Energy Point DDoS Link Failure attack in Mobile Ad-hoc Network reading and writing Medical Images

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Mobile Ad-hoc network is a type of emerging technical achievement concept used in a communication network, meaning, a temporary network can be formed where nodes can participate to communicate with each other without an infrastructure network administrator. Each node relies on dual roles in the network, such as router and computational role. Achieving this role, a routing protocol is designed to adapt dynamic topological configuration. The important problem in Mobile Ad-hoc Network is frequent topological change. Routing protocols are designed to adapt dynamic topological configuration. The MANET needs a solution for reliable packet delivery ,This article elaborates research work for the reliable packet delivery by identifying energy point DDoS link failure attacker . The primary research work starts with identifying the DDoS link failed node in medical application when the scanned images are stored or scaned images are readed from the memory . Many techniques are proposed in the literature for identifying link failed node, But all these techniques do not identify the failed node dynamically. In this research a new algorithm is proposed to read and write energy calculation using energy point utilization of memory read and write operation. This energy point is encorporated with an algorithm called Advanced Ad-hoc On-Demand Distance Vector (AAODV) which is an extension of AODV protocol. This protocol modifies without changing the properties of original AODV protocols. The proposed algorithm is simulated using Network simulator (NS) and the performance is compared with AODV protocol and the results have plotted to show outperformed of the proposed algorithm.

Additional Key Words and Phrases: Mobile Ad-hoc networks, media access control, AAODV algorithm.

1. INTRODUCTION

Any device with an Internet Protocol address is called a node. A collection of nodes is formed to communicate with each other and that is called a Computer Network. Based on the medium used to facilitate each communication between nodes, computer networks can be divided into wired and wireless network. This introductory chapter discusses in detail wireless networks, especially Mobile Ad-hoc network.

1.1 WHAT IS A WIRELESS NETWORK?

The most famous emerging technology in networking is Wireless networking, which permits users to access information and services, without having to connect to networks with wires; irrespective of their location. Two major classifications in Wireless networks are Infrastructured Networks and Infrastructureless networks.

1.1.1 Infrastructured Networks

Network with fixed and wired gateway are called infrastructure networks. Under such networks , mobile nodes in specific radius are controlled by a base station. While connecting to other devices and base stations without wires such mobile nodes can move in space. While communicating it might go out of communication range of that particular base station and will get connected to the neighboring base station. Such process is known as "Hand Over ".So this way base stations can be assumed to be fixed, in infrastructure networks.

Figure 1.1 shows the pictorial representation of infrastructure wireless networks.

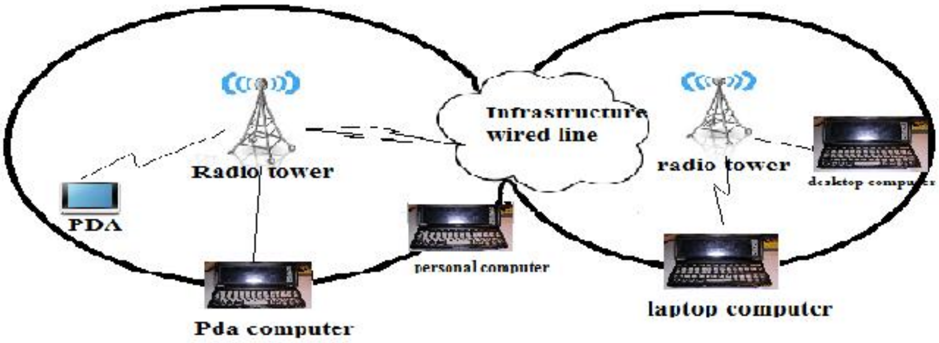

Figure 1.1 Infrastructure Wireless Networks

1.1.2 Infrastructure less (Ad-hoc) Networks

This category of wireless networks is known as Ad-hoc networks.Under such type, there are no base stations.Here the nodes are changeable and capable to be linked with dynamism in a random approach. All mobile nodes under such Ad-hoc networks perform as routers and take part in the discovery process and route maintenance process in the network. The applications of Ad-hoc Networks are widely used in emergency searching and rescue operations, meetings or conventions where people want to share information quickly, and data acquirement operations in harsh environment.

An infrastructure less network is depicted in Figure 1.2.

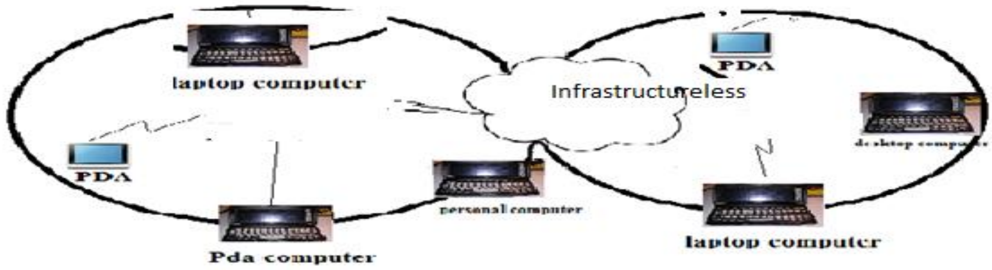

Figure 1.2 Infrastructureless or Ad-hoc Wireless Networks

1.2 MOBILE AD-HOC NETWORKS

Mobile Ad-hoc Network (MANET) is (Macker, J & Corson, S, 2007) an assortment of movable nodes and these communicate with each other with no central control or any fixed infrastructure. In this kind of a network, nodes can move freely, and as a result of this, the network is more prone to error. Packet relay in MANET is critical,due to the dynamic nature of the MANET. Up to date, numerous MANET routing protocols have been coming across, and the best routing protocols that are used in this practice are AODV, DSR (Brochet all 1996) (Johnson, D,et all 2004) and TORA.

A Simple Mobile ad-hoc Network with three nodes is being shown in figure 1.3.

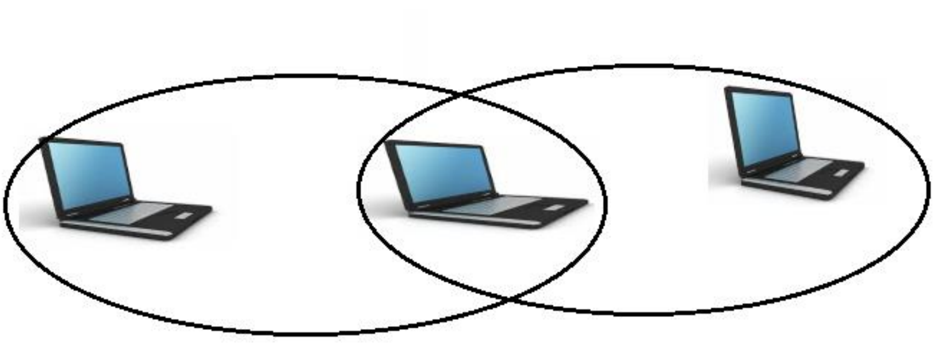

Figure 1.3 MANET

1.2.1 Challenges in MANET

A MANET is a gathering of wireless mobile nodes form a momentary network without any fixed infrastructure. All the nodes are configured among themselves to move freely. Every node is capable of performing a dual role as a router and host. This natural history of MANET leads to the following challenges:

1) The Complexity involved in dynamic reconfiguration in the network

2) Network overhead involved in frequent data updates

3) Power Consumption

4) Secure routing of packets

The protocol stacks of MANET (Siva Ram Murthy,& Manoj B S 1996) (Lin, T, et all , 2003) contain different layers such as physical layer, Network layer, transport layer and application layer.

Figure 1.4 below depicts various challenges involved in different layers of the MANET. In this thesis, solutions have been proposed to mitigate the challenges below and enhance to improve the performance of MANET.

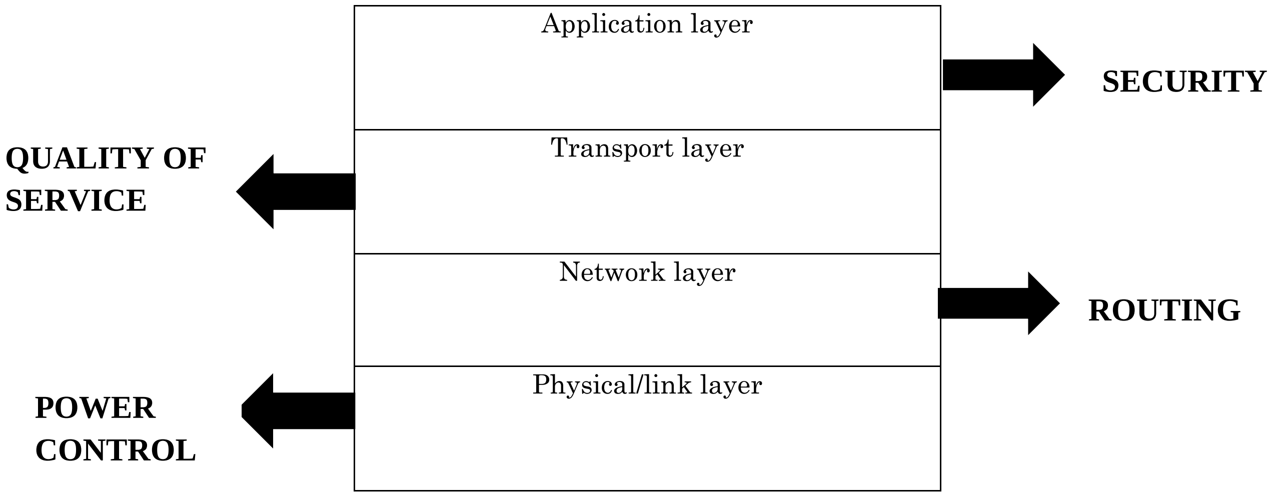

Figure 1.4 MANET Challenges

2. LITERATURE REVIEW ABOUT LINK FAILURE IDENTIFICATION IN MANET

A fair amount of research work has been published on congestion control in MANET. Duc A. Tran & Harish Raghavendra (2006) have proposed a congestion-adaptive routing protocol (CRP) to provide a solution for congestion in MANET. They dealt with it proactively , rather than reactively to prevent congestion in MANET. This lead to packet lost and end to end delay was improved and also this CRP proved that congestion controlling was also an important parameter in routing improvement.

Xia et al (2006), have proposed congestion aware routing protocol for MANET, which used a metric incorporating data rate , MAC overhead and buffer delay to congestion. They used a fuzzy logic system to produce the cross layer design among application layer, data link layer and physical layer in MANET .Performance factors considered for cross layer approaches were average delay, data link layer and application layer, transmission power, times and control decisions.Simulation proved that these factors are better in all aspects with existing approaches.

Boukli Hacene et al (2006), in this paper, the authors use a received signal strength for predicting the link failure and named that protocols implemented in AODV as Predictive Preemptive AODV (PPAODV).Proposed method was called predictive preemptive approach , which maintains the link before break.Simulation results are shown reduction in the number of inactive links , end to end delay and improvement in the packet delivery ratio.

Ming et al (2007) has proposed a Link availability based QoS aware (LABQ) routing protocol for MANET based on mobility prediction and link quality measurement in addition to energy consumption estimate. Their goal was to provide highly reliable and better communication links with energy efficiency. Their routing algorithm has been verified by NS2 simulation and the results have shown that LABQ outperforms existing algorithms by significantly reducing the overhead in reconnection and retransmission. It also reduces the average end to end delay for data transfer and enhances the lifetime of nodes by making energy efficient routing decisions.

RamaChandran & Shanmugavel (2008), have proposed and studied three cross layer designs among physical, medium access control and routing layer using received signal strength (RSS) as cross layer extension parameters for energy consumption, unidirectional link rejection and reliable route formation in MANET. These proposed cross layer designs are implemented using GloMosim and a result produces a new framework, for the cross layer protocol framework.

Hayato et al (2008), have proposed a protocol using interpolations, received signal strength and number of hops for proposed protocols of High Precision - PPAODV (HPPPAODV).

Santhosh Baboo & Narasimhan (2009) have proposed a routing protocol, for congestion aware. Congestion value is measured using the weight values based on data rate, delay in queue.Simulation result in NS2 , proved that proposed method to attain high throughput and packet delivery ratio and reduce packet drop and end to end delay.

Sedrati et al (2011), propose a new protocol for reconstructions of path done by the source, proposed protocols are called M-AODV which takes only a few qualities of services into consideration. Bandwidth and energy resources of AMNET are considered in proposing a new protocol. Multiple disjoint routes are constructed to form a new route.

Dana & Babaei (2011), proposed a routing algorithm using the fuzzy application in order to reduce the number of broken routes, to increase the reliability during the route selection. They choose a stable path for node mobility by considering nodes position / velocity information. They also proposed a method for route maintenance.In this protocol when path fails, a new path is established.

Jailani Kadir at all (2011), in this author uses a strategy for selecting the nodes for packet transmission, which is based on the sufficient energy sources. Optimal path between source to destination route nodes are selected based on the optimal source energy to sustain the connection. Author uses a probability based node selection method for identifying nodes. This method proved that methods help to sustain the nodes in communication.

Ali Cherif et al (2012), in this extends the features of the existing AODV routing protocol to provide additional Quality of services in routing protocols. AODV protocol was extended during the route discovery process.Traffic flow was accepted or rejected based on the current bandwidth capacity in QOS requirement.NS2 was used for the implementation and proved that extended AODV protocol was better than previous AODV protocol

Bisengar et al (2012), has used AODV protocol to enhance the quality of the services and named the proposed protocols as AMAODV (Adaptative Mobility aware AODV), which identify the mobile node in the link using additional metrics like distance, relative, velocity .These metrics avoid losing route . Simulation results depict higher packet delivery ratio and low average end to end delay.

Shivashankar and at al (2012), Authors identified the critical node in the MANET by using the performance factors like residual battery power, reliability, bandwidth, availability and service traffic type.

Preetha et all (2013) , paper proposes a new approaches to reduce the route failure by storing the alternate route in the intermediate nodes.In this algorithm intermediate nodes also involved in the route discovery process. This reduces the route establishment overhead as well as the time to find the reroute when a link failure occurs.

Sourish Mitra1,et all (2014), authors introduces a relay node for packet transmission when the failure occurs. Local link repairing algorithm was proposed, based on the location of link failure inside source route over mobile ad- hoc network. This algorithm was implemented in DSR protocol,which takes decisions on the basis of the location of a Relay node (where link failure is detected) in the source route. The results proved improvement in packet delivery ratio and decrease in end to end delay to improve the scalability of Mobile Ad-hoc network.

This section describes many different technical inventions which were used for identification of the failed link in MANET. All these aspects are not working dynamically .In this thesis, AAODV algorithm is designed to identify the link failure node in the MANET and to work dynamically.

3. DMETHODOLOGY USED

Divide and conquer is a recursive algorithm which is used to find a solution for a given problem. Three major steps for a divide and conquer solution

Step 1: Recursively define sub-problem.

Step 2: Define Base case.

Step 3: Represent recursive cases.

In this thesis Divide and Conquer strategy is used. The steps involved are given below.

Step 1: Recursively define sub-problem

/* Recursively defined sub- problem is the number of hop calculation between the source to destination nodes. This step is used to find the middle node */

Calculate the number of hops between the needed nodes. Calculate the middle node dividing by two.

Step 2: Define Base case

/* Here the base case is defined to check the acknowledgement is received by the source node or not. Base cases refer to the first partition. */

/* This step is used to find out the middle node */

Case 1: Check whether the acknowledgement received from the middle node

If (Yes)

All the nodes from the initial node and up to the middle node are healthy.

Repeat the recursive procedure for other half

Else if (check the middle node is a LINK FAILED node)

Confirm middle node is a LINK FAILED NODE

Else (Find out the new middle and goto case 1)

Step 3: Represent recursive cases

/* In this step recursive case are defined for a source node to check the cases */

Case 2: If the middle node received Acknowledgment

Take the second half and go to step 1.

Case 3: If consecutive nodes acknowledgement is not received

Check whether the previous node of consecutive node forwarded the packet, if not, and then confirm failure node is previous node of the consecutive node after checking following stages.

(i) Send router request for the acknowledgement missing nodes.

(ii) Select the failure node which router reply is not received.

(iii) If more than one Router reply missing goes to (i)

(iv) More than two chances router reply missing confirm all the missing node as a failed node.

This section discusses the divide and conquers strategy test cases for each defined cases. In the next section will define the step for link failure node algorithm.

3.1 ALGORITHM

In this section algorithm is derived for identifying link failed node in MANET.This algorithm is named as Advanced Ad-hoc On-Demand Distance Vector (AAODV) algorithm

Algorithms are detailed below:

Advanced Ad-hoc On-Demand Distance Vector (AAODV) Algorithm

```
Procedure(Source, Dest, G)
Consider the ordered Set G= {1…….. N}.
Step 1: Initialize source = 1, dest = N .
Step 2: Calculate middle = No of hops (source to dest) /2.
Step 3: (i) Check whether the packet passes through the middle node.
          If (yes)
         Calculate the new middle node from the middle node to the
          Destination then goes to step 2.
          Else
        Calculate the middle node from source node to middle node then
         go to  step 2.
       If there is no flow of data, then the node may be a link failure
        Node.
     Check  whether the middle node is a link failed node
       If  True Set Victim = Middle and initiates route discovery process.
Step 4: Confirm Victim node
       Send route request to the Victim node.
       If there is no reply, then confirm Victim node.
Step 5: Retransmit the data through stage 1.
Step 6: Stop.
```

4. AAODV IMPLEMENTATION

From the literature survey of chapter 2 it is evident that link failure node identification mechanisms and MAC link failure detection techniques used basically some additional computation like link congestion monitoring, residual battery power, reliability, bandwidth, availability and service traffic type, signal strength and flow capacity, energy based node selection and alternate path identification etc. Above proposed technique from the literature does not pin point the victim node and link failure node. In this research work link failure node identification algorithm is developed by extending Ad-hoc On-Demand Distance Vector which is named as Advanced Ad-hoc On-Demand Distance Vector (AAODV) algorithm.

Advanced Ad-hoc On-Demand Distance Vector algorithm details are explained in the following section.

4.1. AAODV Algorithm Design

Design Stages: Design Stages involved in Advanced Ad-hoc On-Demand Distance Vector algorithm (AAODV) for identifying a Victim node are as follows:

A. Decide the path using AODV protocol.
B. Transmit packet.
C. Apply AAODV algorithm on packets.
D. Identify the link failure node.
E. Redirect to the new route.

The above design steps of AAODV algorithm are implemented by extending AODV protocol. AAODV algorithm is simulated using Network simulator, assigned parameter for simulation is shown in the below Table 4.1.

Table 4.1 Parameter of the simulation

Channel Type	Wireless Channel
Radio Propagation Model	Two Ray Ground
Antenna type	Omni Antenna
Interface queue type	Drop Tail /Pri Queue
Maximum Packet in Queue	50 packets
Network interface type	Phy/Wireless Phy
MAC type	802_11

Topographical Area	500 X 300 sq.m
TxPower	0.5W
Rx Power	0.1W
Idle Power	0.01W
Initial energy of a Node	1000.0 Joules
Routing protocol	AODV
Number of mobile nodes	10, 20,30,40,50,60,70,80,100
Mobility	0 or 20m/s

A. Decide the path using AODV protocol

In this stage, existing Ad-hoc On-Demand Distance Vector (AODV) protocol is used to identify routes between the source node and the destination node. The Ad hoc On-Demand Distance Vector (AODV) routing protocol is designed for mobile ad hoc networks. AODV is capable of both unicast and multicast routing. It is an On-Demand algorithm, meaning that it builds routes between nodes only as desired by source nodes. It maintains these routes as long as they are needed by the sources. AODV builds routes using a route request / route reply query cycle.

B Transmit Packet

Once the path is identified between source to destination using AODV protocol, source node starts sending packets to the destination node through the identified path. Sender broadcasts a control packet to all its neighbors. Each node receiving the packet and forwards to its neighbors, sequence numbers help to avoid the possibility of forwarding the same packet more than once, Packet reaches destination provided that destination is reachable from sender node, the destination does not forward the packet.

C. Apply Divide and Conquer on packets and identify link failure node

In this stage, the link failure node is identified when the node does not receive the packet from the previous node.

D. Route redirection

The source node discovers new routes to retransmit the packets when the node is identified as Victim node. After identification of victim node, the alert message sends to all the nodes to ensure that packets are not transmitted via victim node. Further the same process is applied if any nodes are suspected of any of the newly established routes. The new path is identified with the help of AODV protocol. Fundamentally AODV protocol focuses on non repetition and shortest path.

5. PERFORMANCE ANALYSIS OF AAODV VS AODV PROTOCOL

Implementation of proposed Advanced Ad-Hoc On-Demand Distance Vector (AAODV) algorithm is simulated using Network simulator. AAODV algorithm is an extension of existing AODV protocol without changing any original properties of AODV.

Performance comparison with properties of AODV Protocol (Kullberg, T 2004)Simulation set up(Li Layuan,et all 2007, ‘)(Jaya Jacob & Seethalakshmi, V 2011,) is shown in Table 4.1. The performance parameters taken for comparisons (Duyen Trung, et all 2007) are Throughput, Packet Delivery Ratio, End to End Delay, Jitter, Hop count, an Energy Consuming and Residual Energy.

5.1. Throughput between AAODV and AODV

Throughput refers to how much data can be transferred from one location to another in a given amount of time. From the figure 5.2, the Throughput comparison between AAODV algorithm produces better data transfer compared with the AODV protocol because of packet are delivered without any delay.

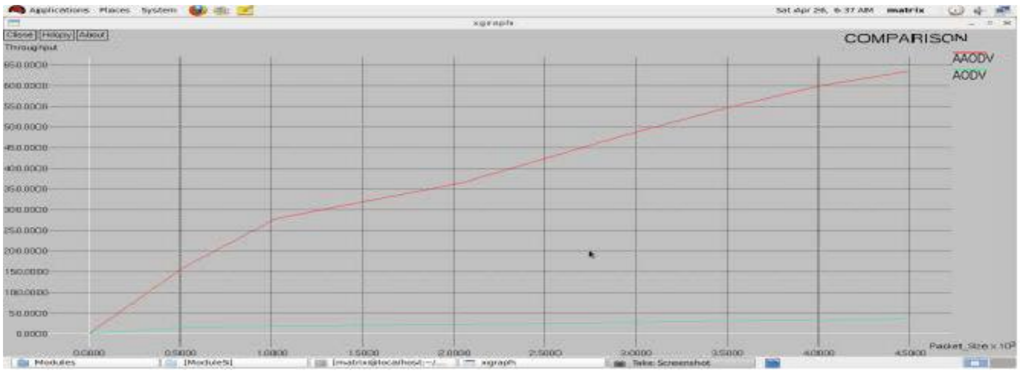

Figure 5.2 Graph for throughput evaluation

5..2 Packet Delivery Ratio between AAODV and AODV

The ratio of the number of packets received to number of packets send.

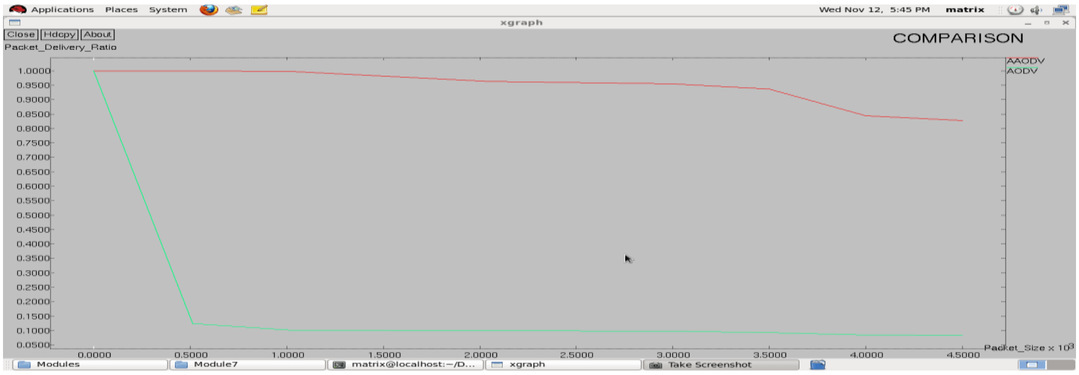

Figure 5.3 Graph for packet delivery ratio

Comparison of packet delivery ratio between the AAODV algorithm and AODV protocol, shown in Figure 5.3, AAODV in packet delivery ratio as waiting time on the packet is reduced.

5.3 End – End Delay between AAODV and AODV

The end to end delay is defined as the average time is taken by a data packet to arrive in the destination. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destinations are counted.

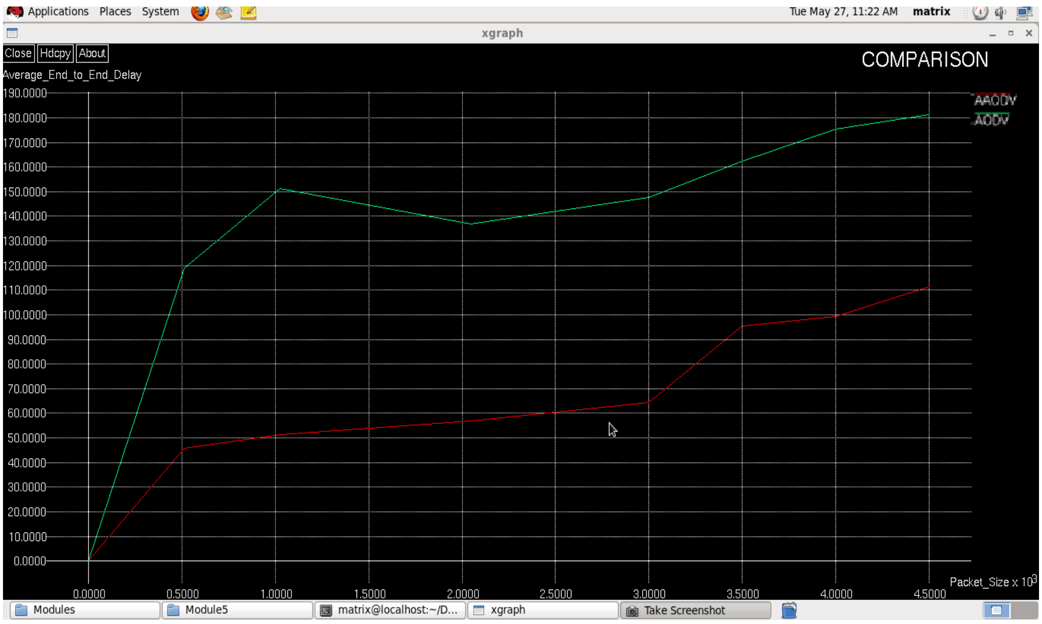

Figure 5.4Graph for end to end delay

Figure 5.4 depicts the end to end delay comparison between Advanced AAODV algorithm and AODV protocol, from the figure above proved that the Advanced AODV algorithm has less end to end delay as no link failure between the packet transmit.

5.4 Jitter between AAODV and AODV

Jitter is an arrival of packet variations in nodes**.** Below figure shows that Advanced Ad-hoc On-Demand Distance Vector algorithm reduces the jitter into low level compared to Ad-hoc On-Demand Distance Vector protocols, which is shown in the Figure 5.5.

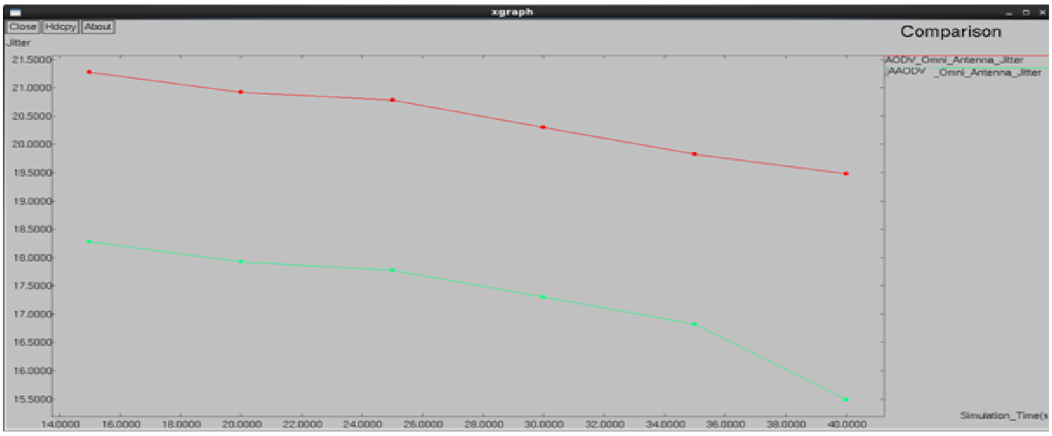

Figure 5.5 Graph for jitter

5.5 Hop Count between AAODV and AODV

Hop count says that number of intermediate nodes a packet travel from source node to destination. The Figure 5.6 shows that both the AODV, AAODV algorithms take the same hop count, because it relies on principles of Ad-hoc On-Demand distance Vector protocol.

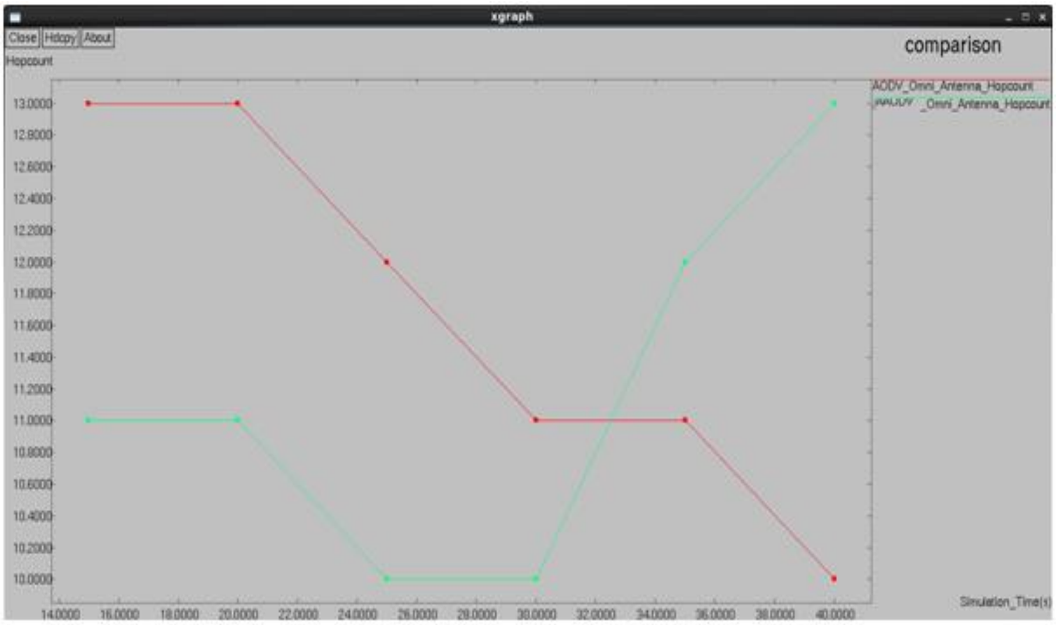

Figure 5.6 Graph for hop count

In this chapter design and implementation of Advanced Ad-hoc On-Demand Distance Vector algorithm is explained.

6. CONCLUSION

A Mobile Ad-hoc network is a combination of different nodes, created for communicating each other without any infrastructure. Transmitting of packets from source to destination is one of the greatest challenges because the packet should reach the destination without disturbances like delay, packet loss. Ad-hoc On-Demand Distance vector protocol is designed for transmitting packet by finding a new route when it's needed. Even though this protocol is creating a path on demand, protocol functional limits on route redirection.

Advanced Ad-hoc On-Demand Distance Vector algorithm designed to identify the link failure node overcome its limitation of reliable packet delivery. Simulation results show that the algorithm performs better than exiting AODV. In future this algorithm can be enhanced to the redirection of packets from the route failed node instead of from the source.

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