

REVIEW OF PROACTIVE PROTOCOLS FOR WIRELESS ADHOC NETWORKS

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ABSTRACT

Different types of wireless adhoc networks can be designed by the number of nodes participating in the network, the mobility pattern of nodes, the traffic demands of nodes etc. Different types of adhoc networks have different requirements on the performance of their routing protocols. Hence, there is no single routing protocol that works for all types of networks.

Keywords: DSDV (destination sequenced distance vector), QoS (quality of service), WRP (wireless routing protocol), CSGR (cluster-head switch gateway routing).

1. INTRODUCTION

Generally, there are three types of routing protocols used in adhoc wireless networks, each of them has distinct features and suitable for certain types of network environment. The first one is called table-driven or proactive routing. The idea behind this type of routing protocol is similar to the routing protocols designed for wireline networks. The second one is called on-demand or reactive routing. One of the distinctive features of this type of routing protocol is that nodes participate in routing only when necessary. The third type is called hybrid, which combines the features from both table-driven and on-demand routing protocols.

Some common features for routing protocols of adhoc wireless networks include:

- (i) High adaptivity to topology changes.
- (ii) Minimal overhead, and
- (iii) Capability of providing certain quality of service (QoS).

2. TABLE-DRIVEN ROUTING PROTOCOL

Under table-driven routing protocols, nodes attempt to maintain routing information regarding every other node at all times. This is done by requiring each node periodically broadcast its location information. In wireless adhoc networks, nodes usually move frequently and operate on battery power; hence this waste of energy can significantly shorten the lifetime of a network.

The following protocols are in this category: Destination Sequenced Distance Vector, Wireless Routing Protocol and Cluster-head Switch Gateway Routing.

3. DESTINATION SEQUENCED DISTANCE VECTOR PROTOCOL

Destination Sequenced Distance Vector (DSDV) protocol was developed in 1994 by C. Perkins [5]. It is based on the classical distributed Bellman-Ford routing algorithm [1, 3]. Each node in the network maintains a routing table that contains all known destinations and the hop distance to each of them. For each entry of the routing table, there are five fields: (i) the destination ID, (ii) next hop node ID, (iii) number of hops to the destination, (iv) sequence number associated with this entry and (v) the time the entry is established. The sequence number shows the freshness of the routing information to the destination. Each time the routing information regarding a node is updated, a higher sequence number will be associated with the node.

The DSDV protocol uses the hop count to the destination as a metric when comparing two paths to the same destination if the two paths have the same sequence number. The one with the smallest hop count is selected as the primary path for data transmission when more than one path is available. Routing tables at all nodes are updated throughout the network immediately after a significant topology change that leads to a path information change.

During the process of route updating, fluctuations in routing table or broadcast storm can occur due to asynchronous broadcast times of different nodes. For example, a node i may receive two route control messages regarding the same destination with the same sequence number. If for some reason, the route with the worse metric arrives to node i earlier, then without paying too much attention to it, the node simply forwards this information to its neighbors. However, since the route

control message with the better metric should arrive shortly and will be forwarded again, broadcasting of the first routing updates could have been saved. Therefore, in order to avoid selection of a suboptimal path, nodes wait an additional amount of time, known as a settling time, before broadcasting the updating messages.

4. WIRELESS ROUTING PROTOCOL

Wireless Routing Protocol (WRP) [11] is a distance vector routing protocol. Under the WRP protocol, nodes exchange the hop distance and second-to-last hop (predecessor) information for each destination. Each node maintains four tables:

(a) distance table (b) routing table (c) link-cost table, and (d) message retransmission table.

The link cost table stores delay information associated with links. The path with the minimum end-to-end delay is used. The message retransmission table contains the sequence number of the update message, a retransmission counter and a list of updates sent in the update message. Under the WRP protocol, each node constantly performs consistency check of predecessor information reported by all its neighbors in order to avoid the count-to-infinity problem and to ensure route convergence.

5. CLUSTER-HEAD SWITCH GATEWAY ROUTING

The Cluster-head Switch Gateway Routing (CSGR) [2] protocol uses the DSDV protocol as the underlying routing algorithm with a hierarchical cluster-head-to-gateway routing approach. Under the CSGR protocol nodes are grouped into clusters. Each cluster has a cluster head. The nodes that are within the transmission range of two or more cluster heads serve as gateways. Each node keeps a cluster member table that stores the cluster head information of each destination. Cluster heads are responsible for relaying traffic for the nodes in their own clusters through gateways.

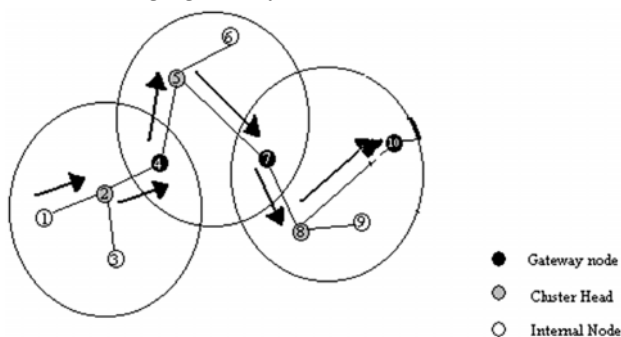


Figure 1: Clusterhead Switch Gateway Routing from Source S(1) to Destination D(10).

When a node S wants to send a packet to a destination node D , it first looks up its routing table to find the cluster head of node D , denoted by $H(D)$. It then transmits the packet to its own cluster head. The cluster head will find

out the gateway shared with the next cluster head along the route to the cluster head $H(D)$. Finally, the cluster head $H(D)$ delivers the packet to the destination. In contrast to most other distant vector protocols, the size of routing tables are much reduced at a large number of ordinary nodes, since they only need to maintain one entry for nodes in the same destination cluster. The burden of routing is now shifted to the cluster heads and gateways. Thus, single point failure becomes a problem. If cluster heads or gateways fail or change frequently, then the performance of this protocol can be significantly degraded.

Cluster heads are elected using a Least Cluster Change (LCC) clustering algorithm. This algorithm can be done in a distributed manner. Changing cluster heads will cause large routing overhead, and thus should be avoided if possible. A cluster head change occurs only when two cluster heads move into the clusters of each other, or one of the nodes moves out of the transmission ranges of all the cluster heads. Within a cluster, the cluster head has a priority for packet transmissions, because it needs to broadcast messages, forward packets and schedule the channel uses among other nodes.

REFERENCES

- [1] R. Bellman, "On a Routing Problem", *Quarterly of Applied Mathematics*, 16, No. 1, pp. 87-90, 1958.
- [2] C. Chiang, H. Wu, W. Liu and M Gerla, "Routing in Clustered Multihop, Mobile Wireless Networks with Fading Channel", *In Proceedings of IEEE Singapore International Conference on Networks, SICON*, Singapore, April 1997.
- [3] L. R. Ford (Jr.), "N/W Flow Theory, Santa Monica", California, The RAND Corp, 14.08.1956
- [4] S. Murthy and J. J. Garcia-Luna Aceves, "A Routing Protocol for Packet Radio Networks", *In Proceedings of ACM International Conference on Mobile Computing and Networking, MOBICOM*, Berkeley, CA, November 1995.
- [5] C. Perkins and P. Bhagwat, "Highly Dynamic Destination-Sequenced Distance Vector Routing for Mobile Computers", *Computer Communication Review*, 24(4), pp. 234-244, Oct, 1994.
- [6] I. D. Aron and S. K. S. Gupta, "On the Scalability of On-Demand Routing Protocols for Mobile Ad Hoc N/W: An Analytical Study", *Journal of Interconnection N/W*, 2, No. 1, pp. 5-29, 2001.
- [7] A. Boukerche, "Performance Comparison and Analysis of Ad Hoc Routing Algorithms", *In Proc. of IEEE International Conference on Performance, Computing & Comm.*, pp. 171-178, 2001.
- [8] V. Park and S. Corson, "Temporally-Ordered Routing Algorithm (TORA) Version 1 Functional Specification", *Internet Engineering Task Force (IETF) Draft*, July 2001.
- [9] S. Murthy and J. J. Garcia-Luna Aceves, "A Routing Protocol for Packet Radio Networks", *In Proceedings of ACM International Conference on Mobile Computing and Networking, MOBICOM*, Berkeley, CA, November 1995.