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Design and Development of Energy Efficient Multipath Routing Protocol for Mobile Ad-hoc Network

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Abstract

Mobile Ad Hoc Networks (MANET) is a collection of nodes connected without an infrastructure. The major design issues in the MANET are multipath routing dynamic energy consumption. To address the above issue there are several energy-efficient multipath routing protocols proposed. To maximize the network Life Time is one of the best methods. It was understanding that the Multipath Routing Protocols have a few major challenges and demands such as Path Discovery and Maintenance as well, Disjoint Route, Route Selection, Route Failure, Bandwidth Allocation, Throughput, Power Consumption, End-to-End Delay. This Research Work identified the following recently proposed Routing Protocols designed for Mobile Ad Hoc Networks (MANET) and the protocols are Ad-Hoc On-demand Multipath Distance Victor with the Fitness Function (FF-AOMDV) and Secure Three Fish Distributed Routing (STFDR).FF-AOMDV is performing well because of the Fitness Function to minimize the energy consumption and FF-AOMDV unable to address Power Dissipation that leads link failure and it minimizes the life time of the MANET. PLA-AOMDV is proposed to address an efficient way to manage Power dissipation. This work has been implemented to address the Power dissipation that leads to link failure. From the Experimental Results, PLA-AOMDV is outperforming compared to the FF-AOMDV. From the analysis of the Results, PLA-AOMDV needs to be observed effectively for the Link Breakage and Link utilization. To address this enhanced model ELA-AOMDV (Energy-Load Aware-Ad Hoc On Demand Multipath Routing Protocol) is proposed. It is to Maximize the Energy Efficiency and Load Balancing for the entire Network and the refinement of the Route Selection of PLA-AOMDV is to yield better results. From the Experimental Results, ELA-AOMDV is outperforming compared to the PLA-AOMDV in terms of Throughput, Packet Dropping Rate, Energy Consumption, Dead Node Count (Network Life Time).

Keywords: *Bandwidth, Throughput, node Failure, Energy consumption, Energy efficiency.*

I. Introduction

MANET is an ad hoc network and it won't require any infrastructure for carrying or supporting data packets any two different nodes. Mobile ad hoc networks consist of a flat network infrastructure. It has a medium called sharable medium which is used in radio communication. In MANET architecture the nodes are considered as a computer node or any end host. The MANET architecture with nodes and hosts belong to autonomous systems. MANET is considered as adynamic in nature so that all nodes promote mobility. The nodes in the MANET architecture also act as a router which promotes routing the packets from other nodes.

The VANET consists of free network nodes and that are installed in vehicles and also in cars. The MANET potential is measured by various challenges like signal protection and the reliability of mobile and also dynamism of nodes. The main limitations are the issue of limited processing power, providing an adequate power supply for more devices within a MANET. Even though several challenges are still there in MANET it acts as an interesting alternative to traditional networks. A Mobile Ad-Hoc Network (MANET) consists of mobile hosts which contains

wireless communication devices.

Proactive Routing Protocol is Table driven Routing Protocol. Routing tables are updated periodically and if there is a change then Each node is used to send a broadcast message to all the other nodes in the network, in order to detect the changes in their network topology. This is working well only for the small networks.

In On-Demand Routing Protocol routes are established based on the requirements. There are two phases 1. Route Discovery and 2. Route Maintenance. Some of the Reactive protocols are Dynamic Source Routing protocol (DSR) and Ad-Hoc On Demand Vector Routing protocol (AODV).

II. Literature Review

The computer industry has been actively building large scale data centers that deliver enormous computational power and storage capacity needed by data-intensive applications [1,2]. Clusters with tens of thousands of nodes have become more prevalent in recent years. As the network size increases, the main concern of the data center operators is to achieve higher performance without increasing the infrastructure cost. The data center architectures have different end goals that require optimization of different characteristics [1,2,3,]. The performance of the data center network can be characterized in terms of Bandwidth, Reliability, Throughput, Packet Delivery Ratio, End-To-End Delay, Power Consumption, Latency and Cost [1, 2, 4, 5]. The Energy Consumption of the data centers has become a critical problem. A cryptographic scheme is used to authenticate the routing control packets to mitigate the malicious attack. The Authentication-Based Routing Protocols are based on the key management mechanism. This sometimes creates a secure routing key management cyclic interdependency problem [1,2,3,4, 6]. Hence, an authentication based secure routing protocol should use a key management mechanism which is not dependent on secure routing [1, 5, 7].

III. Implementation

Identified Problems

Existing Routing Protocols FF-AOMDV & STFDR were implemented and simulated with NS3 and the Protocols were studied clearly in terms of Throughput, Packet Delivery Ratio, End-to-End Delay, Packet dropping Ratio, Energy Consumption & Packet Loss Ratio.

Fitness Function Ad Hoc On Demand Multipath Routing Protocol (FF-AOMDV)

The fitness function performs a scan on the network in order to find nodes that have a greater energy level (blue nodes). The best route will specify the route that has the least distance and highest energy level. Secure Three Fish Distributed Routing (STFDR). This Protocol is able to provide dynamic distributed routing algorithms that can protect the data for secure transmission [1,16,18]. The cipher data included SHDKey and it is reapplied to the decryption process to get the original plain text.

Data flow of Skein Hash dynamic key generation

Step 1: Get the parameters current network time, source-id, receiver-id, port no of source, port no of destination, sequence number, and newkey

Step 2: The Dkey is created by appending with newkey along with secure digital signature

Step 3: The Dkey is merged with Hashkey and generate new SHDkey. STFDR consists of two phases one is route discovery and other one is route maintenance.

Node Selection for the Route Discovery

PLA-AOMDV is used to select the optimal routes with Energy levels of the node. If ELevel > 60% of Actual level, Node is considered as Normal status. If ELevel <= 60% && ELevel > 25% of Actual Level, Node is considered as Warn status. If ELevel <= 25% of Actual Level, Node is considered as Dancer status Power-Load Aware Multipath Routing Protocol

Route discovery and Route Selection Process

The structure of Route Request Packet (RREQ) is modified with control packets are Route Request Packet (RREQ), Route Reply Packet (RREP), Route Error (RERR) and Route Request Table (RRT). There are two steps to be followed for the communication between the nodes i. Route Discovery & ii. Forward Packets.

IV. Results & Discussion

This research work has identified recently proposed two Routing Techniques namely Fitness Function based Ad Hoc On Demand Multipath Distance Vector Routing Protocol (FF-AOMDV) and Secure Three Fish Distributed Routing (STFDR) has been implemented and studied in terms of Throughput, Dropping rate, Packet Delivery Ratio, Packet Loss Ratio, Energy Consumption and End-to-End delay

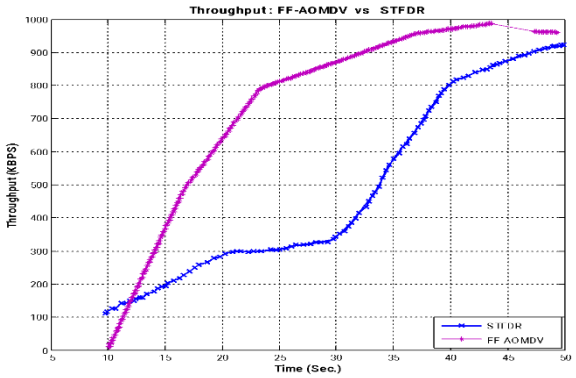


Figure 1: Throughput

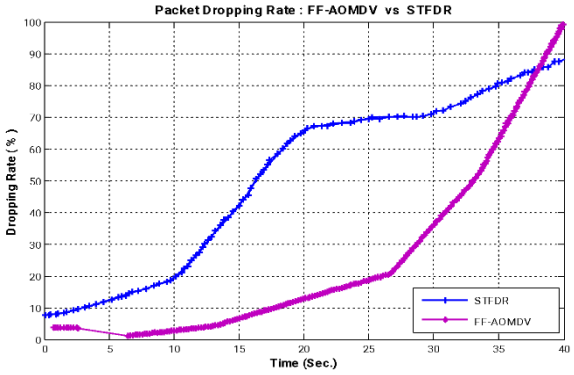


Figure 2: Packet Dropping

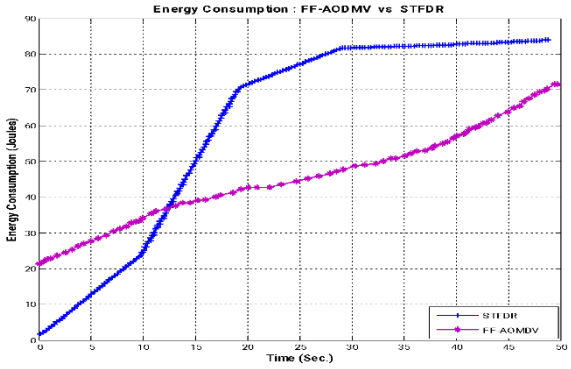


Figure 3: Throughput

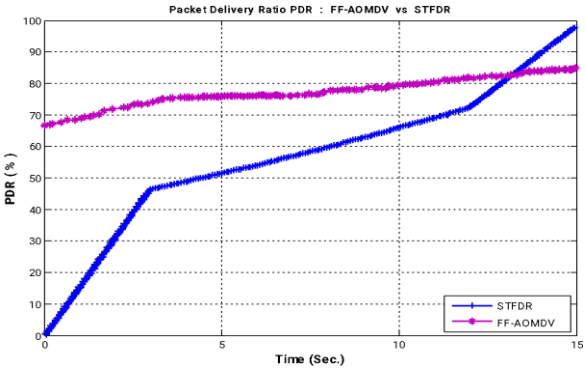


Figure 4: Packet Delivery Ratio

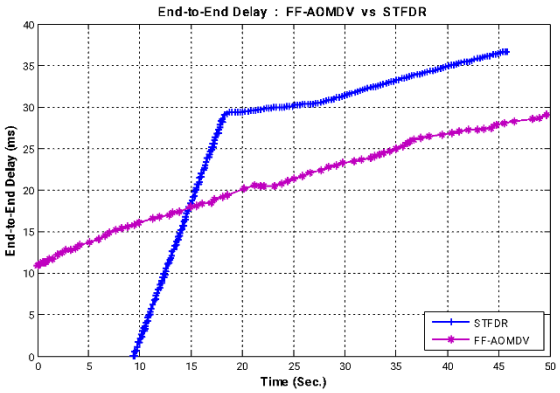


Figure 5: End-to-End delay

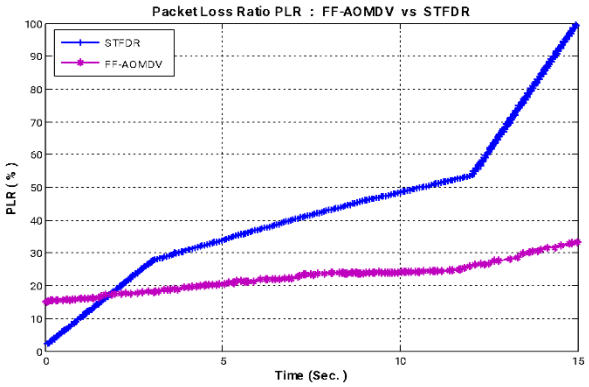


Figure 6: Packet Loss Ratio

The experimental results established that the FF-AOMDV outperformed when compare with STFDR under major network performance parameters. FF-AOMDV unable to address Power Dissipation that leads link failure. It minimizes the life time of the MANET.The Performance of a PLA-AOMDV is carried out. Studied Power Efficiency of a Model with Low Load and Heavy Load. Simulations are conducted in QualNet 6.1 and integrated with VC++ tool. The Simulation Area is 500X500 m2. Different Packet Rates 512KBPS AND 1024 KBPS.

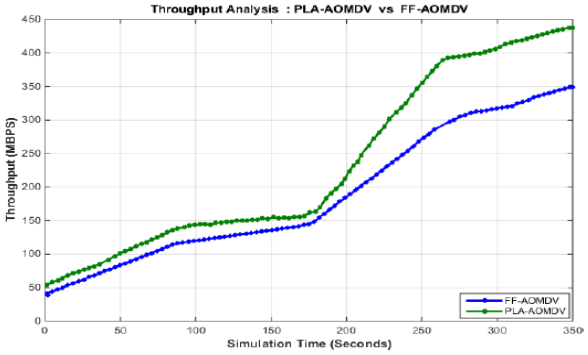


Figure 4.5: Throughput Analysis

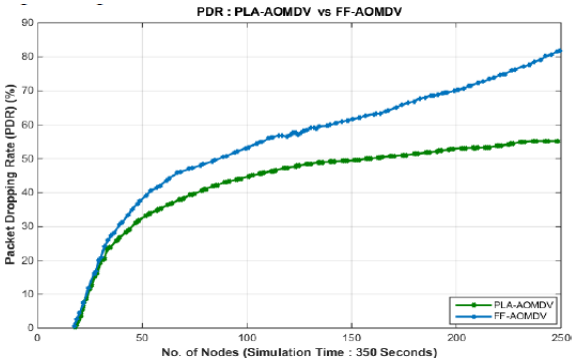


Figure 4.6: Packet Dropping Rate

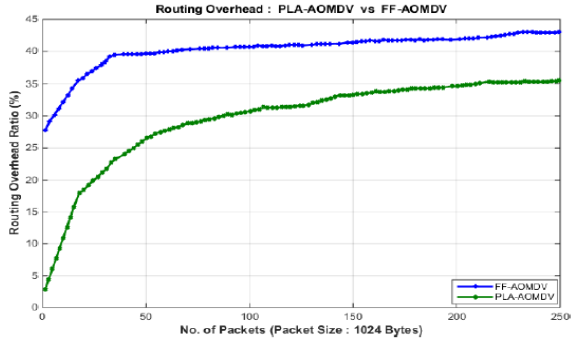


Figure 4.7: Routing Overhead

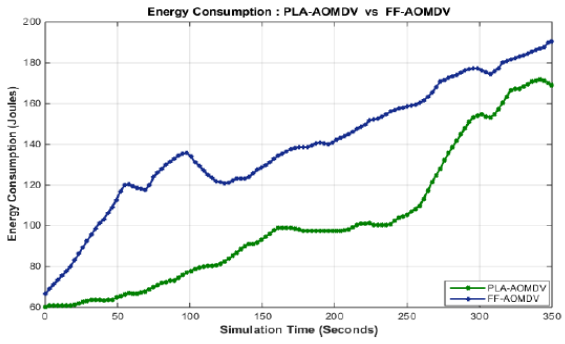


Figure 4.8: Power Consumption

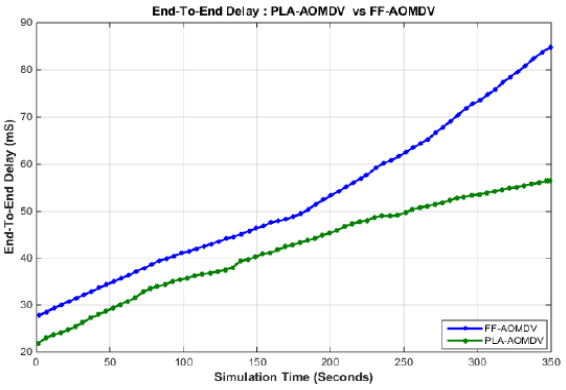


Figure 4.9: Packet Delay

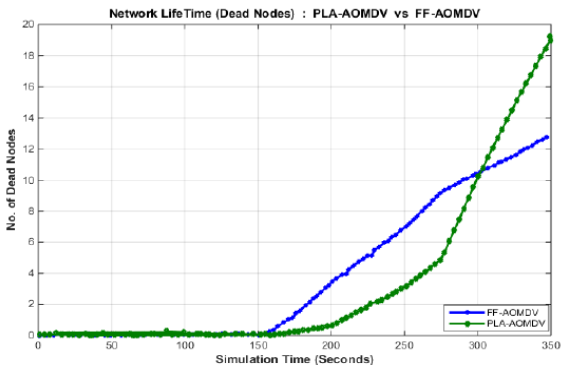


Figure 4.10: No. of Dead Node

From the analysis of the Results, PLA-AOMDV needs to be observed effectively for the Link Breakage and Link utilization. To address this issue, it is to be added ELA-AOMDV (Energy-Load Aware-Ad Hoc On Demand Multipath Routing Protocol) is proposed. It is to Maximize the Energy Efficiency and Load Balancing for the entire Network. The refinement of the Route Selection of PLA-AOMDV is to yield better results. The performance efficiency of a ELA-AOMDV is carried out. Studied Power Efficiency of a Model with Low Load and Heavy Load. Simulations are conducted in QualNet 6.1 and integrated with VC++ tool. The Simulation Area is 500X500 m2 and Different Packet Rates 512KBPS AND 1024 KBPS.

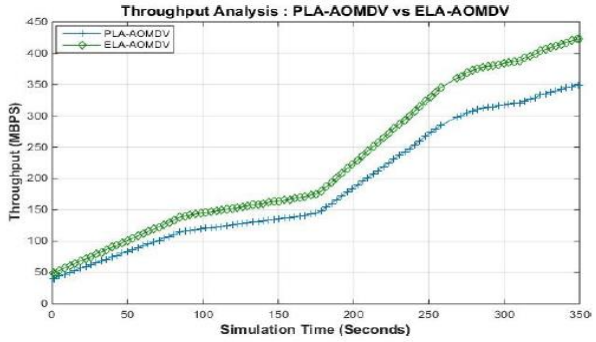


Figure 5.3: Throughput -ELA-AOMDV

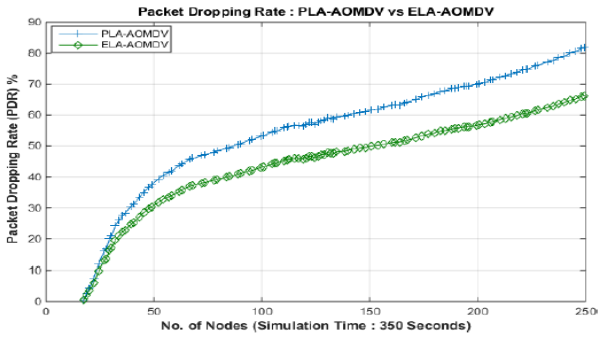
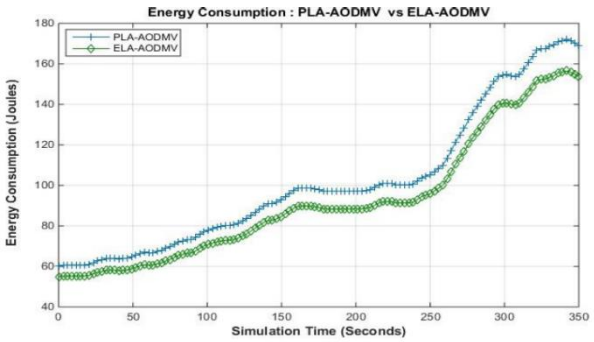


Figure 5.4: Packet Dropping Rate- ELA-AOMDV



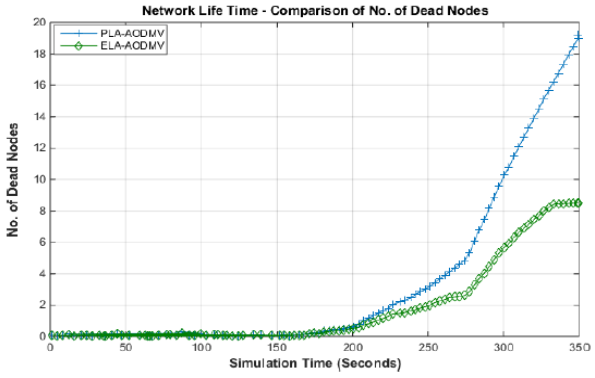


Figure 5.5: Energy Consumption-ELA-AOMDV
Figure 5.6: No. of Dead Node - ELA-AOMDV

Enhanced PLA-AOMDV by modifying the Route Selection Process of Energy Consumption, Residual Energy of Nodes and Link usage and Link Break Degree Proposed an efficient Route Selection Scheme to maximize Energy

Efficiency and Load Balancing of the entire Network.

V. Conclusion and Future Work

This Research work has been identified recently proposed two Routing Protocols are Fitness Function based Ad Hoc On Demand Multipath Distance Vector Routing Protocol (FF-AOMDV) and Secure Three Fish Distributed Routing (STFDR). These Two techniques have been implemented and studied carefully in terms of Throughput, Packet Delivery Ratio, End-to-End Delay, Packet Dropping Ratio, Energy Consumption and Packet Loss Ratio. These Two techniques have been implemented and studied carefully and the Experimental Results shows that FF-AOMDV outperformed compared to the STFDR. This Research work noticed that FF-AOMDV unable to address Power dissipation that leads to Link failure. This minimizes the lifetime of the Network. This work proposed an efficient Power-Load Aware Ad Hoc On Demand Multipath Routing Protocol. Experimental Results shows that Link Break Degree and Link Utilization needed to calculate effectively to retain a stable route for the communication. To address the identified issue the enhanced model of PLA-AOMDV is implemented. The proposed model ELA-AOMDV was implemented with the better performance in terms of Throughput, Packet Dropping Rate, Energy Consumption & Dead node count.

In this Research work, Routing Protocols features can be extended to future works. To Prevent the Ad hoc Networks from the malicious attacks It includes, to avoid malicious nodes which can easily interact with the Network. It may break the communication between the nodes. Dynamic Topologies of the MANET is difficult to identify the malicious behavior. Security Performance needs to be taken care in the future work.

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