Asian Journal of Information Science and Technology (AJIST)
Vol.3.No.1. 2015 pp 1-7
available at: www.goniv.com
Paper Received :09-10-2015
Paper Accepted:25-10-2015
Paper Reviewed by: 1. R. Venkatakrishnan 2. R. Marimuthu
Editor : Prof. P.Muthukumar

A STUDY ON MINIMIZING REDUNDANCY, RETRANSMISSION ERROR AND ROUTING OVERHEAD IN MANET

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Abstract

A unique characteristic of MANET is the dynamic nature of its network topology which would be frequently changed due to the unpredictable mobility of nodes. In MANET, several routing techniques are being used for the transmission of data over networks. The Proactive protocols are a static routing protocol, so the rate of transmission is high but overhead occur. In reactive protocol, dynamic routing techniques are being used so that it minimizes routing overhead and also we can minimize the retransmission error. Broadcasting is a fundamental and effective data spreading problem. Broadcasting can cause broadcast storm problem. Reactive routing protocols in Mobile Ad hoc Network (MANET) send periodic messages to recognize the topology changes. Sending periodic messages cause overhead. Reactive routing protocols used to minimize overhead.

***Key words*: *Broadcasting, Mobile Ad hoc Networks, Route, Routing protocol, reactive and proactive*.**

1. Introduction

Mobile Ad Hoc Networks (MANETs) consist of a collection of mobile nodes that can move freely. These nodes can communicate without any aid of infrastructure and can be deployed for many applications such as battlefield, disaster relief and civilian applications [5]. One of the fundamental challenges in MANETs is

Fig. 1.1 Mobile Ad Hoc Network

to design a routing protocol with good performance and less overhead.

Ad hoc on-demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR) are some of the on-demand routing protocols that improve the scalability of MANETs by reducing the routing overhead in route discovery in Fig 1.1. The node mobility in MANETs causes frequent link breakages may lead to frequent path failures and route discoveries. Thus, reducing routing overhead in route discovery is an essential problem.

2. Routing Overhead

In static routing protocol, the routing overhead is high whereas, nodes in the reactive routing protocols are trying to minimize the overhead by only sending routing information as soon as the communication is initiated between them.

a) *Flooding*

Flooding in wireless networks is mostly achieved via each node send the request to its neighbors. In flooding, every incoming packet is sent through every outgoing link except the one it arrived on [16]. Flooding utilizes every path through the network and it uses the shortest path. A conventional on-demand routing protocols are used in flooding to discover a route.

b) *Broadcasting*

The sending of a message from one host to other hosts in the network is known as the broadcast problem [6].The characteristics of broadcasting are:

- *The broadcast is spontaneous:* Any mobile host can issue a broadcast operation at any time.
- *The broadcast is unreliable:* Because no acknowledgement mechanism will be used.

c) *Broadcast Storm problem*

Broadcasting is a common operation in a network to resolve many issues. In a mobile ad hoc network (MANET), due to host mobility, such operations will be executed more frequently (such as finding a route to a particular host, paging a particular host and sending an alarm signal). A straightforward broadcasting by flooding is usually very costly and will result in serious redundancy, contention, and collision, and it is known as the broadcast storm problem.

d) *Broadcast storm problem caused by flooding*

A direct approach to perform broadcast is by flooding [6].In a CSMA/CA network, the drawbacks of flooding include:

- Redundant rebroadcasts
- Contention
- Collision

4. Study Of Techniques And Algorithm Used For Reducing Routing Overhead Redundancy And Retransmission Error

A protocol for routing in ad hoc networks uses Dynamic Source Routing (DSR). This protocol rapidly adapts to routing changes in ad hoc networks and it incurs less protocol overhead during frequent host movement [5]. The basic operations performed in DSR protocols are route cache, route discovery and route maintenance. A number of optimizations are performed in the basic operation of route discovery and route maintenance, and that can reduce the number of overhead packets and can improve the average route efficiency of data packets. The optimizations are as follows:

a) Full use of the Route Cache: Route cache is used to avoid propagating a route request packet received from another host.
b) Piggybacking on Route Discoveries: The route discovery delay and the total number of packets transmitted can be reduced by

piggybacking of data on route request packets.

c) Reflecting Shorter Routes: During host communication using cached routes, it is possible to use shorter routes.
d) Improved handling of Errors: It is to support negative caching information in a host's route cache.

It is concluded that, by combining other routing protocols such as distance vector or link state routing with ad hoc networks, then the nodes can be reachable by all the ad hoc network nodes and this paper does not addresses the security concerns in wireless networks or packet routing.

4.1 Probabilistic Routing

Although the random way-point mobility model is popular to use in evaluations of mobile ad hoc protocols, real users are not likely to move around randomly, but rather move in a predictable fashion based on repeating behavioral patterns such that if a node has visited a location several times before, it is likely that it will visit that location again. We would like to make use of these observations and this information to improve routing performance by doing probabilistic routing and thus, we propose PROPHET, a Probabilistic Routing Protocol using History of Encounters and Transitivity [6].

When two nodes meet, they exchange summary vectors which in this case also contain the delivery predictability information stored at the nodes. This information is used to update the internal delivery predictability vector as described below, and then the information in the summary vector is used to decide which messages to request from the other node based on the forwarding strategy used.

4.2 Forwarding strategies

In traditional routing protocols, choosing where to forward a message is usually a simple task; the message is sent to the neighbor that has the path to the destination with the lowest cost (usually the shortest path) [14]. Normally the message is also only sent to a single node since the reliability of paths is relatively high. However, in the settings we envision here, things are completely different. For starters, when a message arrives at a node, there might not be a path to the destination available so the node have to buffer the message and upon each encounters with another node, the decision must be made on whether or not to transfer a particular message. Furthermore, it may also be sensible to forward a message to multiple nodes to increase the probability that a message is really delivered to its destination.

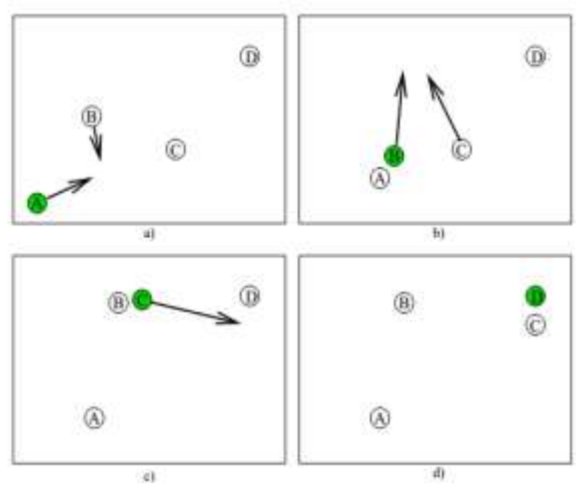


Fig.1.2 Transitive communication

A message (shown in the figure by the node carrying the message being green) is passed from node A to node D via nodes B and C through the mobility of nodes.

4.3 RAPID

The model DTN set mobile nodes where two nodes transfer data packets to each other when within communication range. During a transfer, the sender replicates packets while retaining a copy. A node can deliver packets to a destination node directly or via intermediate nodes, but packets may not be fragmented. There is limited storage and transfer bandwidth available to nodes. Destination nodes are assumed to have sufficient capacity to store delivered packets, so only storage for in-transit data is limited. Node meetings are assumed to be short-lived [8]. The goal of a DTN routing algorithm is to deliver all packets using a feasible schedule of packet transfers, where feasible means that the total size of packets transferred during each opportunity is less than the size of the opportunity, always respecting storage constraints.

4.4 Heuristic Approach

Two fundamental reasons make the case for a heuristic approach to DTN routing. First, the inherent uncertainty DTN rules provably efficient online routing algorithms. Second, computing optimal solutions is hard even with complete knowledge about the environment. Both hardness results formalized hold even for unit-sized packets and unit-sized transfer opportunities and assume no storage restriction [12]. Rapid has three core components: a selection algorithm, an inference algorithm, and a control channel. The selection algorithm is used to determine which packets to replicate at a transfer opportunity given their utilities. The inference algorithm is used to estimate the utility of a packet given the routing metric. The control channel propagates the necessary metadata required by the inference algorithm.

4.5 Selection Algorithm

The rapid protocol executes when two nodes are within radio range and have discovered one another. The protocol is symmetric; without loss of generality, and describes how node X determines which packets to transfer to node Y (refer to the box marked Protocol rapid). Rapid also adapts to storage restrictions for in-transit data. If a node exhausts all available storage, packets with the lowest utility is deleted first as they contribute least to overall performance [3]. However, a source never deletes its own packet unless it receives an acknowledgment for the packet.

4.6 Inference Algorithm

For the routing algorithm to be work conserving, rapid computes utility for the packet whose delay is currently the maximum; i.e., once a packet with maximum delay is evaluated for replication, the utility of the remaining packets is recalculated.

4.6.1 Estimating Delivery Delay

To estimate expected delay it is assumed that the packet is delivered directly to the destination, ignoring the effect of further replication. This estimation is nontrivial even with an accurate global snapshot of system state. For ease of exposition, we first present rapid's estimation algorithm as if we had knowledge of the global system state, and then it present a practical distributed implementation [7].

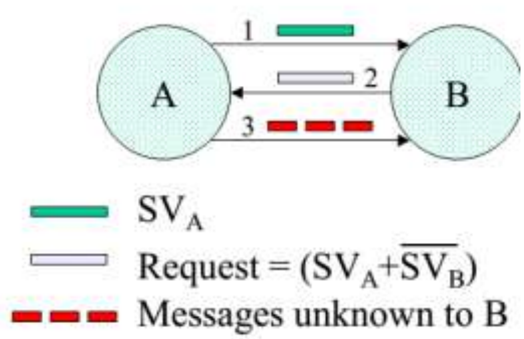
4.7 Epidemic Routing

The overall goal of Epidemic Routing is to maximize message delivery rate and minimize message delivery latency, while also minimizing the aggregate system resources consumed in message delivery. Here accomplishing this by placing an upper bound on message hop count and per-node buffer space (the amount of memory devoted to carrying other host's messages). By increasing bounds on these parameters, applications can increase the probability that a message will be successfully delivered in exchange for higher aggregate resource consumption.

4.7.1 Routing Protocol

Epidemic Routing supports the eventual delivery of messages to arbitrary destinations with minimal assumptions regarding the underlying topology and connectivity of the underlying network. In fact, only periodic pair-wise connectivity is required to ensure eventual message delivery [13]. The Epidemic Routing protocol works as follows. The protocol relies upon the transitive distribution of messages through ad hoc networks, with messages eventually reaching their destination.

Each host maintains a buffer consisting of messages that it has originated as well as messages that it is buffering on behalf of other hosts [13]. For efficiency, a hash table indexes this list of messages, keyed by a unique identifier associated with each message.



Given that messages are delivered probabilistically in epidemic routing, certain applications may require acknowledgments of message delivery. The acknowledgement request field signals the destination of a message to provide an acknowledgment of message delivery [8]. Each host sets a maximum buffer size that it is willing to allocate for epidemic message distribution.

Of course, there is an inherent tradeoff between aggregate resource consumption and message delivery rate/latency [12]. To ensure eventual delivery of all messages, the buffer size on at least a subset of nodes must be roughly equal to the expected number of messages in transit at any given time. Otherwise, it is possible for older messages to be flushed from all buffers before delivery.

The design for Epidemic Routing associates a unique message identifier, a hop count, and an optional acknowledgement request with each message. The message identifier is a unique 32-bit number. This identifier is a concatenation of the host's ID and a locally-generated message ID (16 bits each). However, if hosts in an ad hoc network are assigned the same subnet mask, the remaining bits of the IP address can be used as the identifier. While the hop count is similar to the TTL field in IP packets, messages with a hop count of one will only be delivered to their end destination [15].

Thus, high priority messages might be marked with a high hop count, while most messages can be marked with a value close to the expected number of hops for a given network configuration to minimize resource consumption.

5. Performance Measures

Four performance measures are used such as rebroadcast number, mobility overhead evaluation in fig 5.1, reachability, and collision, throughput evaluation in Fig 5.2 to evaluate the performance of this approach.

a) Rebroadcast number

Rebroadcast number is the number of rebroadcast packets. By comparing with other approach, our proposed approach can significantly reduce the number of rebroadcasts shown in Fig 5.1.

Fig.5.1 Mobility Overhead Evaluation

b) *Reachability*

Reachability is the sum of mobile node that receives the broadcast message directly or indirectly. This proposed approach is a good solution for maintaining good reachability.

c) *Collision*

Collision is the number of collided packet that mobile nodes send. The proposed scheme can reduce the collision packets more than 50% when compare with flooding scheme.

d) *Throughput*

Throughput is defined as the amount of broadcast data (bits) transmitted during a second in the MANET. Our proposed scheme is good throughput which results in decreased rebroadcast node and reduced collision packets shown in Fig 5.2.

Fig.5.2 Throughput Evaluation

6. Conclusion And Future

In this paper, a survey is carried out to reduce the routing overhead, Minimizing redundancy and retransmission error in MANETs by comparing different protocols. The comparative analysis is based on parameters such as scheme, routing overhead, and throughput. The Comparative analysis shows that the DSR and AODV protocol is used to minimize routing overhead by assigning optimal relay nodes in the transmission path. It helps to avoid redundancy using logical select and forward operation and it conserve energy efficiently by reducing number of relay nodes.

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