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A Study on Proactive Routing Protocol in Ad-hoc network

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Abstract: *With wireless devices increasing in popularity and ad-hoc wireless networks getting larger, scalable routing protocols are needed. Recent advances in portable computing and wireless technologies are opening up exciting possibilities for the future of wireless mobile computing. An ad-hoc network is a self-configuring infrastructure less network of mobile devices connected by wireless. The network topology in a ad-hoc network usually changes with time. Therefore, there are new challenges for routing protocols in ad-hoc network. In this course we will focus our attention on current protocols which provides connectivity in ad-hoc networks, such as routing protocols. In particular, in ad-hoc network, any node may compromise the routing protocol functionality by disrupting the route discovery process. Routing in the ad-hoc network is a challenging task and has received a tremendous amount of attention from researches. In this paper, we provide an overview of a wide range of routing protocols. The ad hoc routing protocols can be divided into two classes. They are table-driven and on-demand. This paper discusses about table-driven routing protocols belonging to each category.*

Keywords: *ad-hoc network, proactive, Routing protocol*

I. INTRODUCTION

An ad hoc network is a collection of mobile nodes forming an instant network without fixed topology. In such a network, each node acts as both router and host simultaneously, and can move out or join in the network freely. The instantly created network does not have any base infrastructures as used in the conventional networks, but it is compatible with the conventional networks. Wireless network has become very popular in the computing industry. Wireless network are adapted to enable mobility. There are two variations of mobile network. They are Infra-structured network and ad-hoc network. Infra-structured network are the network with fixed and wired gateways. Infrastructure mode wireless networking bridges a wireless network to a wired Ethernet network. Infrastructure mode wireless also supports central connection points for WLAN clients. [3] An ad hoc network typically refers to any set of networks where all devices have equal status on a network and are free to associate with any other ad hoc network devices in link range. Wireless ad hoc networks can be further classified by their application: mobile ad hoc networks (MANET), wireless mesh networks (WMN), wireless sensor networks (WSN). [1] A MANET is an autonomous collection of mobile users that communicate over relatively bandwidth constrained wireless links. Since the nodes are mobile, the network topology may change rapidly and unpredictably over time. The network is decentralized, where all network activity including discovering the topology and delivering messages must be executed by the nodes themselves, i.e., routing functionality will be incorporated into mobile nodes. Reactive and Proactive Protocols are the routing protocols that are used in Ad hoc networks to send data from the host to the destination. A packet data is sent from source to destination in an Ad hoc network through multiple nodes that are mobile.[2] This type of network is generally used in a disaster hit area, military field or in space where fixed infrastructure is destroyed or does not exist. In this paper we discussed about six protocols they are DSDV, WRP, STAR, OLSR, FSR, HSR GSR, from proactive and from reactive protocols.

II. Proactive protocols

In this type of routing protocol, each node in a network maintains one or more routing tables which are updated regularly. [11]Each node sends a broadcast message to the entire network if there is a change in the network topology. However, it incurs additional overhead cost due to maintaining up-to-date information and as a result; throughput of the network may be affected but it provides the actual information to the availability of the network. Destination Sequenced Distance Vector (DSDV) protocol, Wireless Routing protocol (WRP), Hierarchical State Routing (HSR) protocol, Source Tree Adaptive Routing Protocol (STAR), Optimized Link State Routing (OLSR), Global state routing protocol (GSR) are the examples of Proactive protocol.

1.1. Wireless routing protocol (WRP)

The Wireless Routing Protocol (WRP)[2] is a table-based distance-vector routing protocol. Each node in the network maintains a Distance table, a Routing table, a Link-Cost table and a Message Retransmission list. WRP uses an enhanced version of the distance-vector routing protocol, which uses the Bellman-Ford algorithm to calculate paths. The DT contains the network view of the neighbors of a node. It contains a matrix where each element contains the distance and the penultimate node reported by a neighbor for a particular destination. The RT contains the up-to-date view of the network for all known destinations. [4] The LCT contains the cost (e.g., the number of hops to reach the destination) of relaying messages through each link. The MRL contains an entry for every update message that is to be retransmitted and maintains a counter for each entry. [6] This counter is decremented after every retransmission of an update message. Each update message contains a list of updates. A node also marks each node in the RT that has to acknowledge the update message it transmitted. Once the counter reaches zero, the entries in the update message for which no acknowledgments have been received are to be retransmitted and the update message is deleted. Thus, a node detects a link break by the number of update periods missed

since the last successful transmission. After receiving an update message, a node not only updates the distance for transmission neighbors but also checks the other neighbors' distance, hence convergence is much faster than DSDV.

1.2. Global state routing protocol (GSR)

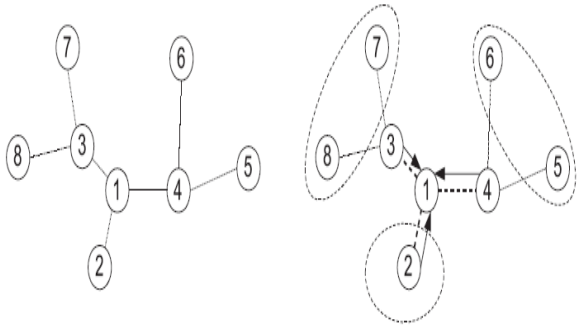
Global State Routing (GSR) [4] is similar to DSDV, It takes the idea of link state routing but improves it by avoiding flooding of routing messages. In this algorithm, each node maintains a Neighbor list, a Topology table, a Next Hop table and a Distance table. Neighbor list of a node contains the list of its neighbors. For each destination node, the Topology table contains the link state information as reported by the destination and the timestamp of the information. For each destination, the Next Hop table contains the next hop to which the packets for this destination must be forwarded. The Distance table contains the shortest distance to each destination node.

1.3. Hierarchical State Routing (HSR)

The characteristic feature of Hierarchical State Routing (HSR) is multilevel clustering and logical partitioning of mobile nodes. The network is partitioned into clusters and a cluster-head elected as in a cluster-based algorithm. In HSR, the cluster-heads again organize themselves into clusters and so on. The nodes of a physical cluster broadcast their link information to each other. The cluster-head summarizes its cluster's information and sends it to neighboring cluster-heads via gateway.

1.4 Source Tree Adaptive Routing Protocol (STAR)

The key feature of this protocol is that it applies Least Overhead Routing Approach (LORA) rather than the optimum routing approach (ORA). LORA makes Routing information updates are exchanged among nodes only to reflect an altering change. In STAR protocol each node is required to send an update message to its neighbors during initialization and also send update messages about new destinations, chances of routing loops, costs of paths. Every node broadcasts its source-tree information to wireless links used by the node in its preferred path to destinations. A router in STAR communicates to its neighbors the parameters of its source routing tree, which consists of each link that the router needs to reach every known destination (and address range) in the ad hoc network every node in the network should have a path to every destination. If a node does not have a path to a particular destination which the node wants to send packets to it [7], the node initiates a path absence message to its neighbors.



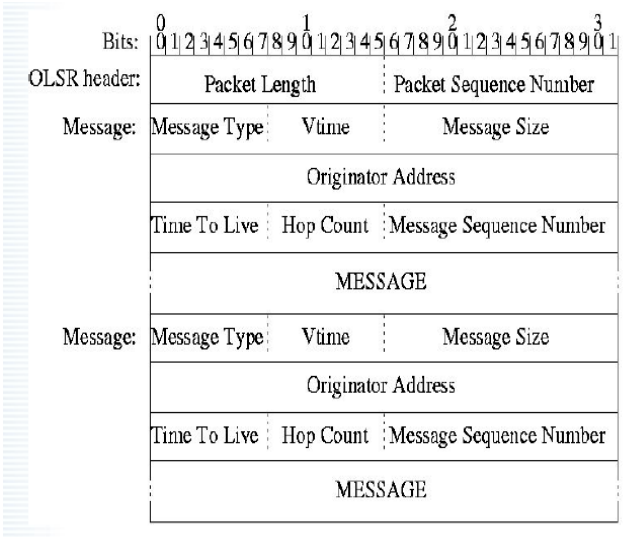
If a node 1 wishes to send data to node *N* and does not have path in its source tree it sends update message to all neighbors and indicates that there is no path to *N*; Neighbor that have the path, responses with update messages; node 1 updates its source tree and may begin transmission. In STAR, the topology of a network is modeled as a directed graph G=(V,E), where V Is the set of nodes and E is the set of edges connecting the nodes. A neighbor which has a path to this destination sends its own source tree in response. Otherwise, a neighbor forwards the message to its neighbors and so on until some alternate path is replied. This is considered as the link break maintenance mechanism in STAR.

1.5 Destination sequenced distance vector routing (DSDV)

Destination sequenced distance vector routing (DSDV) is adapted from the conventional Routing Information Protocol (RIP) to ad hoc networks routing. It adds a new attribute, sequence number, to each route table entry of the conventional RIP. [9]Using the newly added sequence number, the mobile nodes can distinguish stale route information from the new and thus prevent the formation of routing loops. [8]The improvement is made include freedom from loops in routing tables. Every mobile node in the network maintains a routing table for all possible destinations within the network and the number of hops to each destination node. Each entry is marked with a sequence number, number assigned by the destination node Routing table updates are periodically transmitted throughout the network in order to maintain table consistency. Large amount of network traffic, route updates can employ in two types of packets they are first is the "Full Dump" and second is the "Incremental routing". A full dump sends the full routing table to the neighbors and could cover many packets whereas, in an incremental update only those entries from the routing table are sent that has a metric change since the last update and it must fit in a packet.[10]When the network is relatively stable, incremental updates are sent to avoid extra Traffic and full dump are relatively infrequent.

1.6 Optimized Link State Routing (OLSR)

OLSR is a proactive link state routing protocol designed for MANET and VANET, which uses *hello* and *topology control* (TC) messages to discover and then disseminate link state information throughout the mobile ad-hoc network Individual nodes use this topology information to compute next hop destinations for all nodes in the network using shortest hop forwarding paths.



This protocol has been chosen for a series of features that make it suitable for highly dynamic ad hoc Networks. These features are the following:

1) OLSR is a routing protocol that follows a proactive strategy, which increases the suitability for ad hoc networks with nodes of high mobility generating frequent and rapid topological changes, like in VANETs [4], [5].
2) Using OLSR, the status of the links is immediately known. Additionally, it is possible to extend the protocol information that is exchanged with some data of quality of the links to allow the hosts to know in advance the quality of the network routes.
3) The OLSR protocol is well suited for high density networks, where most of the communication is concentrated between a large number of nodes (as in VANETs) [5].

OLSR is also a flat routing protocol; it does not need central administrative system to handle its routing process. The proactive characteristic of the protocol provides that the protocol has all the routing information to all participated hosts in the network. However, as a drawback OLSR protocol needs that each host periodic sends the updated topology information throughout the entire network, this increase the protocols bandwidth usage. But the flooding is minimized by the MPRs, which are only allowed to forward the topological messages.

III. CONCLUSION

In this paper, several existing routing protocols for ad hoc Wireless Networks were described. In table-driven protocols, each node maintain up-to-date routing information to all the nodes in the network where as on-demand protocols a node finds the route to a destination when it desires to send packets to the destination. Several table-driven protocols were discussed. GSR is table-driven protocols that use destination sequence numbers to keep routes loop-free and up-to-date. HSR are hierarchical routing.WRP is a table-based distance-vector routing protocol. Each node in OLSR discovers and maintains topology information of networks, and builds a shortest path tree to achieve preferred paths to destinations. DSDV updates its Routing table by periodically transmitted throughout the network in order to maintain table consistency. Routers in STAR communicate to its neighbors their source routing trees either incrementally or in atomic updates. Source routing trees are specified by stating the link parameters of each link belonging to the paths used to reach every destination.

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