Survey of Energy Efficient Multipath Routing Protocols for Mobile ad-hoc Networks

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Abstract *– In Mobile Ad-hoc networks (MANETs), due to restricted power energy offering and frequent topology changes caused by node mobility, routing becomes a difficult problem. In this paper we have studied the varied techniques and algorithms to overcome these entire drawbacks. The network communication between a source and destination is generally in multi hop for which energy of the devices plays a vital role besides mobility. The process of routing in energy dependant networks needs to meet stability and sustainability throughout the communication period. Death of node due to energy exhausted in ad hoc network leads to the network partition and causes communication failure in the network. Simply, the link stability and flawless communication relies indirectly over the energy of the devices. Since energy is limited in wireless mobile ad-hoc networks, designing energy aware routing protocols has become a main issue. Routing protocols are responsible for ensuring energy efficient path discovery and attempts to reduce energy consumption of the nodes, in the network. The analysis planned during this paper highlights this very specific drawback of energy consumption in MANETs. We propose a new multipath routing protocol called the FF-AOMDV routing protocol, which is a combination of Fitness Function and the AOMDV's protocol and dragonfly topology.*

Keywords*: Energy efficient protocol, mobile ad hoc network, multipath routing.*

I. Introduction

Mobile Ad-hoc Networks (MANETs) are assortment of self routing enabled devices that communicate among themselves with none specific network infrastructure. Obviously, these networks are decentralized and believe neighbors for communication. The topology of the networks isn't fixed and is subjected to alter over time because of the mobile nature of the devices. The network communication between a supply and destination is mostly in multi hop that energy of the devices plays an important role besides quality. The method of routing in energy dependant networks must meet stability and property throughout the communication amount. Simply, the link stability and perfect communication depends indirectly over the energy of the devices.[8] Routing protocols are responsible for ensuring energy economical path discovery and tries to reduce energy consumption of the nodes, within the network. Major routing protocols minimize energy consumption by choosing minimum hop distant nodes, so as to enhance transmission rates or to reduce delay in transmission. Recent approaches in energy routing concentrates in choosing specific nodes supported their on the market residual energy by that the protocol/ technique is sure to realize energy efficiency with different limited network performance.[8]

Due to the speedy progress of wireless and mobile Communications, mobile ad hoc networks (MANETs) became very popular within the previous few years. A mobile ad hoc network is outlined as a set of mobile and wireless devices that hand in glove forms a brief and self-organizing network and doesn't would like any underlying infrastructure or centralized administration. Indeed, communication between mobile nodes within the network is wireless and every one mobile devices behave as an end point or as a router, forwarding messages to nodes among radio vary, per the network wants [10]. MANETs are very flexible and appropriate for many varieties of applications. Some necessary applications of MANETs are military applications, disaster recovery, exploration, enforcement, sensor networks and transmission applications [10]. In style of ad hoc networks an essential issue is that the effective routing of packets to destinations. These challenges are with success controlled naturally, which, as a results of many years of evolution, have yielded several biological systems and processes with intrinsic appealing characteristics like adaptively to variable environmental conditions, inherent resiliency to failures and damages, successful and cooperative operation on the idea of a limited set of rules and with global intelligence that is larger than superposition of people, self-organization,
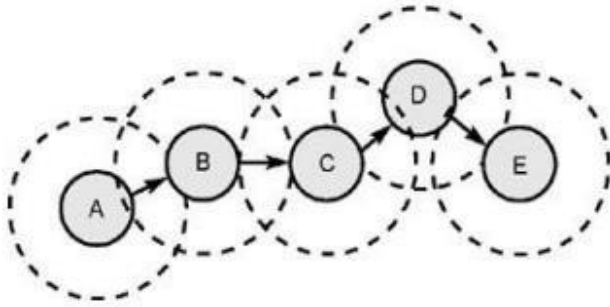
survivability, and resolvability.[10]

Fig.1 A mobile Ad hoc network of five nodes

II.   Literature Survey

Mueen Uddin et al.[1] "Energy Efficient Multipath Routing Protocol for Mobile ad-hoc Network Using the Fitness Function", In this analysis, we tend to projected a replacement energy economical multipath routing algorithmic rule known as FF-AOMDV simulated using NS-2 below 3 totally different situations, variable node speed, packet size and simulation time. These situations were tested by 5 (5) performance metrics (Packet delivery ratio, Throughput, End-to-end-delay, Energy consumption and Network lifetime). Simulation results showed that the projected FF-AOMDV algorithmic rule has performed much better than each AOMR-LM and AOMDV in throughput, packet delivery ratio and end-to-end delay. It additionally performed well against AOMDV for conserving a lot of energy and higher network lifetime.

Dhirendra Kumar Sharma et al.[2] "An Update based Energy-Efficient Reactive Routing Protocol for Mobile Ad Hoc Networks", In on-demand routing protocols, a group of links (route) is created by route discovery method whose correct maintenance will increase the period of time. In our planned technique, periodic update and overhearing method consume less energy, as a result of the periodic update (HELLO process) starts only there's any quality. We tend to are using hello intervals, 1500ms and 500ms, for static and dynamic networks severally, to update the entries of the routing table (and ART). The high-speed movement of nodes is that the major weakness of RSS. It will increase the distance between nodes and needs high transmission power to hide it. This successively speedily discharges the battery power (PS). Another issue of high-energy consumption is that the retransmission tries for successful delivery. Our proposal is inspired by energy aware routing protocols. During this paper, we've planned 3 algorithms: route discovery (RREQ process, RREP processing), link-failure prediction and route maintenance. Our planned route discovery is employed to search out the low value energy efficient route on the idea of RSS and ps. Link failure prediction formula helps to watch the active route that avoids the retransmission of packets through weak link. It works by the means that of received packets that

contain, latest RSS and ps. once the link failure method, we tend to begin the route maintenance as mentioned in route maintenance formula. The target of our planned technique is to keep up the continuity of routing while not intense excess energy. Our planned technique doesn't use the load equalization approach for load distribution as a result of multipath routes are broken by random quality of mobile nodes. Our results show that planned technique reduces the ability consumption throughout the topological changes. We tend to reduce the receive threshold of nodes to regulate the overhearing method. In our simulation only active nodes begin the hello method. We tend to establish low value energy routes using the planned route discovery method and maintain the broken link by increased route maintenance method.

Omar Smail et al.[3] "A multipath energy-conserving routing protocol for wireless ad hoc networks lifetime improvement", In this article, we've got provided a solution to the issues of routing in a billboard hoc network. Mobile ad hoc networks are characterized by their lack of infrastructure and their dynamicity: link failures and route breaks occur often. Moreover, the frequent changes of topology exhaust the batteries of the nodes that decrease the network performance. a replacement multipath routing protocol, AOMR-LM, has been projected during this paper, performing energy-aware routing in mobile ad hoc networks. We've got shown that AOMR-LM conserves the residual energy of nodes and balances the consumed energy over multiple ways. AOMR-LM routing protocol is an extension of the present multipath routing protocol AOMDV. It uses an energy-aware mechanism that exploits the residual energy of nodes to select and classify the ways consistent with the energy of their nodes. This idea extends the network lifespan and improves energy consumption in comparison with different solutions known within the literature. The constant α is analyzed so as to search out acceptable values, that are needed to outline the category of a node throughout the reply-forwarding method and to preserve the node residual energy. Comparison the performance of AOMR-LM with those of the AOMDV and ZD-AOMDV protocols, AOMR-LM is ready to balance the energy consumed. It will increase the lifetime, consumes less energy, and contains a lower average end-to-end delay than the opposite simulated protocols because ways are computed depending on the energy of their nodes, and also the one amongst the simplest ways is chosen.

Hassanali Nasehi et al.[4] "IMPROVING ENERGY EFFICIENCY IN MANETS BY MULTI-PATH ROUTING", Some multipath algorithms within the ad hoc networks divide information at supply and at the same time send completely different the various components to destination via different ways to reduce end-to-end delay. During this approach, using node disjoint ways sounds like a good possibility. however sending traffic through node disjoint ways isn't fully

independent of every different and since of the mechanisms for shared channel access in wireless networks like the CSMA/CA protocol, sending data through a path will affect another path. Such issues may be solved by implementing regional disjoint ways rather than node disjoint ways for sending data at the same time. During this paper, a new multipath routing formula is usually recommended supported AODV that uses all antennas to get and use regional distinct ways. To attain this goal, active neighbors of every path square measure counted. Also, choice is dead supported the quantity of active neighbors. The planned formula is compared to AOMDV, AODVM and IZM-DSR algorithms throughout numerous situations, and enhancements are obtained within the field of energy consumption, end-to-end delay and packet delivery ratio. However instead, our planned algorithm's routing overhead is above AOMDV and AODVM algorithms.

Yogesh Chaba et al.[5] "ISSUES AND CHALLENGES INVOLVED IN MULTIPATH ROUTING WITH DYMO PROTOCOL", Multipath routing is a good suggests that of improving the performance of on-demand routing protocols in MANETs. Having backup routes to a destination helps reduce packet loss and also the frequency of route discovery (especially within the presence of mobility-induced failures), that may be a major supply of performance loss and latency in on-demand protocols like DYMO. At the same time, finding multiple ways during a single route discovery reduces the routing overhead incurred in maintaining the affiliation between supply and destination nodes. Multipath routing will offer load equalization under actual traffic conditions. Quality of service ought to be measured multiple metrics, not in terms of specific metrics, like bandwidth, delay, or responsibleness. As an example, once checking out multiple ways that have the specified bandwidth, it's desirable to search out reliable and non energy constraint ways. Given the faulty nature of MANETs, constructing a multipath route that meets the bandwidth needs whereas additionally meeting sure different necessities would lead to higher performance. It might be desirable to develop a multipath protocol which will offer delay bounds or guarantees.

Table 1 Literature Survey

S.No.	Author's Name	Paper Title	Proposed Work	Limitations
1.	Mueen Uddin et al.[1]	Energy Efficient Multipath Routing Protocol for Mobile ad-hoc Network Using the Fitness Function	Proposed energy economical multipath routing algorithmic rule known as FF-AOMDV	Throughput becomes unstable with varying node distance, and energy consumption
2.	Dhirendra Kumar Sharma et al.[2]	An Update based Energy-Efficient Reactive Routing Protocol for Mobile Ad Hoc Networks	Planned 3 algorithms: route discovery (RREQ process, RREP processing), link-failure prediction and route maintenance for consume less energy	Limiting power consumption at multiple nodes is not possible
3.	Omar Smail et al.[3]	A multipath energy-conserving routing protocol for wireless ad hoc networks lifetime improvement	Performing energy-aware routing in mobile ad hoc networks.	Not feasible at higher network load
4.	Hassanali Nasehi et al.[4]	Improving Energy Efficiency In Manets By Multi-Path Routing	A new multipath routing formula that supported AODV that uses all antennas to get and use regional distinct ways.	Exposed Terminal Problem and Hidden Terminal Problem
5.	Yogesh Chaba et al.[5]	Issues And Challenges Involved In Multipath Routing With Dymo Protocol	Improving the performance of on-demand routing protocols in MANETs.	High packet loss

III. Energy Efficient Routing Protocol

In ad-hoc network or the other wireless network battery power is major necessity. The technology friendly devices that operates on battery power helps to extend energy with efficiency by decreasing the energy they consume, additionally maintains the performance as per expectance. Power consumption isn't only the live for energy efficiency. Energy efficiency may be measured by noting the time that network performs very well referred to as network lifetime. Generally once routes with lowest energy are followed .Through these routes additional traffic will flow however it adversely affects the entire nodes gift within the network. These nodes get exhausted in very short time therefore in this case network cannot offer smart results because of failure of network nodes. For higher energy efficiency power consumed by each node ought to be in balanced quantity at the same time network period of time ought to be most therefore all the routes and nodes get balanced globally [13].

There are many sorts of routing algorithms. 1st is broadcasting. In broadcasting if any rout gets failed then it broadcasts message to different nodes so new route get developed simply. The second sort is multicasting in routing protocols. Throughout multicasting one cluster of nodes will communicate with multiple different teams of nodes. Last sort is uni-cast routing during which only 1 to 1 communication occurs. In wireless network nodes is failed. It's hard to save energy whereas broadcasting as re-routing is needed throughout node failure. Throughout multicasting saving energy is same massive challenge to realize as in broadcasting. In uni-cast saving energy fully depends on standing of link [14].

In ad hoc networks energy is limiting value all different factors whole depends on energy. It's necessary to use energy in correct method. Nodes behavior depends on few characteristics they are:

Firstly energy of nodes fully depends on battery with limited power provide. Second there's probability of failure in routes because nodes are mobile implies that they will move with none central control. Third bandwidth of wireless network is incredibly limited as compared to wired network. Bandwidth isn't constant it varies time to time. Wireless network have very low bandwidth that adversely affect the network. Someday higher than characteristics creates several issues like node failure, route failure etc in network.

To get eliminate higher than issues only 1 resolution is feasible that's to style energy efficient protocols. Making protocol energy efficient is generally done in reactive protocols as they are additional energy efficient than proactive protocols. The energy efficient protocols that are already introduced still have several drawbacks. Flooding in correct sense in reactive protocol also can

help in achieving energy efficiency. If effective metrics like value, per node energy and battery level are used for route selection it'll additionally save energy properly.

Proposed System:
We proposed a new multipath routing protocol called the FF-AOMDV routing protocol, which is a combination of Fitness Function and the AOMDV's protocol and dragonfly topology.
In a normal scenario, when a RREQ is broadcasted by a source node, more than one route to the destination are found and the data packets are forwarded through these routes without knowing the routes' quality.
By implementing the proposed algorithm on the same scenario, the route selection will be totally different. When a RREQ is broadcast and received, the source node will have three types of information in order to find the shortest and optimized route path with minimized energy consumption.

IV. Conclusion

Different protocols behave differently in ad hoc networks. Performance of the routing protocols varies on the idea of variation in network parameters like nodes are mobile they'll move in uncontrolled approach, their behavior additionally depends on the power provided by battery and variation in low bandwidth. This review can help the researchers to choose smart energy economical protocol and additionally helps them to introduce new energy economical protocol.

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