Routing Optimization to Maximize Network Life time using Deactivation of Uninteresting Nodes in ADHOC Network

Vikas Sarkar, Nikhat Raza, B. L. Pal

Abstract— **In ad-hoc networks, to guarantee the delivery of a packet from sender to destination, each node must maintain the energy level information of its neighbor along with itself in routing tables depending upon the network structure and geographic position assisted routing. Energy aware routing proposal deals with efficient utilization of energy resources. By controlling the early depletion of the battery it changes the power to decide the proper power level of a node and include the low power strategies into the protocols used in various layers of protocol stack. Therefore, a network needs to meet such requirements for the end users to satisfy a particular application while transporting a packet stream from a source to its destination. The energy aware routing should be efficient enough to deal with wide range of performance issues like Packet Delivery Ratio, Network Routing Load, Average End-End Delay, Routing Packet and Jitter. This paper focuses on method of energy awareness in communications between ad-hoc network nodes. The problem, of, energy constraints has been addressed in different protocols, which are based on existing protocol.**

Index Terms— **MANET, AODV, Routing Protocol, Routing Table, Energy of Node, Packet Delay**

I. INTRODUCTION

An ad-hoc mobile network is a collection of mobile nodes that are dynamically and arbitrarily located in such a manner that the interconnections between nodes are capable of changing on a continual basis. Nodes are capable of moving randomly and connected without having any fixed infrastructure i.e. wireless medium. Routing protocols are used to discover routes between nodes. All the nodes in a MANET act both as a host and as a router. The biggest challenge in MANET is to reduce energy consumption also the overhead of each node to give a better packet delivery ratio. This research paper gives the new energy based suggestion in AODV protocol that will takes node's remaining energy into account for finding better route for communication to forward the packets in MANET. Results are simulated using Network Simulator NS-2.34 which shows significant performance enhancements during communication as compare to the original AODV in terms of energy consumption and network reliability. This Proposed approach gives the acceptable level of packet delivery ratio.

Manuscript received October 12, 2014.

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II. ENERGY EFFICIENT MANET

To achieve reduced energy consumption while maintaining effective communication, our framework incorporate routing information from on-demand ad-hoc routing protocols and power management capabilities from the MAC layer. Energy conservation is accomplished by judiciously turning on and off the specific nodes in the network. The innovation of framework is that such power management decisions are driven by active communications in the network. Transitions between power management modes for each node are related with a soft-state timer that is established and refreshed by data and control messages in the network. Once the soft state is established, subsequent data delivery can be speed up without incurring additional delays from waking up sleeping nodes along the route. The length of the soft state timer reflects the adaptiveness of the power management framework since the operations of transmitting to a sleeping node and an active node are different; the mechanisms to discover a neighbor's power management mode [1]. In this situation, neighbor discovery is challenging because a node in power-save mode cannot monitor the channel consistently. Therefore, any neighbor information may be ambiguous. The key idea of our on-demand power management framework is that transitions from power-save mode to active mode are triggered by communication events such as routing control messages or data packets and transitions from active mode to power save mode are find out by a soft-state timer. The soft-state timer is refreshed by the similar communication events that trigger a transition to active mode. A node keeps track of its neighbor's power management mode either by HELLO messages or by snooping transmissions over the air.

For route discovery, when the source node requires a route to a destination node with particular energy requirements, it broadcasts a RREQ packet on the basis of node current energy to its neighbor nodes. When a node receives a RREQ packet, it first makes sure that it has enough available energy for the request. A node which does not satisfy the energy constraint will avoid rebroadcasting of RREQ packet [2]. If required energy is available, a reverse route entry is created with the particular session ID and used to forward the RREP to the source node. Once the route discovery packet is delivered at the destination, a route reply is generated. In packet forwarding process every node along the path check its remaining energy as control condition and based up on this it will forward the packets or else drop the packets.

One distinguishing feature of Energy Efficient ad hoc routing protocol is its use of power for each route entry. For given choice between two routes to a destination, anode which requests is required to select one with better power status and more active.

A new scheme has been proposed that works on a reactive approach and utilizes alternate paths by satisfying a set of energy and distance based threshold criteria. This new modified scheme can be incorporated into any ad hoc on-demand routing protocol to reduce frequent route discoveries. When data cannot be delivered through the primary route then only an alternate routes are utilized.

Energy efficiency has become an increasingly important requirement in designing access networks. One aspect in designing energy efficient networks lies in reducing the static network power consumption by optimizing node, system and architecture design. Another aspect lies in adopting load adaptive techniques such that power consumption can be further decreased during periods of reduced network load. Load adaptive techniques range from simple autonomous power shedding techniques to advanced system or network functions that require cooperative scheduling decisions between different network elements.

Battery power of the nodes is primarily consumed while transmitting packets (in addition to performing the processing in the nodes). As, MANETs are multi-hop, there are chances of a node's involvement in data transfer irrespective of not being a target or a source. The routing algorithm decides which of the nodes needs to be selected in a particular communication. Thus, routing algorithms play an important role in saving the energy of a communication system and the life of the nodes and thus of the whole network.

III. Literature Review

There are various so many methods for appraisal of network lifetime and improvement of reliability of MANET. A number of routing algorithms are used to improve the link lifetime as well as the nodes battery life time as routing metrics to allow the most consistent and energy efficient route to be selected for communication.

In [3], S. Preethi proposed an energy efficient route discovery procedure for AODV based on ERS. The approach saves energy of the nodes by avoiding the redundant rebroadcasting of the route request packets. The relaying position of the node is decided based on the broadcasting of its RREQ packets by its neighbors. It support in reducing routing overhead incurred during the route discovery process.

Dr Chandra Shekar Reddy Putta at.el in [4], author approach must take into account the ad-hoc networks specific characteristics: limited bandwidth, dynamic topologies, energy constraints and limited physical security. There are two main routing protocols classes are studied in this paper: proactive protocols (e.g. Optimized Link State Routing - OLSR) and reactive protocols (e.g. Ad hoc On Demand Distance Vector - AODV, Dynamic Source Routing - DSR).

Sanjay Kumar Dhurandher at el. in [5] has proposed an energy efficient metric for MANETs to minimize energy consumption and increase the network's stability. Earlier works mainly focused on the shortest path method to reduce energy, which might result into network failure because some nodes might weaken fast as they are used repetitively. There can be while some other nodes might not be used at all. It may lead to energy disparity and to network life reduction. The paper proposed an Energy Efficient Ad-Hoc on-Demand Routing (EEAODR) algorithm that balances energy load between nodes so that a minimum energy level is maintained among nodes and the network life is improved. The work focused on increasing the network long life by distributing energy consumption in the network.

Feeney [6] shows the requirement and actual measured current represented by one popular wireless network interface card in the four possible modes. Receive and idle mode require same power and transmit mode requires a little greater power. Sleep mode requires less power than idle mode. These power measurements demonstrate that the network interface expends similar energy, whether it is simply listening or receiving data. Therefore, cleverly switching to sleep mode whenever possible will significantly increase energy savings.

Zorzi and Rao presented new strategies for routing protocol where each node follows the duty cycle that is distinct nodes wake up and sleep. MBCR (Minimum Battery Cost Routing) has been proposed in [7]. The routing protocol MBCR calculates the sum of the enduring power of all nodes in a path and uses it for choosing a path, but the method may choose a path in which there may present mobile nodes with less power. These low power mobile nodes may affect path breakage.

J. M. Kim et al., introduced an algorithm based on an energy mean Value to increase AODV routing protocol [8] and to improve the network lifetime of mobile ADHOC network.

Waoo et al. discussed the processing power of activated and deactivated node and they discussed that CPU does no processing and the node has no capability to send/receive messages. The node is inactive and consumes only 150 to 170mW. Initially the energy of nodes is set to any random value. Also, the transmission power, receiving power, idle power and sleep power is also set to a specified value. Also, they first the nearest hop node is determined because it saves energy of individual nodes. The node found after this process will become the participating node and provide alternate path to destination node [9].

C. L. Krishna and H. K. Joseph [10] proposed the idea to increase energy efficiency of nodes in the network goes into a sleep mode and wake up at preset time slot(s) to snoop for transmissions from its instant neighbours to arrange the transmissions within the neighbourhood. Also, nodes adjust their sleeping cycles based on neighbour topology and residual battery life in order to maximize the network lifetime to satisfy the latency requirements of sensor applications.

IV. Objective and Problem Statement

The main objective of the present work is to suggest the improvement in AODV routing protocol for MANETs in order to handle the problem of power management. The power management of AODV is outlined below-

- The Modified protocol will be proposed after proper verification and validation through simulations based upon the knowledge so gleaned will act as pathway for improving an existing routing protocol. The verification of the proposed protocol has been done by taking various performance metrics such as route acquisition time, routing packet, average end-to-end delay and network routing load.
- The assessment and study of on-demand routing protocols is done to evaluate and analyze the existing ad-hoc routing protocol which will help in better understanding of the basic characteristics and functioning of the protocols. The protocol is analyzed under different mobility models proposed which can be carried through simulation in

NS-2.
- Based on various parameters, comparison is done with the performance of proposed method and the existing algorithm.

The nodes in an ad hoc network are constrained by battery power for their operation. To route a packet from a source to a destination involves a sufficient number of intermediate nodes during communication. Therefore, battery power of a node is a precious resource that must be used efficiently in order to avoid early termination of a node or a network. Thus, Energy awareness is an important issue in such networks as it increases the life of a node as well as network lifetime.

The problem of node failure is serious in ad-hoc networks, which results in network partitioning. In contrast, as pointed out in a single node failure in sensor networks is usually unimportant if it does not lead to a loss of sensing and communication coverage. Ad-hoc networks are oriented towards personal communications and the loss of connectivity to any node is significant. Real time applications need mechanisms that guarantee restricted delay and delay jitter. For instance, the most important delays that affect the end to end delay in packet delivery from one node to another node are: the queuing delay at the source and intermediate nodes; processing time at the intermediate nodes, the transmission delay and the propagation duration over multiple hops from the source node to the destination node. QoS in ad-hoc networks relates not only to the available resources in the network but also to the mobility speed of these resources. It is just because mobility of nodes in ad-hoc networks may cause link failures and broken paths. In order to continue a communication and hence it requires finding a new path.

Communication (transmission and reception) is one of the main sources of energy consumption. Since the rate of battery performance improvement is rather slow and in the absence of breakthroughs in this field, it has to take other measures to achieve the goal of getting more performance out of the currently available battery resources. This study focuses on effort on method of energyness in communications between ad-hoc network nodes. The problem, of, energy constraints has been addressed in different protocols, which are based on existing protocol. Those nodes which are loss there energy they are not being a part of network, but nodes having a capability to take part in communication having a sufficient energy to do communication in the network. Due to suddenly loss of session following problems are occurring:
- Maximize the loss of packets.
- Maximize the routing load.
- Minimize throughput.

V. Proposed Concept

This proposed concept is taking node, routing protocol and the communication path as input to generate the path with nodes having highest energy of node. In this method, path is established by flooding the RREQ packets to each node to calculate the node which is having the highest energy along with ignoring the node which is not interested in participating i.e. having the least energy. Procedure for route establishment works with all participating active node and it calculate energy level of the node; It compare the energy level of the node with working level of node for all connected node; if it founds the remaining energy is greater than 50% then it returns node with highest remaining energy after checking nodes or it follows the same path. In this manner it updates the routing table and deactivates relax nodes.

VI. Simulation Parameters

To simulate our proposed models and existing models in NS-2 we used following Network parameters illustrated in Table 1. The results of our simulations represent the average of 4 runs each with different mobility scenario. These same traffic patterns are used for all simulation experiments.

Table 1: Network Simulation Parameters

Type	*Values*
Channel	Channel/Wireless Channel
Radio Propagation Model	Propagation Model / Two ray ground
Antenna	Antenna/Omni antenna
Network Interface	Physical/Wirless phy
Mac	MAC/802_11
Logic Link Layer	LL
Routing Protocol	*AODV*
Interface Queue	*Queue / Droptail / Priqueue*
Transport Layer Protocol	*UDP*
Traffic Type	*CBR*

The power consumption values and general parameter of simulation for the different modes of operation are listed in Table 2.Received packets are basically the number of packets properly received by the node or router. The number of received packet is increased in the network shows the better performance of the network. Total lost packets and received packets combines to form total transmitted packets.

Table 2: General Simulation Parameters

Type	*Values*
No. of Nodes	10
Topography	800 X 600
Packet Rate	40 packets/sec
Packet Size	512 byte
Initial Energy	Random (20m/s)
Transmission Power	1.5 J
Receiving Power	1.0 J
Idle Power	0.0 J
Sense Power	0.0175

In figure 2, shows observe that the modified algorithm achieves high reliability with higher packet receiving rate which around 12% as compared to existing AODV routing protocol. This graph increases exponentially by increasing the mobility of nodes. This shows that modified approach is more reliable and having higher network life time. We did various anlaysis which is the indication of improvement in AODV with the issues of energy efficiency.

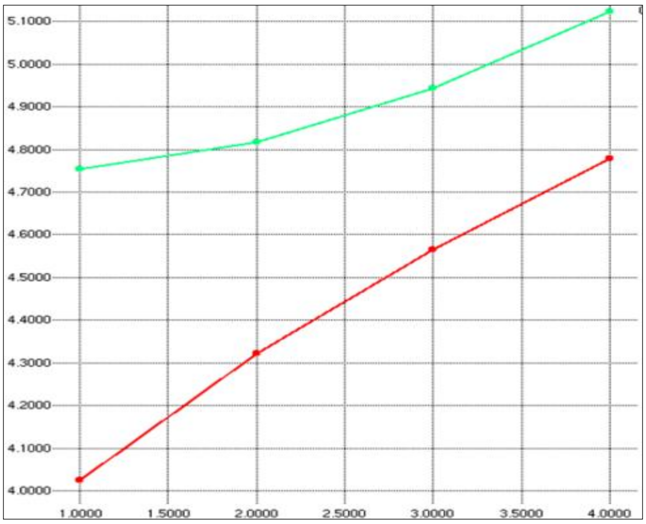

Figure 2: Comparison of Packet Received using AODV with Modified Approach

VII. Conclusion

In this paper, an overview of energy efficiency issues in ad hoc networks is discussed in detail with different energy models, which are widely used in analyzing and set up ad hoc protocols. In case of mobile nodes, data forwarding to the proper recipient cannot be done without the use of a routing algorithm. The sources of energy consumption that is associated to communications in ad hoc network were shown to exist in four main modes of operation: transmitting, receiving, idle and sleep modes. The sources of energy consumption overhead such as idle condition and collisions and by control messages protocol have been talk about. The metrics used for energy-efficiency strategies have also been explored briefly. This paper presented a case study which sheds light on some of the energy inefficiency issues encountered in ad hoc networks.

VIII. Future Work

Future work should also investigate the feasibility of applying different techniques to enhance the performance of the proposed approach. This approach has been focused on small-sized MANETs advance research can be extended to larger-scale networks involving hundreds of nodes. It can be applied to support the real implementation of complete cluster-based protocols, and assists the operation of the clusters during data transmission phase. We would like to suggest another metrics of interferences and congestion control to study their performance benefits from multipath routing approach used in the AODV routing protocol.

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