A survey on energy efficiency in mobile ad hoc networks

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Abstract

A mobile ad-hoc network is a collection of wireless mobile nodes which temporarily forms a network without any type of centralized administration which is already in use. In adhoc network, the battery lifetime of the mobile nodes is less. If suppose any nodes battery power is drained it leads to spreading of many divisions in the networks. Hence these spreader nodes are the very important spot in this network. For the purpose of data forwarding some very important nodes can drain their battery power in advance because of increase in load and processing for forwarding the data. Because of the variance in loads developed, the network of nodes will be collapsed very badly, the route lifetime will be reduced, network will be partitioned and route reliability is reduced in MANETs. Because of this, the most important criteria which have to be improved is the consumption of energy in mobile ad-hoc networks. The very important technique is power aware routing technique in MANETs. Hence minimization of energy in the network of mobile nodes individually can be done by using some of the routing techniques. The most important thing is to study the power aware protocol in order to help the new research doers and application developers to find a new idea for designing more efficient routing protocols.

Keywords: Mobile Ad hoc Networks (MANET), Proactive Routing Protocol, Reactive Routing Protocol, Hybrid Routing Protocol, Destination-Sequenced Distance-Vector (DSDV), Optimized Link State Routing (OLSR), Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA), Ad-Hoc On-Demand Distance Vector (AODV), Cluster Based Routing Protocol (CBR), Zone Routing Protocol (ZRP) etc.

1. Introduction

Mobile ad hoc network (MANET) is a set of mobile nodes which are connected with each other. The most important aspect of mobile nodes is the power is consumed and hence a new protocol which is energy-efficient is used in MANET. Signal packets are transmitted in order to reduce the hidden terminal issue by using minimum energy routing protocols because of using asymmetric transmission powers from all parts of the network nodes. Because of lot of collisions the data packets devour higher power during transferring of the packets.

Mobile ad-hoc networks is at present one of the most important research subjects, because of the large variety of applications (emergency, military, etc...). Since all the mobile nodes can act as a host as well as a router, packets are transferred from one node to another in MANET. The network topology keep on changing very often. The routing protocols which is used in wireless networks generally cannot be applied and hence a new protocol has to be implemented in order to solve this problem in MANETs.

Mobile ad hoc networks (MANETs) are independent nodes of mobile hosts which are joined by wireless links. These type of networks is has become every much important due to huge number of applications, such as:

1. Military applications like planes, tanks, soldiers, etc.
2. Personal networks like PDA's (Personal Digital Assistants), communication equipments, Laptops, etc.
3. Emergency operations such as police and firemans, searching and rescue equipment, etc.
4. Civil applications such as Transport service networks, meeting centers, boats, sport arenas, etc.

New routing protocols have to be developed in order to communicate effectively. Routing protocols which are used in wired networks cannot be applied as a protocol in the MANETs territory.

The proactive protocols use shortest path algorithm which are based on distributed protocols. With them, Each and every node have to maintain the route for all the destinations in the routing table in the network. The updated messages are sent at regular intervals to all the nodes. A huge band width is devoured because of these protocols which are implemented. A large routing overhead is available and hence route path is available for all the destination in the router table and hence delay is also less.

The reactive protocols always select the route only when it is needed. In order to maintain the route path the source node takes care of the routes. The routes are needed only on demand because the routing overhead is small. Hence there is a huge delay in the route discovery. These protocols can be used mostly in networks with movements, but it should not be unresponsive to the delay. But in proactive protocols, semi static networks are used with small delay requirement.

No particular routing protocol is available for all kinds of MANETs.

Every routing protocol have some parameters improved in some specific networking environments and also in all kinds of environments mobile nodes should be able to operate. When data packets are transferred from one mobile node to another, each and every nodes routing performance is very high in different environments i.e., from a low mobility environment to a high mobility environment).

The hybrid routing protocol combines proactive and reactive protocols and are adaptative.

2. Related work

Routing are used for wireless adhoc networks in which correct route was discovered and the path was used and also route was saved in the routing table. For all the types of routing, shortest path algorithms are used. Types of routings are given below in fig1:

2.1. Energy efficiency proactive routing

Link-state algorithms are used for wired networks using the routing table. For each and every node, a list for the next hop and for each destination the total number of hops is saved in the router for successful sending of packets. Table-driven proactive routing is used in wireless network, here each node can send and receive up to date routing information which is passed to other nodes inside the network [7].
Every node will amend the routing table and also it transfers the reconditioned one to its nearest nodes whenever there is any change in the network.
Hence, if any packet has to be sent in a proactive routing protocol the route is already available and hence the router table can be instantly used and hence battery power is not that much used for selection of routes from different routes which are available. Some of the proactive routing protocols are Optimized Link State Routing (OLSR), Destination-Sequence Distance-Vector(DSDV), Wireless Routing Protocol(WRP) [7], [8].

2.2. Energy efficiency reactive routing

A routing protocol which is reactive is called as on-demand routing. Each and every nodes in the network dispatches its request for the route to its nearest nodes and that node will send its request for the route to the next nearest nodes and hence the process continues until it arrives at the destination. When the destination node receives the request for the route it gives an acknowledgement again to the sender.
When the route connection has started successfully, the receiving node receives all the packets which is sent by the sender. Some of the routes that are used before are stored in the route cache and is used whenever the same route connection is established.
When there is connection of route always the route is maintained [7].
An on-demand routing is always used to check whether the routes are ready and also maintains them. When the routing protocols like table-driven are compared every node do not store all of the information which were used before [8].
This routing protocol does not find the un required routes and hence power is less used and also the cost is less.

2.3. Energy efficiency hybrid routing

The proactive and reactive routing protocols together combines to form hybrid routing protocol.
The overhead traffic will be controlled by proactive protocol and the delays in the discovery of routes which is in the routing table will be reduced by reactive protocol.
Examples of hybrid routing protocols are Zone Routing Protocol (ZRP), Cluster Based Routing Protocol (CBR), Hazy Sighted Link State (HSLS) [7].
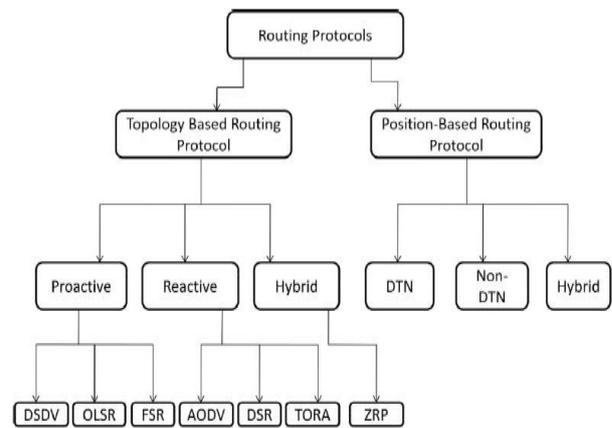

Fig.1: Types of routing

3. The routing protocols

The routes are provided for the packets to flow from a particular mobile node to the final node. The data packet travels through all the mobile nodes after the connection is established. For transferring of data packets from one mobile node to another, various algorithms are available. It can be proactive, reactive or hybrid.

3.1. Destination-sequenced distance-vector protocol

The Bellman-Ford algorithm is used for finding the less number of hops from the starting point to the ending point using destination-Sequenced Distance-Vector protocol. The number of hops, destinations, sequence numbers and the next hop address are stored in DSDV node.[12]

3.2. Optimized link state routing protocol

This optimized Link State Routing follows packet forwarding type in link state which also has a point to point protocol. Two ways of rearrangement of good like is done by this OLSR protocol. The control packets size is decreased and then the number of links is reduced [7].

3.3 Wireless routing protocol

The distance vector path finding algorithms are done by Wireless Routing Protocol. The next hops information and the last hops previous hop information also will be maintained by the WRP. The shortest path can be found out from the accessible paths. Frequently amended data is sent to every node [7], [10].

3.4 Dynamic source routing protocol

The discovery and maintenance of routes has two number of types in Dynamic source routing protocol Only during in demand these types are worked. If suppose the particular route is not specified, the routes will cause congestion in the whole mobile nodes network [11]. The routes which are needed is implemented by source routing. The packets will not be lost if the route is maintained and cache storage is available [12].

3.5. Ad Hoc on demand distance vector protocol

The adhoc on demand distance vector protocol is based on distance vector routing and when there is a demand and the maintenance of routing table is done the routes for the AODV protocol is found out.

3.6. Temporally ordered routing algorithm protocol

The temporally ordered routing algorithm which is a reactive protocol uses link reversal if destination-oriented directed acyclic graph is available.

4. Energy efficiency routing protocols for manet

In Mobile Ad hoc Networks (MANETs), by using some energy efficiency techniques energy can be preserved. While packets are transferred, more collisions occur and the power consumed is high and a hidden terminal issue is reported. In this paper, they have an energy efficiency model which is presented for MANET which uses Energy-efficient Optimized Link State Routing (EE-OLSR) protocol implements a new scheme for maintenance of path. This EE-OLSR energy model is based on a progressive search and reduce the routing overhead, path setup delay and also enhances the network lifetime for the most energy-efficient path. Here EE-OLSR model is compared with the proposed energy models. When compared to packet size, nodal speed, grid size, packet inter-arrival time, average connection arrival rate and the number of nodes this EE-OLSR model consumes lesser energy.

An efficient and new protocol called Efficient Proactive Source Routing Protocol is used to reduce the overhead of communication and to improve the packet delivery ratio for all the mobile nodes. The author has compared with the previous method that the link of transmission breaks. Hence this protocol is useful for reducing the overhead. Here where there is more strength of signals the nodes are chosen. The Multipath Route Discover Algorithm is used to reduce the overhead using destination sequence distance vector algorithm.

When the parameters of multiple tunable protocol and issues of different performance are done together, it is a tedious one. Improvement of energy can be done using protocol tuning technique and the necessities of resource. In systems which has sensor net, energy can be improved. A new method of optimization called multi-objective is discussed for two different routing protocols by using different techniques. Initially factorial design method is used and then statistical model is completed. The Strength Pareto Evolutionary Algorithm 2 and evolutionary algorithms are also used for space exploration for finding out the space in the problem.

In mobile ad hoc networks, most of the mobile devices have become more sensible with sensors and also easy movement of nodes without packet drop. The power should be reduced in MANETs because all the mobile nodes keep on moving and each mobile node will be active at all times. Hence during communication energy has to be improved without reducing the battery life. A new protocol called efficient power aware routing is implemented in order to increase the network lifetime, to reduce overhead and also to maintain the path. There may be many changes in the topology of network even though there are large amount of data, but mean delay has to be decreased.

In mobile ad hoc networks, the very important issue in research is routing and the throughput and the ratio of delivery for all the mobile networks is available. There is an Efficient, Stable, Disjoint Multipath Routing protocol which implements on-demand multipath routing protocols which reduces the node-disjoint which is selected has an interference. This protocols has very high delivery rate, high throughput is analysed with the split multipath routing protocol. It controls the packet overhead with the given router information. The GloMoSim simulator is used by the split multipath routing protocol in order to make improvement in the throughput.

Green Cellular Networking is one of the emerging trends because of some money reduction and seasonal changes also. Energy should be saved. Either new equipments can be bought and some new hardwares can be developed, replacement can be given a price for the improvement of energy efficiency. If an architecture of network has to be developed it has to be compared for the testing as well as implementation. This green cellular networking can be done a research using sleep mode techniques from any base station. The pattern in data traffic has low energy consumption and hence a very large amount of energy can be saved. While energy has been conserved for load and traffic dependent factor.

A protocol called radio resource control is implemented for less complexity or less cost and also the utilization of energy through machine communication should be reduced. Since machines are used for communication, it can be used for the purpose of Internet of Things. Hence improvement of energy on those things should be concentrated. The mobiles or machines should be used for long terms. So, improvement of energy is very important. According to the traffic pattern, some parameters are used and semi-persistent RRC state transition is used for preservation of energy and also quality of service is improved.

Huge traffic demands for ubiquitous access and emerging multimedia applications significant increase in the energy consumption of battery-powered mobile devices. This assumption leads to that energy efficiency (EE) becomes essential for mobile ad-hoc networks (MANETs). In this paper, we adapt EE optimization as measured in bits per Joule for MANETs based on the cross-layer design paradigm. We model this problem as a non convex mixed integer nonlinear programming (MINLP) formulation and jointly considering routing, traffic scheduling, and power control, because the non convex MINLP problem is NP-hard in general, it is exceedingly difficult to globally optimize this problem. We devise a customized branch and bound (BB) algorithm to efficiently solve this optimal problem. The novel of our proposed BB algorithm include upper and lower bounding schemes, branching rule that are designed using characteristics of the non convex MINLP problem. We describe the efficiency of our proposed BB algorithm by offering numerical comparisons with a reference algorithm that uses the relaxation manners. Numerical results show that our proposed BB algorithm scheme respectively decrease the optimality gap 81.98% and increases the best feasible solution 32.79% compared to the reference algorithm. Our results not only provide insights into the design of EE maximization algorithms for MANETs by enhancing co-operations between different layers and serve as performance benchmarks for distributed protocols developed for real-world applications.

5. Conclusion

Protocol has not been designed for efficient use of battery power till now. While sending packets from one mobile node to another power cannot be minimized for each and every packet and in some areas nodes also cannot make their transmission level high or low. In Mobile Ad hoc networks, each and every protocol will make act diversely. The performance of the mobile nodes depends on the various parameters otherwise, they behave in a different way. The battery power may change depending upon the bandwidth. A new protocol should be found out in order to reduce the energy consumed by all the neighbouring mobile nodes in the network. Hence a protocol which has an improvement in the network lifetime should be developed with good and efficient energy. This review can help the new research people to develop a good and new energy efficient protocol.

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