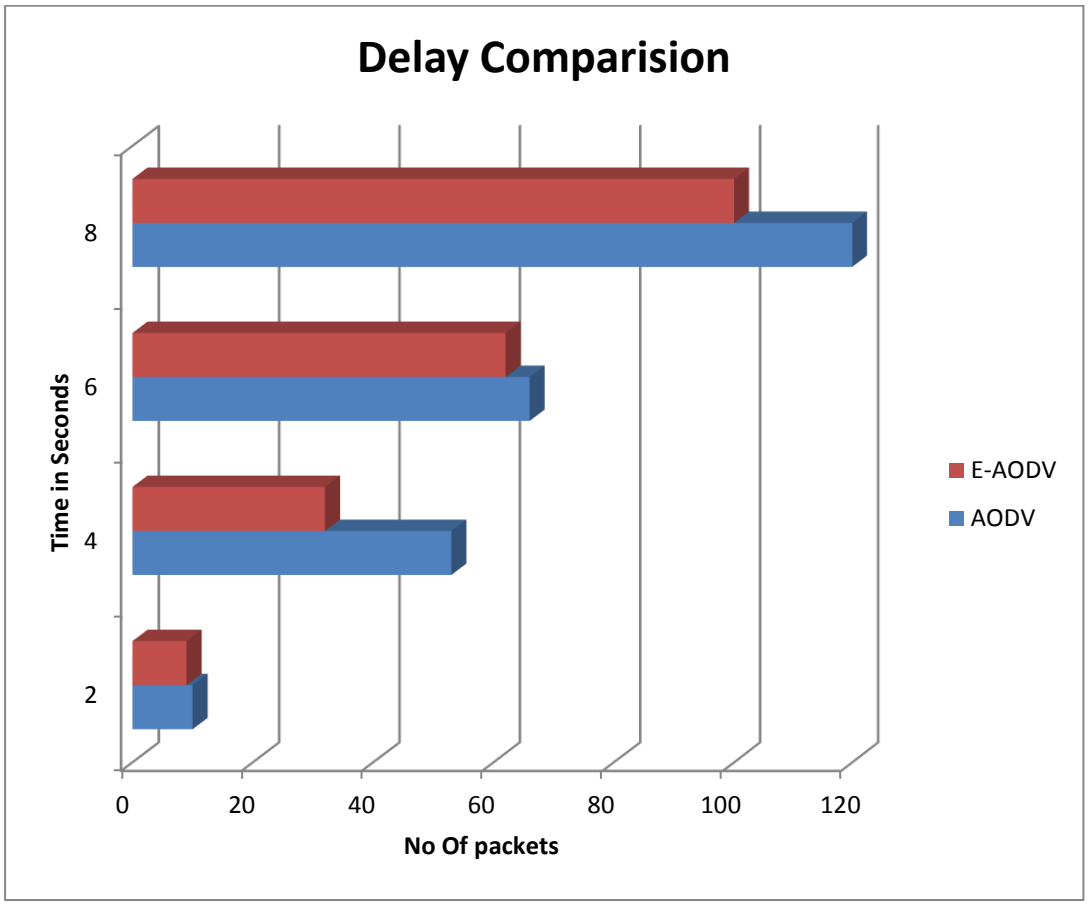


Figure 4.17.1: Delay comparison

Here in figure, graph is shown that shows the delay comparison between the existing algorithm and proposed algorithm. It is clear from the graph that when we use the proposed technology then the delay will be less than before.

Chapter 5

CONCLUSION AND FUTURE SCOPE

5.1 Conclusion:

The conclusion of this network is that vehicular ad hoc network is a network in which network topology changes in every short period of time. The prediction based technique is used to establish the shortest and safe route between the source and destination. Source node flood the data packet over the route towards the destination and all the nodes that are adjacent to the destination will respond back with the route reply packets. Then depend upon the sequence number and hop count source will select the best possible path. Time is required for establishing the path because the nodes in the network has high mobility nature. In this, we improve the LAR algorithm which is used to predict the locations of the nodes that makes the path toward the destination. Hence network throughput is improved and network delay is also minimized.

5.2 Future Scope:

Following are the various possibilities which can be done in future:-

1. The proposed algorithm leads to reduction in packet loss, delay and increase network throughput. This proposed algorithm is multicasting algorithm, which can be compared with other multicasting algorithms to test its reliability.
2. The proposed algorithm is the multicasting algorithm which can be tested on the different scenarios to analyze network performance.

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PUBLICATIONS

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Paper published in International Journal Of Innovtive Research in Science, Engineering and Technology

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