LOCATION AWARE ROUTING SCHEMES FOR MOBILE ADHOC NETWORKS

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ABSTRACT

One of the promising wireless network that is based on anytime, anywhere access is the mobile ad hoc network (MANET). A MANET consists of a set of mobile hosts without any support of other devices such as base stations. It is attractive since it can be quickly setup and operated by batteries only. Some critical issues are required to be handled carefully while implementing MANETs in reality. Routing is one of the most critical issues in MANETs. As MANETs allow nodes to be mobile, to change their positions during communication, it may generate issues like route failures and network partitions. The conventional routing schemes are not appropriate in such scenarios. Some advance routing algorithms, such as AODV, DSR, DSDV are proposed which has improved performance significantly. By location awareness, we mean that a host is capable of knowing its current physical location in the three-dimensional world. This paper explores some of the most successful location aware routing schemes.

Keywords: Gedir, Gps, Gpsr, Gra, Lalr, Manet

I. INTRODUCTION

1.1 Network Layer Issues

MANETs support user mobility and so dynamic topologies. As the topology is dynamic, routing is very critical. The traditional routing algorithms don't provide good performance under such scenarios where nodes are continuously changing their locations as well as becoming up and down.[1]

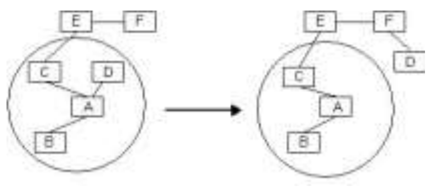

Fig. 1- Node D moves out of Range of A

Fig. 2 shows that some nodes in a MANET become off due to power failure or shut down by the owner. In such case, sometimes network is partitioned in to two or more halves if the node was the only connecting point among them. [1]

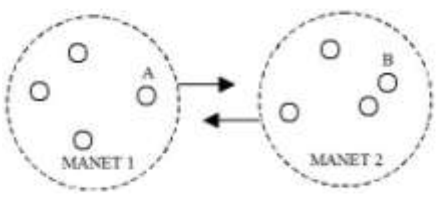

Fig. 2- MANET Partitions

1.2 Routing Architecture

Flat routing keeps information about every node in the MANET without differentiation as per their locations. This strategy is suitable for small MANET to get good performance but it becomes difficult as number of nodes increases. it generates a lot of overload in maintaining information at every node. Hierarchical architecture divides MANET into a set of geographically separated small chunks called the clusters. Every cluster has a set of nodes inside and one of them is selected as cluster head. Routing is performed among cluster heads only.[1]

In proactive routing algorithms, so every node has complete topology of the network to which it belongs. Every node maintains latest toplogy in its own database so it provides fast routing. WRP and DSDV are proactive routing protocols in MANETs.[1]

In reactive routing algorithms, route is searched only when it is needed. So these algorithms are light weighted as compared to proactive algorithms but require more time when a new route is required to be created. DSR and AODV are reactive routing protocols in MANETs.[1]

1.3 Location Awareness

GPS (Global Positioning System) is the most widely used tool to calculate a device's physical location. GPS is a worldwide, satellite -based radio navigation system. The GPS system consists of 24 satellites which transmit navigation messages periodically. Each navigation message contains the satellite's orbit element, clock, and status. After receiving the navigation messages, a GPS receiver can determine its position and roaming velocity. To determine the receiver's longitude and latitude, we need at least three satellites. If we also want to determine the altitude, another satellite is needed. More satellites can increase the positioning accuracy. The positioning accuracy of GPS ranges in about a few tens of meters. GPS receivers can be used almost anywhere near the surface of the Earth. By connecting to a GPS receiver, a mobile host will be able to know its current physical location. This can greatly help the performance of a MANET, and it is for this reason that many researchers have proposed to adopt GPS in MANETs. [2]

II. GPSR (GREEDY PERIMETER STATELESS ROUTING)

2.1 Gpsr

The greedy perimeter stateless routing (GPSR) protocol assumes that each mobile host knows all its neighbors' locations (with direct links). The location of the destination host is also assumed to be known in advance. The GPSR protocol does not need to discover a route prior to sending a packet. A host can forward a received packet directly based on local information. Two forwarding methods are used in GPSR: greedy forwarding and perimeter forwarding. [3]

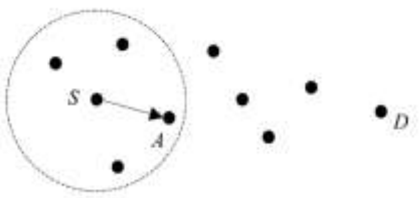

Fig. 3- Greedy Approach

Fig 3. Shows an example of greedy forwarding. When host S needs to send a packet to host D, it picks from its neighbors one host that is closest to the destination host and then forwards the packet to it. In this example, host A is the closest one. After receiving the packet, host A follows the same greedy forwarding procedure to find the next hop. This is repeatedly used until host D or a local maximum host is reached.[3]

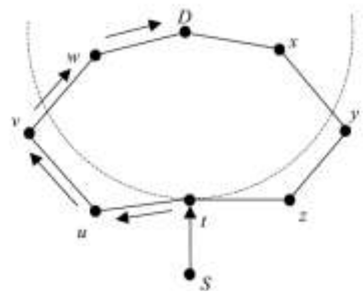

Fig. 4- perimeter forwarding approach

A local maximum host is one that finds no other hosts that are closer to D than itself. In the example in Fig. 4, host t is a local maximum because all its neighbours are farther from D than itself. Therefore, the greedy forwarding method will not work here. When this happens, the perimeter forwarding method is used to forward the packet. The perimeter forwarding method works as follows. The local maximum host first "planarizes" the graph representing the network topology. A graph is said to be planar if no two edges cross. The graph may be transformed into a relative neighbourhood graph (RNG) or a Gabriel graph (GG). Both RNG and GG are planar graphs. After the graph is planarized, the local maximum host can forward the packet according to a right-hand rule to guide the packet along the perimeter of a plane counter clockwise. For example, in Fig. 18.3 at t , we can forward the packet along the perimeter of the plane dxyztuvw counter clockwise. As the packet is forwarded to host w, we know that we are closer to D (as opposed to the location of host t). Then the greedy forwarding method can be applied again, and the packet will reach destination D. Overall, these two methods are used interchangeably until the destination is reached. The GPSR is a stateless routing protocol since it does not need to maintain any routing table.[3]

2.2 Gra

The geographical routing algorithm (GRA) is also derived based on location information. To send or forward a packet, a host first checks route entries in its routing table. If there is one, the packet is forwarded according to the entry. Otherwise, a greedy approach is taken, which will try to send the packet to the host closest to the destination. If the packet runs in to a local maximum host, GRA will initiate a route discovery procedure to discover a route from the host to the destination. This is done by flooding. After the route reply comes back, the route entry will be stored in the host's routing table to use in future. [3]

2.3 Gedir

The geographic distance routing (GEDIR) protocol assumes that each host has the locations of its direct neighbors. Similar to GPSR, the GEDIR protocol also directly forwards packets to next hops without establishing routes in advance. There are two packet-forwarding policies: distance approach and direction approach. In the distance approach, the packet is forwarded to the neighbor whose distance is nearest to the destination. However, in the direction approach, the packet is forwarded to the neighbor whose direction is closest to the destination's direction. The latter can be formulated by the angle formed by the vector from the current host to the destination and to the next hop. [3]

III. LAR (Location-Aided Routing)

The location-aided routing (LAR) protocol assumes that the source host (denoted as S) knows the recent location and roaming speed of the destination host (denoted as D). Suppose that S obtains D's location, denoted as (Xd, Yd), and speed, denoted as v, at time t0 and that the current time is t1 . We can define the expected zone in which host D may be located at time t1 (refer to the circle in Fig. 5). The radius of the expected zone is R = v(t1 – t0). [4]

From the expected zone, we can define the request zone to be the shaded rectangle as shown in Fig. 6 (surrounded by corners S, A, B, and C). The LAR protocol basically uses restricted flooding to discover routes. That is, only hosts in the request zone will help forward route-searching packets. Thus, the searching cost can be decreased. When S initiates the route-searching packet, it should include the coordinates of the request zone in the packet. A receiving host simply needs to compare its own location to the request zone to decide whether or not to rebroadcast the route-searching packet. After D receives the route-searching packet, it sends a route reply packet to S. When S receives the reply, the route is established. If the route cannot be discovered in a suitable timeout period, S can initiate a new route disco very with an expanded request zone. The expanded request zone should be larger than the previous request zone. In the extreme case, it can be set as the entire network. Since the expanded request zone is larger, the probability of discovering a route is increased with a gradually increasing cost. [4]

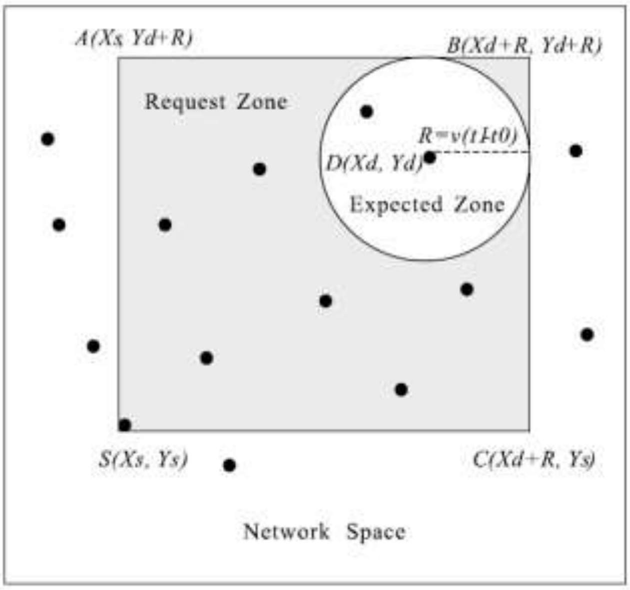

Fig. 5- LALR

IV. CONCLUSION

Algo	Strategy	Information
LAR	Discover route by flooding request packets in request zone	Destination's location and roaming speed
GPSR	Greedy forwarding (distance-based) and perimeter forwarding	Destination's location and all neighbors' locations
GRA	Greedy forwarding (distance-based) and flooding	Destination's location and some neighbors' locations
GEDIR	Greedy forwarding (distance- or direction-based) and flooding	Destination's location and all neighbors' locations

REFERENCES

[1] Hardik K Molia, Rashmi Agrawal , "Exploring the Challenges in MANETs", International Journal of Advanced Networking & Applications 2014

[2] A. Fasbend er et al., Variable and Scalable Security: Protection of Location Information in Mobile IP, Mobile Technology for the Human Race, IEEE 46th Vehicular Technology Conference, 1996.

[3] D. Forsberg et al., Distributing Mobility Agents Hierarchically Under Frequent Location Updates, Sixth IEEE International Workshop on Mobile Multimedia Communications, 1999.

[4] W. Chen, N . Jain, and S. Singh, ANMP: ad hoc network management protocol, IEEE Journal On Selected Areas In Communications, 17(8), 1999.