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Efficient Energy Consumption in Ad hoc Network using AOMDV-FF

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ABSTRACT

In this paper we are going to analyze the energy consumption in MANET by applying the fitness function to optimize the energy consumption in ad hoc on demand multipath distance vector (AOMDV) routing protocol. The proposed protocol is AOMDV with the fitness function (FF-AOMDV). The fitness function is mainly used to find the optimal path from source node to destination node to reduce the energy consumption in multipath routing. The performance of FF-AOMDV protocol has been evaluated by using network simulator version 2, where the performance is compared with optimized link state routing (OLSR) and AOMDV protocol.

Key Terms: **AOMDV (Ad-hoc On demand Multipath Distance Vector), AOMR-LM (Ad-hoc On demand Multipath Routing with Lifetime Maximization), DYMO (Dynamic Multipath On-demand routing protocol), FF-AOMDV (Fitness Function- Ad-hoc On demand Multipath Distance Vector), OLSR (Optimized Link State Routing).**

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1. INTRODUCTION:

MANET has the limited battery power and limited bandwidth. It is expected that the uses and applications of mobile wireless computing will be increased rapidly to utilize the Internet Protocol (IP) for our future development. Mobile ad hoc networks (MANETs) are continuously supporting the effective and robust mobile wireless network operation using the routing protocols to communicate the mobile nodes [1]. In MANET, the topology has been changed rapidly with limited bandwidth-constrained environment.

The multipath routing protocols enable the source node to choose the best route among many routes during a single route discovery process.

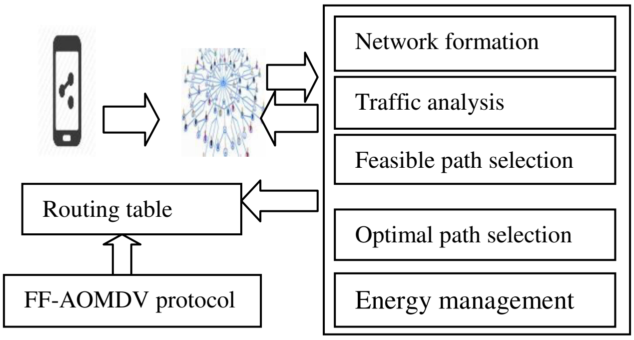

Figure 1.System architecture

2. RELATED WORKS:

Mobile Ad-Hoc Network (MANET) forms a temporary network without the aid of any stand-alone infrastructure or centralized administration. The primary goal of any ad-hoc network routing protocol is to face the many challenges of dynamically changing network and provide an efficient route between any two nodes with minimum routing overhead and limited bandwidth consumption [2]. Limited routing securities are used in the existing work. An ad-hoc networks environment has a new challenge that it is not a fixed network. A several protocols are introduced to improve the routing mechanism and also find out the route between source and destination host across the network.

A MANET routing protocol should be able to perform the fast and effectively change the network layout. We proposed to increase the reliability of data transmission (i.e., fault tolerance) or to provide load balancing. Load balancing is the important one in MANET because of the limited bandwidth between the nodes [3]. Providing the trustworthy quality of service guarantees in a MANET is very challenging in dynamic and uncertain nature of these networks. Dynamic Multipath On-demand (DYMO) routing protocol for MANETs which uses delay, traffic load etc instead of hop count, as metric for route selection.

A multipath routing protocol is used to maximize the network lifetime [4]. An energy-efficient multipath routing protocol, called ad hoc on-demand multipath routing with lifetime maximization (AOMR-LM), which preserves the residual energy of nodes and also balance the consumed energy to increase the network lifetime. Using the multipath selection mechanism we classify the paths. Two parameters are analyzed in this scenario: the energy threshold β and the coefficient α. The parameters are required to classify the nodes and to ensure the preservation of node energy.

A MANET is a highly dynamic wireless network that can be formed without the need for any pre-existing infrastructure in which each node can act as a router. In this paper we focus on the AOMDV (Ad-hoc on-demand Multipath Distance Vector) routing protocol. It is an extension to the AODV (Ad-hoc On-demand Distance Vector) routing protocol for computing multiple loops free and link disjoints paths [5]. In ad-hoc networks dynamic link failures and route breaks occur frequently. AOMDV reduce the routing overhead and also reduce the frequency of route discovery operation [6].

Energy conservation is a most important issue in mobile ad hoc networks (MANET), where the terminals are always supplied with limited energy. A new routing protocol is presented in the study of low-energy nodes in ad hoc networks. The energy sensing routing protocol (ESRP) is based on the energy sensing strategy [7]. Multiple strategy routing and substitute routing are both adopted in these MANET. To refer the level of residual energy and the situation of energy consumption, are chosen for the different packets transmission. Using the energy sensing routing protocol to reduce the packet retransmission after that link will be break. We focus on the network lifetime most of all performances. The evaluation is done in comparison with other routing protocols on NS2 platform and the simulation results show that the network lifetime will be increased and balance energy consumption effectively.

3. PERFORMANCE METRICS:

3.1 Packet delivery ratio: It means the ratio of the data packets that has to be delivered to the destination node to the data packets that were generated by the source.The performance metrics shows that the routing protocols qualify in its delivery of data packets from source to destination [8]. The ratio will be higher; Performance of the routing protocol is improved better. PDR is calculated using the below formula:

$$PDR = \frac{\text{Number of Packet received}}{\text{Number of Packet sent}} * 100 \qquad (1)$$

3.2 End-to-End delay: It refers to the average time taken by data packets in successfully transmitting messages across the network from source to destination [9]. It includes different types of delays, like queuing at interface queue; retransmission delays; and buffering during the time of route discovery process. Stated below is the formula to calculate the E2E delay**:**

$$E2E = \sum_{i=1}^{n} \frac{(Ri - Si)}{n} \qquad (2)$$

3.3 Energy consumption: It refers to the amount of energy that is spent by the network nodes within the simulation time. It is obtained by calculating each node's energy level at the end of the simulation, factoring in the initial energy of each one [10]. The following formula will produce the value for energy consumption:

$$\text{Energy Consumption} = \sum_{i=1}^{n} (\text{int}(i) - \text{ene}(i)) \qquad (3)$$

4. DESCRIPTION:

4.1 Network formation: Mobile node is the basic of ns node object with added functionalities like movement, transmit and receive on a channel that allows to be used to create mobile node on the wireless simulation environments [11]. The mobility features are node movement, periodic position updates, maintaining topology boundary etc are implemented in C++ while plumbing of network components within mobile node itself (like classifiers, dmux, LL, Mac layer, Channel etc) have been implemented in Otcl. The network consists of a beginning node (n1), a termination node (n2), a simple link connecting n1–n2, a source transport layer agent (UDP), and a sink transport layer agent (null). This mobile node can be created using the following TCL simulation script:

```
set ns [new simulator]
set n1 [$ns node]
set n2 [$ns node]
$ns simplex-link $n1 $n2 drop tail
set udp [new Agent/UDP]
set null [new Agent/null]
$ns attach-agent $n1 $udp
$ns attach-agent $n2 $null
```

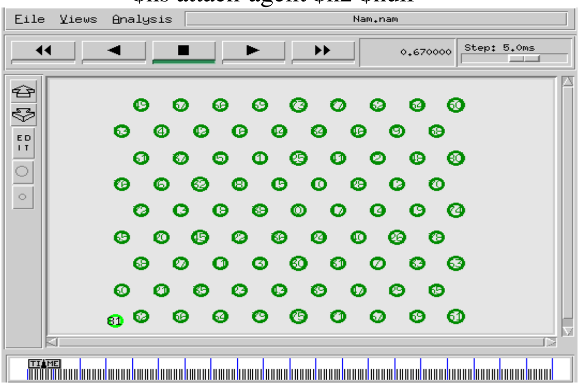

Figure 2.Network formation

4.2 Traffic analysis: Using the packet sniffers software to identify the source of attack in that network [12]. Our existing protocols are never differentiating the connectivity loss or shutting down of nodes due to malicious activities and other network issues (e.g. energy loss and mobility). The packet sniffers can be extremely useful to detect and analyzing the traffic in different malicious activities from normal routing failures and to limit their harmful consequences. In this part we are analyzing how many numbers of nodes can be failed. The failed nodes are cannot be taken in optimal or feasible path. So that the performance of the routing protocol will be increased.

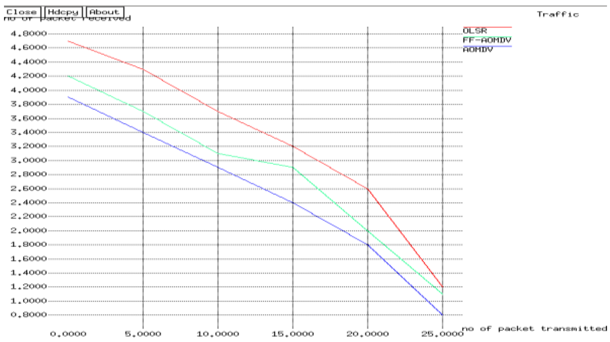

Figure 3.Traffic analysis

4.3 Feasible path selection: After finding the source and destination where the fitness function performs a scan on the network in order to locate the nodes that have a higher level of energy [13]. The source point will then receive a RREP that contains information on the available routes towards the destination along with their energy levels. Calculating each route's energy level, the fitness function will then compare to finding the route with highest energy level. The distance of this route will be considered. If the route has the low energy level and less distance it is feasible path.

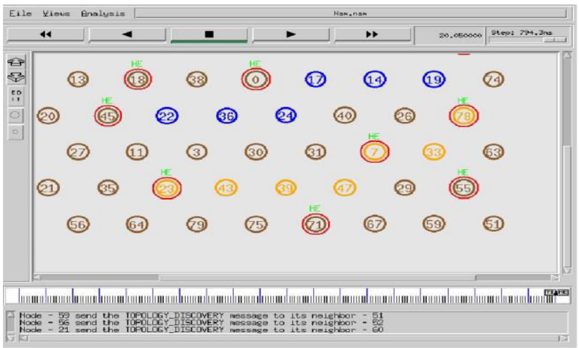

Figure 4.Feasible path selection

4.4 Optimal path selection: The Optimized Link State Routing (OLSR) protocol is used to choose the stronger coverability nodes that creates the overlap of nodes in the Multi Point Relay (MPR) selection [14]. Multi point relay is to reduce the performance of the network. Multipoint Relay is a technique to reduce the number of redundant retransmissions broadcast messages in the network. Optimized Multicast Routing (OMR) protocol is to change the behavior in different situations in order to improve the metric like delivery ratio of the packet and throughput. If the route has the high energy level and less distance it is the optimal path.

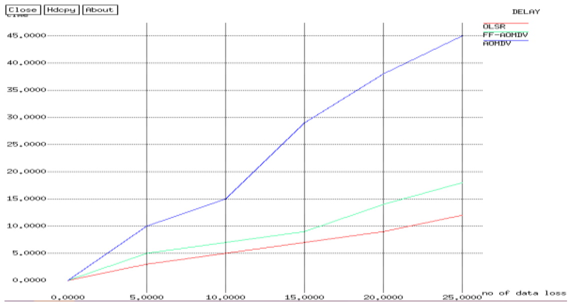

Figure 5.End-to-End delay

4.5 Energy Efficiency: In MANET, a battery power of the mobile node will be low, energy consumption should be considered seriously [15]. In this research we are increasing the mobile node energy. Using the three routing protocols (AOMDV, FF-AOMDV, and OLSR) the energy level of the mobile node is calculated. The fitness function scan the whole network if energy level of the mobile node be low then it will consider as the failure node. The node can route through an optimal path. The node will be a failure node if it cannot be able to transmit the packet.

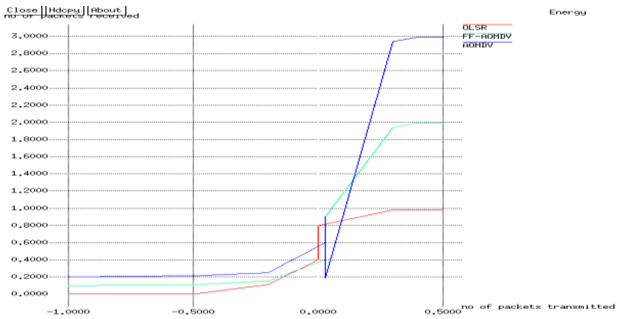

Figure 6.Energy efficiency

5. CONCLUSION:

Our existing protocols have the limited network lifetime and energy consumption so in this paper we proposed a new energy efficient multi-path routing protocol called FF-AOMDV simulated using NS-2 based on three different scenarios,varying node speed, packet size and simulation time. These scenarios were tested by five performance metrics (packet delivery ratio,throughput,end-to-end delay, energy consumption and network lifetime). Simulation results showed that the proposed FF-AOMDV protocol has performed much better than both OLSR and AOMDV.FF-AOMDV routing protocol gives the 50% of network lifetime will be increased and also 30% of energy consumption will be decreased.

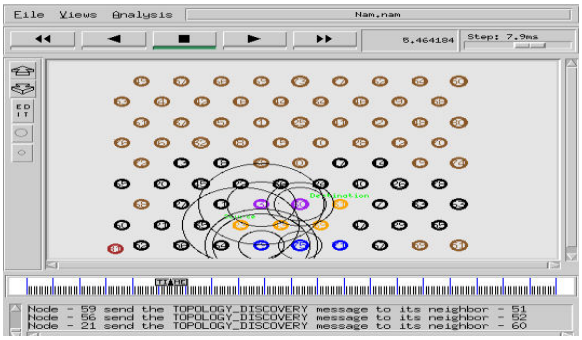

Figure 7.Optimal path selection

6. FUTURE WORK:

FF-AOMDV protocol only gives the 50% to increase network lifetime and energy consumed in our proposed work. So we will choose the optimized Energy Efficient Hybrid Routing Protocol (EE-HRP). The EE-HRP routing protocol gives the lot of advantages compared to FF-AOMDV routing protocol. The optimized EE-HRP reduces total power consumption, reduces end-to-end delay, increases packet delivery ratio and achieves maximum network lifetime. An optimized Energy Efficient Hybrid Routing Protocol (EE-HRP) has some routing strategy that seeks to find the best balancing power consumption and evenly using all nodes within the network to avoid early exhaustion of individual node. In EE-HRP we use multiple threshold values for remaining battery power of nodes and assigning the different roles for each mobile node depending on remaining battery power of the mobile node using our Node Energy Monitoring Algorithm (NEMA). Here we previously designed algorithm is Zone Head Selection Algorithm (ZHSA) which is used to select maximum energy node as Zone Head (ZH). In a simulation results shows that our optimized EE-HRP reduces total power consumption, reduces end-to-end delay, increases packet delivery ratio and achieves maximum network lifetime.

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