Delay and Energy-Aware Routing (DEAR) In Proactive Source Routing Protocol for Mobile Adhoc Networks

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Abstract-A wireless communication where the nodes are not within direct transmission range of each other it requires other node to forward the data this is a Mobile Adhoc Network (MANET).Opportunistic data forwarding express an assuring solution to utilize the broadcasting nature of wireless communication link. It has drawn much diligence in research community of multihop wireless network, but it has not been used in MANET because of lack of light weight proactive routing scheme with strong source routing capability .In this paper a lightweight proactive source routing(PSR) is proposed , which can have more network topology information and less overhead than other traditional DV-based protocol[e.g., destination-sequenced DV (DSDV)],link state (LS)-based routing [e.g., optimized link state routing(OLSR)],and reactive source routing [e.g., dynamic source routing (DSR)]. In this proposed PSR network overwhelming is occurring due to the route update and energy consumed is more because of node mobility. To overcome this disadvantage and new innovative method called delay and energy aware routing method (DEAR) is proposed for reducing energy consumption. In this method the delay is selected until the end of the cycle so that only one update is broadcast in each period. Furthermore, due to the dynamic topology, node consumes more energy while roaming. For this, the topology control approach has been introduced. In this approach, considered two cases, i) Energy consumption of the node and routes. ii) Link stability and location stability. The experimental result using computer simulation in Network Simulator 2(ns-2)shows that the proposed PSR and DEAR yield similar or better data transportation performance than these baseline protocols.

Keywords: Differential update, mobile ad hoc networks (MANETs), opportunistic data forwarding, proactive routing, routing overhead control, source routing, and tree-based routing

1. INTRODUCTION

A mobile ad hoc network (MANET) is a wireless communication network, where nodes that are not within the direct transmission range of each other require other nodes to forward data. It can operate without existing infrastructure and support mobile users, and it falls under the general scope of multihop wireless networking. This networking paradigm Originated from the needs in battlefield communications, emergency operations, search and rescue, and disaster relief Operations. It has more recently been used for civilian

applications such as community networks. A great deal of research results have been published since its early days in the 1980s [1]. The most salient research challenges in this area include end-to-end data transfer, link access control, security, and providing support for real-time multimedia streaming [2].

The network layer has received a great deal of attention in the research on MANETs. As a result, abundant routing protocol in this network with differing objectives and for various specific needs have been proposed [3]. In fact, the two most important operations at the network layer, i.e., data forwarding and routing, are distinct concepts. Data forwarding regulates how packets are taken from one link and put on another. Routing determines what path a data packet should follow from the source node to the destination. The latter essentially provides the former with control input. Despite the amount of effort in routing in ad hoc networks, data forwarding, in contrast, follows the same paradigm as in Internet Protocol (IP) forwarding in the Internet. IP forwarding was originally designed for multihop wired networks, where one packet transmission can be only received by nodes attached to the same cable. However, in wireless networks, when a packet is transmitted over a physical channel, it can be that channel. Traditionally, overhearing a packet not intended for the receiving node had been considered completely negative, i.e., interference.

Opportunistic data forwarding represents a promising solution to utilize the broadcast nature of wireless communication links [4]. Opportunistic data forwarding refers to a way in which data packets are handled in a multihop wireless network. Unlike traditional IP forwarding, where an intermediate node looks up a forwarding table for a dedicated next hop, opportunistic data forwarding allows potentially multiple downstream nodes to act on the broadcast data packet. One of the initial works on opportunistic data forwarding is selective diversity forwarding by Larsson [5]. In this paper, a transmitter picks the best forwarder from multiple receivers, which successfully received its data, and explicitly requests the selected node to forward the data. However, its overhead needs to be significantly reduced before it can be implemented in practical networks. This issue was successfully addressed in the seminal work on ExOR [6], outlining a solution at the link and network layers. In ExOR, nodes are enabled to overhear all packets on the air; therefore, a multitude of nodes can potentially forward a packet as long as they are included in the forwarder list carried by the packet. By utilizing the contention feature of the medium-access-control

(MAC) sub layer, the forwarder closer to the destination will access the medium more aggressively. Therefore, the MAC sub layer can determine the actual next-hop forwarder to better utilize the long-haul transmissions.

To support opportunistic data forwarding in a mobile wireless network as in ExOR, an IP packet needs to be enhanced such that it lists the addresses of the nodes that lead to the packet's destination. This entails a routing protocol where nodes see beyond merely the next hop leading to the destination. Therefore, link state (LS) routing [e.g., optimized LS routing (OLSR)] or source routing [e.g., dynamic source routing (DSR)] would seem to be good candidates. On one hand, LS routing protocols include interconnectivity information between remote nodes, which is hardly useful for a particular source node, but this incurs prohibitively large overhead. This is even true with optimization techniques such as multipoint relaying, as in OLSR [7].

Energy consumption is also an important aspect that should be considered. In general there are three components of energy consumption in adhoc network 1.energy consumed during transmission of individual packet 2. Energy consumed while forwarding these packets through network 3.energy is consumed by nodes that are idle and not transmitting or forwarding packets. Routing protocol for adhoc network generally use hop count as the routing metric which does not necessarily minimize the energy of route as packet [14]. Energy aware routing address this problem by finding energy –efficient routes for communication

A lightweight proactive source routing (PSR) protocol is proposed to facilitate opportunistic data forwarding in MANETs. In PSR, each node maintains a breadth-first search spanning tree of the network rooted at it. This information is periodically exchanged among neighboring nodes for updated network topology information, and another DEAR method is proposed which will reduce delay and energy consumption of MANET due to dynamic topology nature.

2. RELATED WORK

Routing protocols in MANETs can be categorized using an array of criteria. The most fundamental among these is the timing of routing information exchange. On one hand, a protocol may require that nodes in the network should maintain valid routes to all destinations at all times. In this case, the protocol is considered proactive, which is also known as table driven Examples of proactive routing protocols include destination sequenced distance vector (DSDV) [9] and OLSR [7]. On the other hand, if nodes in the network do not always maintain routing information, when a node receives data from the upper layer for a given destination, it must first find out about how to reach the destination. This approach is called reactive, which is also known as on demand. DSR [8] and ad hoc on-demand DV (AODV) [10] fall in this category.

These well-known routing schemes can be also categorized by their fundamental algorithms. The most important algorithms in routing protocols are DV and LS algorithms. In LS, every node floods the information of the links between itself and its neighbors in the entire network, such that every other node can reconstruct the complete topology of the network locally. In a DV, a node only provides its neighbors with the cost to reach each destination. With the estimates coming from neighbors, each node is able to determine which neighbor offers the best route to a given destination. Both LS and DV support the vanilla IP packets. DSR, however, takes a different approach to on demand source routing. In DSR, a node employs a path search procedure when there is a need to send data to a particular destination. Once a path is identified by the returning search control packets, this entire path is embedded in each data packet to that destination. Thus, intermediate nodes do not even need a forwarding table to transfer these packets. Because of its reactive nature, it is more appropriate for occasional or lightweight data transportation in MANETs.

AODV, DSDV, and other DV-based routing algorithms were not designed for source routing; hence, they are not suitable for opportunistic data forwarding. The reason is that every node in these protocols only knows the next hop to reach a given destination node but not the complete path. OLSR and other LS-based routing protocols could support source routing, but their overhead is still fairly high for the load-sensitive MANETs. DSR and its derivations have a long bootstrap delay and are therefore not efficacious for frequent data exchange, particularly when there area large number of data sources. In fact, many lightweight routing protocols had been proposed for the Internet to address its scalability issue, i.e., all naturally "table driven." The path-finding algorithm (PFA) [11] is based on DVs and improves them by incorporating the predecessor of a destination in a routing update. Hence, the entire path to each node can be reconstructed by connecting the predecessors and destinations; therefore, the source node will have a tree topology rooted at itself. In the meantime, the link vector (LV) algorithm [12] reduces the overhead of LS algorithms to a great deal by only including links to be used in data forwarding in routing updates. The extreme case of LV, where only one link is included per destination, coincides with the PFA.

PFA and LV were both originally proposed for the Internet, but their ideas were later used to devise routing protocols in the MANET. The Wireless Routing Protocol (WRP) [13] was an early attempt to port the routing capabilities of LS routing protocols to MANETs. It is built on the same framework of the P FA for each node to use a tree to achieve loop-free routing. Although it is an innovative exploration in the research on MANETs, it has a rather high communication overhead due to the amount of information stored at and exchanged by the nodes. This is exacerbated by the same route update strategy as in the PFA, where routing updates are triggered by topology changes. Although this routing update strategy is reasonable for

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the PFA in the Internet, where the topology is relatively stable, this turns out to be fairly resource demanding in MANETs.

3. EXISTING SYSTEM

Opportunistic data forwarding refers to a way in which data packets are handled in a multihop wireless network. Unlike traditional IP forwarding, where an intermediate node looks up a forwarding table for a dedicated next hop, opportunistic data forwarding allows potentially multiple downstream nodes to act on the broadcast data packet. In existing method, a transmitter picks the best forwarder from multiple receivers, which successfully received its data, and explicitly requests the selected node to forward the data. However, its overhead needs to be significantly reduced before it can be implemented in practical networks. In ExOR, nodes are enabled to overhear all packets on the air; therefore, a multitude of nodes can potentially forward a packet as long as they are included in the forwarder list carried by the packet. By utilizing the contention feature of the medium-access-control (MAC) sublayer, the forwarder closer to the destination will access the medium more aggressively. Therefore, the MAC sublayer can determine the actual next-hop forwarder to better utilize the long-haul transmissions.

Disadvantages of Existing System

1. High energy consumption
2. Less network lifetime
3. Network would be overwhelmed due to route updates
4. Incurs prohibitively large overhead

4. PROPOSED SYSTEM

A lightweight proactive source routing (PSR) protocol is proposed to facilitate opportunistic data forwarding in MANETs. In PSR, each node maintains a breadth-first search spanning tree of the network rooted at it. This information is periodically exchanged among neighboring nodes for updated network topology information. Thus, PSR allows a node to have full-path information to all other nodes in the network, although the communication cost is only linear to the number of the nodes. This allows it to support both source routing and conventional IP forwarding.

Delay and energy-aware routing (DEAR) another innovative method is proposed for reducing energy consumption and reduce the overhead.

1. When a node should share its updated route information with its neighbors, a delay is selected it

until the end of the cycle so that only one update is broadcast in each period. If a node were to transmit it immediately when there is any change to its routing tree, it would trigger an explosive chain reaction and the network would be overwhelmed by the route updates.

2. Due to the dynamic topology, node consumes more energy while roaming. For this, the topology control approach has been introduced. In this approach, consider two cases.
    a. Energy consumption of the node and routes.
    b. Link stability and location stability.

4.1 Advantages of Proposed System

1. Less energy consumption
2. High network lifetime
3. Network does not been overwhelmed
4. Offer a similar or better data transportation capability.
5. Reduce the routing overhead of PSR as much as it can

5. SYSTEM IMPLEMENTATION

5.1 list of Modules

1. Route update
2. Neighborhood trimming
3. Streamlined differential update
4. Delay and energy-aware routing(DEAR)

5.2 Description

5.2.1 Route Update

Due to its proactive nature, the update operation of PSR is iterative and distributed among all nodes in the network. At the beginning, node v is only aware of the existence of itself; therefore, there is only a single node in its BFST, which is root node v. By exchanging the BFSTs with the neighbors, it is able to construct a BFST within $N[v]$.In each subsequent iteration, nodes exchange their spanning trees with their neighbors. From the perspective of node v, toward the end of each operation interval, it has received a set of routing messages from its neighbors packaging the BFSTs. Note that, in fact, more nodes may be situated within the transmission range of v, but their periodic updates were not received by v due to, for example, bad channel conditions.Node v incorporates the most recent information from each neighbor to update its own BFST. It then broadcasts this tree to its neighbors at the end of the period.

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Formally, *v* has received the BFSTs from some of its neighbors.Node *v* constructs a union graph.

$$G_v = S_v \cup \bigcup_{u \in N(v)} (T_u - v) \qquad (1)$$

Assume that the network diameter, i.e., the maximum pair wise distance, is *D* hops. After *D* iterations of operation, each node in the network has constructed a BFST of the entire network rooted at itself since nodes are timer driven and, thus, synchronized. This information can be used for any source routing protocol.

5.2.2 Neighborhood Trimming

When a neighbor is deemed lost, its contribution to the network connectivity should be removed, this process is called neighbor trimming. Consider node *v* the neighbor trimming procedure is triggered at *v* about neighbor *u* either by the following cases:

1) No routing update or data packet has been received from this neighbor for a given period of time.

2) A data transmission to node *u* has failed, as reported by the link layer.

Node *v* responds by:

1) First, updating *N(v)* with *N(v) − {u}*;

2) Then, constructing the union graph with the information of *u* removed, i.e.

$$G_v = S_v \cup \bigcup_{w \in N(v)} (T_w - v) \qquad (2)$$

3) Finally, computing BFST.

With this updated BFST at *v*, it is able to avoid sending data packets via lost neighbors. Thus, multiple neighbor trimming procedures may be triggered within one period.

5.2.3 Streamlined Differential Update

1) Compact tree representation. For the full-dump messages, goal is to broadcast the BFST information stored at a node to its neighbors in a short packet. To do that, we first convert the general rooted tree into a binary tree of the same size.

2) Stable BFST. The size of a differential update is determined by how many edges it includes. Since there can be a large number of BFSTs rooted at a given node of the same graph, we need to alter the BFST maintained by a node as little as possible when changes are detected.

Consider node *v* and its BFST *Tv*. When it receives an update from neighbor *u*, which is denoted *Tu*, it first removes the subtree of *Tv* rooted at *u*. Then, it incorporates the edges of *Tu* for a new BFST. Note that the BFST of (*Tv − u*) ∪ *Tu* may not contain all necessary edges for *v* to reach every other node. Therefore, we still need to construct union graph

$$(T - u)_v \cup \bigcup_{w \in N(v)} (T_w - v) \qquad (3)$$

before calculating its BFST. To minimize the alteration to the tree, we add one edge of *Tw − v* to *Tv − u* at a time. When node *v* thinks that a neighbor *u* is lost, it deletes edge (*u, v*).

5.2.4 Delay and energy-aware routing (DEAR)

When a node should share its updated route information with its neighbors, a delay is selected it until the end of the cycle so that only one update is broadcast in each period. If a node were to transmit it immediately when there is any change to its routing tree, it would trigger an explosive chain reaction and the network would be overwhelmed by the route updates.

Due to the dynamic topology, node consumes more energy while roaming. For this, the topology control approach has been introduced. In this approach, we have considered two cases,

1. Energy consumption of the node and routes.
2. Link stability and location stability

In first case, the dynamic and adaptive topology is proposed. It will adopt, according to the node moves with in the network. The number of links connected to a node is very kept low. The link with the low transmission power is also taken in to the consideration for the energy consumption of the route. For link stability and location stability, each node carrying link with highest density and efficient transmission power with adaptable location. The location stability which implies node is on the stable state which is ready state to send the number of packets to the intended destination node with degrading the network performance. While implementing these two cases, the energy consumption of the whole network can be effectively reduced.

6. RESULTS

Table 1: End To End Delay

Average Number Of Neighbor Per Node	End To End (ms)
0	0.387
2	0.603
4	0.8735

8	0.976
12	1.006
16	1.109
20	1.223

Table 2: Delivery of Packets

Average Number Of Neighbor Per Node	Delivery
0	0.7434
2	0.69002
4	0.59103
8	0.52134
12	0.4912
16	0.4512
20	0.3213

7. CONCLUSION

In PSR proposed method each node maintain BEFS each node has full path information to route itself and can reduce overhead as much as possible.

For link stability and location stability, each node carrying link with highest density and efficient transmission power with adaptable location. The location stability which implies node is on the stable state which is ready state to send the number of packets to the intended destination node with degrading the network performance. Due to mobility of the nodes more energy is consumed.The proposed system an innovative technique is introduced which is called delay and energy-aware routing (DEAR) for reducing energy consumption and reduce the overhead. In this technique the delay is selected until the end of the cycle so that only one update is broadcast in each period. Furthermore, due to the dynamic topology, node consumes more energy while roaming.

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