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Exercises of lecture
Mobile Ad Hoc Networks
Summer 2007

Sheet 8

SECTION 1:
MANET Routing Protocols

1. Compared to pure flooding, a route discovery based on LAR reduces the control packet overhead and possibly avoid the broadcast storm. Consider the MANET provided in Figure 1, which topology does not change during the route discovery, node S wishes to send data to node D that is two hop away from node S. Assume that location information can be obtained, for instance, by the GPS receiver.

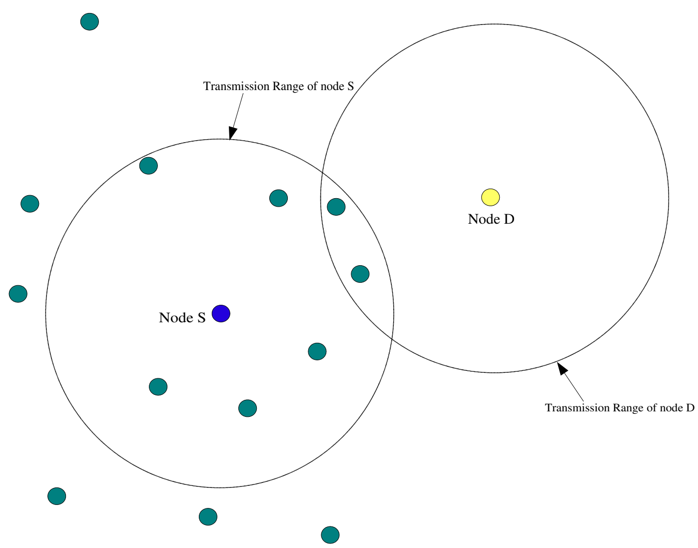

Figure 1: MANET

   (a) Propose a simple LAR algorithm that utilizes the distance information of each node to reduce the number of control message during route discovery.

   (b) If this MANET is using DSR, how can the RREQ packet be modified to adopt your proposed algorithm in its route discovery?

Solutions:

1. Here is one of the possible solutions:

   NOTE: *With location info of every node, some may argue that we do not need flooding or route discovery. BUT, location info does not represent the link condition of route determined based purely on the given location info, which may be degraded by the physical obstacles. Therefore, route discovery is still necessary. Only when route discovery is successful, we can say that the route determined beforehands is valid.*

   (a) Referring to Figure 2, we divide the neighbors of node S into 2 zones based on their distance to destination node D. Node S first flood a route request message to all of its neighbors. Upon receiving this message, only its neighbors in *Forward Zone* will rebroadcast the message. (If node D is located further away, same procedure is repeated based on the distance of destination node to each node for every hop.) The total control message saved is depicted in the diagram.

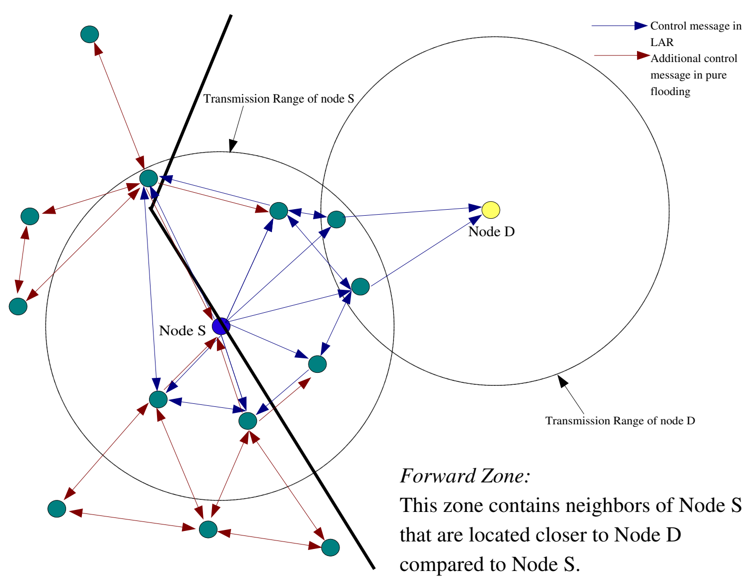

Figure 2: MANET

   (b) Additional fields have to be added so that RREQ contains the followings location information: coordinates of destination node (X_d, Y_d) and the distance of source node S to destination D. *Reference: http://www.swen.uwaterloo.ca/ knaik/750/adhoc.pdf*

SECTION 2:
Distance Vector Routing

1. Figure 2 shows five routers, and links connected them. Furthermore, pseudo port IPs forming end point of links is also showed. Assume that each link has unit cost. Each router-x has a single initial routing table entry as shown in figure-3, where Next hop is the port-IP though which router-x can be reached to a destination router. Assume that all the routers advertise their routing table at the same time and there are no collisions.

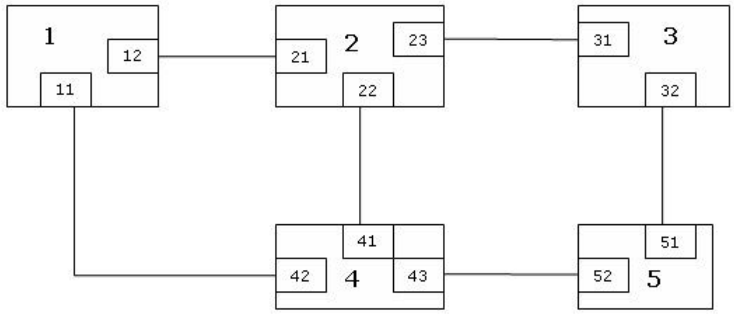

Figure 3: Topology

Apply well known and simplest distance-vector routing algorithm called Routing Information Protocol (RIP) and show each new entry created in routing table after receiving advertisements until they have no more new entries. RIP makes use of Bellman-Ford algorithm.

Destination router	Cost	Next hop
x	0	-

Figure 4: Routing-table initial entry

Solutions:

Router 1:

Dest. Router	Cost	Next-hop
1	0	-

Router 2:

Dest. Router	Cost	Next-hop
2	0	-

Router 3:

Dest. Router	Cost	Next-hop
3	0	-

Router 4:

Dest. Router	Cost	Next-hop
4	0	-

Router 5:

Dest. Router	Cost	Next-hop
5	0	-

Figure 5: Routing-tables initial entries

Router 1:

Dest. Router	Cost	Next-hop
1	0	-
2	1	12
4	1	11

Router 2:

Dest. Router	Cost	Next-hop
2	0	-
1	1	21
3	1	23
4	1	22

Router 3:

Dest. Router	Cost	Next-hop
3	0	-
2	1	31
5	1	32

Router 4:

Dest. Router	Cost	Next-hop
4	0	-
1	1	42
2	1	41
5	1	43

Router 5:

Dest. Router	Cost	Next-hop
5	0	-
3	1	51
4	1	52

Figure 6: Routing-tables entries, after exchanging routing information once.

Router 1:

Dest. Router	Cost	Next-hop
1	0	-
2	1	12
4	1	11
3	2	12
5	2	11

Router 2:

Dest. Router	Cost	Next-hop
2	0	-
1	1	21
3	1	23
4	1	22
5	2	23

Router 3:

Dest. Router	Cost	Next-hop
3	0	-
2	1	31
5	1	32
1	2	31
4	2	32

Router 4:

Dest. Router	Cost	Next-hop
4	0	-
1	1	42
2	1	41
5	1	43
3	2	43

Router 5:

Dest. Router	Cost	Next-hop
5	0	-
3	1	51
4	1	52
1	2	52
2	2	52

Figure 7: Routing-tables entries, after exchanging routing information twice.