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A Proposed Model for Ant Based Routing Using Two Step Method

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Abstract: *A mobile ad-hoc network (MANET) is a set of mobile nodes which communicate over radio and do not need any infrastructure. This kind of networks is very flexible and suitable for several situations and applications. Nodes not only have to fulfill the functionality of hosts, but each node has also to serve as a router, forwarding packets for other nodes. However, the performance of such networks has to be improved before this can be realized. Here in this paper I have proposed 2 step improvements in Ant – Based Routing Protocol for enhancing improvement in the network and to reduce overburden of the network.*

Keywords: MANET, Ant Based Routing

1. Introduction

Ad hoc networks are emerging as the new generation of networks and defined as a collection of mobile nodes (MNs) forming a temporary network without the aid of any centralized administration or standard support services. An ad hoc network is usually thought of as a network with nodes that are relatively mobile compared to a wired network. Hence, the topology of the network is much more dynamic and the changes are often unpredictable oppose to the internet which is a wired network. This fact creates many challenging research issues, because the objectives of how routing should take place is often unclear because of the different resources such as bandwidth, battery power and demands like latency. The routing protocols used in ordinary wired networks are not well suited for this kind of dynamic environment. In contrast to infrastructure based wireless networks, in ad hoc networks all nodes are mobile and can be connected dynamically in an arbitrary manner.

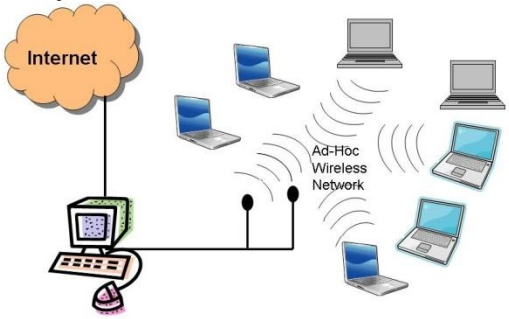

Figure 1. Mobile ad-hoc netwrok

In the case where only two hosts, within the transmission range, are Involved in the ad hoc network, no real routing protocol or routing decisions are necessary. But, in many practical ad hoc networks, two hosts that wish to communicate may not close enough to be within wireless transmission range of each other. These hosts could communicate only if other hosts between them, also participating in the ad hoc network, are willing to forward packets for them.

2. Ad-hoc Network Classification is as follow:

1. According to Communication
   1.1. Single-hop Ad Hoc Network
   1.2. Multi-hop Ad Hoc Network
   1.3. Mobile Multi-hop Multimedia Ad Hoc Network (3M-Network)
2. According to Topology
   2.1. Flat Ad Hoc Networks
   2.2. Hierarchical Ad Hoc Networks
   2.3. Aggregate Ad Hoc Networks
3. According to Coverage Area
   3.1. BAN
   3.2. PAN
   3.3. LAN
   3.4. MAN
   3.5. WAN
4. According to node Configuration
   4.1. Homogeneous Ad Hoc Network
   4.2. Heterogeneous Ad hoc Network

3. Basic of Multi Ant Based Routing Protocol

It utilizes a collection of mobile agents or "ants" to perform optimal routing activities. These "ants" are simple routing packets that collect and disseminate useful routing information as they travel throughout the network. In the case of MARP, the nodes periodically produce multi-sequence ants and send them out into the network in reactive manner and are maintained by proactive way. MARP offers quick adaptation to dynamic link conditions, low network utilization and determines multicast routes to destinations within the ad hoc network.

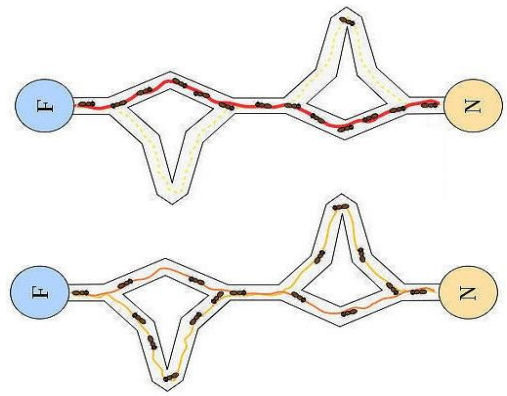

Figure2: Source to destination

Mobile Ad-Hoc Network is a frequently disconnected network consisting of multi-hop from a source 'A' to a destination 'B' because of the dynamic nature such as the topology change caused by node's mobility. In order to resolve this situation, existing routing protocols for MANETs have performed route repair scheme to repair the disconnected route. In Case, when a source node unnecessarily start the route rediscovers for the whole path even just one node moves and moreover, even if the rest of path needs not to be re – arranged. Now, in this type of case, the time for rediscovery of the whole path may often take too long. In order to solve this problem, a new ant – based routing has been proposed in combination with local repair scheme called "ant-based local repair routing protocol".

4. Working Principle of Ant Algorithm

The basic idea of the ant algorithm has been developed by DiCaro and Dorigo (1998), is taken from the food searching behavior of real ants. When ants search for food, they start from their nest and walk towards the food. When an ant reaches an intersection it decides which branch to take next. While walking they deposit "pheromone" which marks the selected route. The concentration of pheromone on a certain path is an indication of its usage. Over the time the concentration of pheromone decreases due to diffusion effects.

At the intersection the first ant randomly selects a branch. Because the lower route is shorter than the upper one, the ants, which take this path, will reach the food place first. On their way back to the nest, the ants again have to select a path. After a while the pheromone concentration on the shorter path will be higher than on the longer path, because the ants using the shorter path will increase the pheromone concentration faster. Thus, eventually all ants will only use this path.

This behavior of the ants can be used to find the shortest path in networks. Especially, the dynamic component of this method provides a high degree of adaptation to changes in MANET topology, because in these networks the existence of links is not guaranteed and link changes occur frequently.

5. Review of Existing Scheme

Following are the two Existing Scheme defined by Duggirala et al (2003) and Lee and Gerla (2000) respectively

5.1 Local Routing Repair (LRR) Scheme

Is a modified protocol from AODV with local repair scheme, as developed by Duggirala et al (2003), He assumes that the relative movement of only one node on the route causes the link error. A "neighbor node" is defined as a node, which is on the route from the source to the destination and is in the immediate of the moved node. In other words, a neighbor node is a former one of moved node on the route.

The aim of this scheme is to patch the route between the two nodes of the broken path through some other link or node. The zone in which the route repair packet propagates is defined as the "request zone." In LRR, the TTL field of the IP packets is used to limit the request zone to two hops. The neighboring node in the direction of the source initiates the patch up, because it is first to recognize that the route is broken. The neighbor node broadcasts a route repair packet with TTL = 2 so as to reach a latter node of moved node and then recover the route error locally.

5.2 AODV – BR

This one is also a modified protocol from AODV, studied in Lee and Gerla (2000). The basic route discovery process has not been changed. A source node sends a route request message (RREQ) packet to a destination node and the destination replies to RREQ as a route reply packet (RREP) packet. The different thing is that each node in the network operates in promiscuous mode. When a RREP packet comes back to the source node, a neighboring node, which is not part of the route, overhears a RREP packet. And then it records the node, which transmitted a RREP packet as the next hop to the destination in its alternate route table. Likewise this, all nodes existing beside of the route updates their alternate route table after overhearing RREP packet. After these operations, the members of the route and neighboring nodes organize a mesh structure.

6. Limitation of Existing Scheme

When the node detecting that the route is break down then following steps will be followed:

1. Node broadcasts a route-repair packet with TTL.
2. The route - repair packet is forwarded to certain nodes which are located two-hops away from detecting node.
3. The reply message then has to undergo same procedures as normal route discovery phase.

The whole time required in this processes may take too long. In order to minimize the bad effect of the route error, the route has to be recovered as soon as it can. In this manner, LRR is not proper for prompt route repair scheme. Also, AODV-BR adopts the same procedure because let nodes get explicit information about neighbor nodes.

Now, continuously operating in procedure increases much overhead to nodes in terms of energy consumption. Moreover, AODV-BR sometimes recovers the route longer than before. This is another overhead because the source node has to be noticed about changed hop counts.

7. Proposed Ant Based Local Repair Routing

New proposed Ant Based Local Repair Routing is as follows:

Step 1: Addition of witness Node in the Network

A witness node is defined as a host which can overhear a transmission in the network that are not supposed to be. Figure shows how witness's node can be added into the network and will participate in the routing process. In the taken network our source is the 'S' Node and destination is the 'E' node. Process can be defined in following steps:

1. Both Witness node W1 and W2 hear node A's transmission to node B, which makes them potential active witnesses of node A.
2. At this point, they will wait to see if node B attempts to deliver the packet to node C, which would mean that node B received it from node A.
3. If any one of the witness node does not hear the transition from node B to node C, Now witness assume that packets from node A to B failed to reach node C
4. In this case, they both attempt to deliver the packet directly to node C, although, indirectly, they target node B as well because node W1 and node W2 do not necessarily have a way to communicate with each other.
5. If node C rejects their packets, it means that it has already received the packets from node B. and thus path exit in the network. This is just a network error.
6. Now if, Node C accepts the packets from witness node that means Node B is moved out of the network.
7. At this stage witness node call form Local Repair Scheme. This is link failure.

Step 2: Local Repair Scheme

In the case of a link failure, this proposes local repair technique can be used locally on the upstream node to recover the network. Assuming that a mode is moved away from the network then the path recovery can be done in following ways at local level:

1. Witness node registers that the particular node is no longer available in the network.
2. Witness node send message to the entire nodes in the network to update the routing table and initiate route discovery process.
3. Then all nodes in the network remove all associated entries regarding the moved node from its routing table.
4. Nodes in network starts route discovery process by sending out TTL packets with max length 2 hops. Thus every node in the networks updates its routing table.
5. All node receive the message and update their routing table using the available node in the network

8. Future Work

Algorithm design is under progress for the proposed two step approach. This new approach save time in communication and reduces the overhead of communication with a large extents. For the implementation purpose of this new approach I'll use the concept of bi-directional weighted graph.

9. Conclusion

By this new two – step approach routing in ad – hoc network will be light weighted in terms of communication. Communication channels will remain free for the communication purposes instead of routing and forwarding route discovery packets in the network.

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