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STUDY AND ANALYSIS OF DSDV AND OLSR

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Abstract: An instant network which is a collection of mobile nodes without any fixed topology is called as ad hoc network. Each node is free to join and leave the network independently. Each node has to act as both router and host at the same time. No base or fixed infrastructures is available in ad hoc networks like conventional fixed topology network. In this Paper, we discuss one link state protocol named optimized link state routing protocol (olsr) and one distance vector protocol named as Destination sequenced distance vector routing protocol (DSDV). Olsr and Dsdv both are table driven protocols. These protocols commonly used in wireless network but these are compatible with wired networks also. Ad-hoc version of famous Bellman-Ford algorithm used for wired network is known as Dsdv. The problems faced in wired network because of broken links is addressed in Dsdv. This modification in wired network protocol makes it suitable for wireless networks. Olsr is based on link state algorithm and it is proactive in nature. To maintain topology information of network at each node it periodically exchanges messages. It compacts the size of control packets by reducing the amount of information sent in messages and it reduces the retransmission of flooding messages in the network. For efficiently and economically flooding of control messages multipoint relay concept is used. It has optimal routes immediately available in terms of number of hops. This protocol is best suited for large and dense networks.

Keywords: Dsdv, Olsr, ad hoc network, table driven protocols, link state, distance vector.

I. INTRODUCTION

As new technologies are emerging, demand for flexibility and ease in working is increasing because of use of mobile computing is growing very fast. Day by day with the use of mobile networks they are growing in size too. Groups containing nodes from tens to several hundred can function independently. Due to mobility nodes get dispersed in an area larger than radio range of individual nodes as network size increases. For communication with out of range nodes one has to employ routing techniques which use

intermediate nodes. Our focus of discussion in this paper is problem of routing in mobile ad hoc networks and two protocols are proposed here as a solution. There are some design issues in developing protocols for wireless networks with mobile nodes which are more complex and different than those for wired network with static nodes. There are some major problems in ad hoc networks like limited bandwidth, high rate of topology changes, looping problem in routes, inconsistencies of information in different parts of network. The routing protocol for ad hoc networks should be capable of rapidly adapting to the link failures and additions caused due to nodes movement. It should also minimize the control traffic overhead caused in table driven protocols for maintaining routing table. It means, it should work in a distributed manner. It should be of self starting and self organizing nature. The problem of scaling also arises because of possibility of ad hoc networks to grow in size to have diameters.

II. Dsdv

The protocol used to solve the major problem which is loop free path associated with distance vector protocol of wired network is Destination Sequenced Distance Vector Protocol(DSDV).It is a proactive or table driven protocol and it is based on Bellman-Ford algorithm. It was introduced by C. Perkins and P. Bhagwat in 1994.Each mobile host maintains a routing table where each entry contains destinations IP address, next hop IP address, number of hops to reach the destination, sequence number assigned by the destination node and settling time. Sequence number is the number which is used to remove stale entries from the routing table. If there is valid link available to destination then sequence number is generated by destination node which is owner node. Owner node always uses even number. If there is a link break in the route a non owner node can also update sequence number for that route which is an odd number. Each mobile host advertises its own routing table entries with its neighbors nodes in update packet forms.

Types of update packets:

To reduce traffic route update packet is of two types. Full dump packets are used to send complete routing table entries. Full dump packets are used in case of fastly changing network. Incremental update packets are used to send only those entries from the routing table that has a metric change since the last update and it must fit in a packet. It is used when the network is relatively stable to avoid traffic. Each route update packet in addition to the routing table information also contains a unique sequence number assigned by the transmitter. There are two ways to select a route. 1) The route labeled with the highest sequence number is used. 2) If two routes have the same sequence numbers then the route with the best metric cost is used. Based on the past history, the nodes estimate the settling time of routes. The stations delay the transmission of a update packets by settling time so as to eliminate those updates that would occur for a very small time. Each row of the update packets contains Destination IP Address, Destination Sequence Number, Hops Count.

Pros:

1. It is easy to implement.
2. It is well suited for networks with small number of nodes.
3. It solves the loop problem in routing.

4. It has sequence number which is used to remove stale entries from the routing table.
5. It is compatible with conventional wired network.

Cons:

1. It requires regular update of its routing table which uses up battery power and a small amount of bandwidth even when the network is idle.
2. It is not suitable for highly dynamic networks.

III. Olsr

A routing table is maintained by each node in link state routing protocol for complete topology information. It is used to find the link costs of shortest paths. This information of link cost is periodically exchanged between nodes using flooding technique. Because of dynamic behavior of topology, wireless medium and instantaneously incorrect long propagation delays etc, link cost information may be inconsistent. It results in routing loops which are short lived and disappear on link updates.

Olsr is a proactive routing protocol for mobile ad hoc networks. It inherits its stability from the link state algorithm. As it is a proactive protocol it has immediately routes available when needed. Olsr is an optimization over pure link state protocol used for conventional network. In pure link state algorithm all the links with the neighbor nodes are declared and then flooded in the network. Firstly, olsr declares links with only a subset of neighbors which are its multipoint selector. Hence, it reduces the size of control packets. Secondly, it allows only selected nodes to retransmit its broadcast messages in the network called as multipoint relays. Hence, it minimizes the flooding of control traffic by reducing the retransmission of flooding messages. In response to link failure and additions, it does not generate any extra control traffic other than normal periodic control messages. It is beneficial for networks where a large number of nodes are communicating with each other and the source destination pairs are changing with time very frequently, as it has routes always available. Multipoint relays works well with large and dense networks. More dense and large a network is, more optimization is achieved as compared to link state algorithm. It does not depend upon any central entity as it works in a completely distributed manner. In radio networks, due to collision or other transmission problems, some loss of packets can be there. Olsr can sustain that loss because it periodically sends its control messages and does not require a reliable transmission for its messages. Each control message has a sequence number which shows it is the most recent information. Old information cannot be interpreted as the recent one at the receiving end. So, it does not require an in-order delivery of control messages. Olsr performs hop by hop routing, as it uses its most recent information to route a packet. If movement of a node can be followed in its neighborhood its packets can be delivered to it, even after it is moving.

Multipoint Relays:

The idea of multipoint relays is to reduce the retransmission of flooding messages in the same region so that flooding of broadcast messages can be minimized. Each node in the network selects a subset of neighbor nodes which can retransmit its broadcast messages. This set of selected nodes is called as multipoint relays (MPRs). The neighbor nodes of N, which are not in the MPRs set can read and process the broadcast packets received

from node N, but cannot retransmit them. Each node maintains a list of its neighbor nodes which are called its multipoint relay selector nodes N.

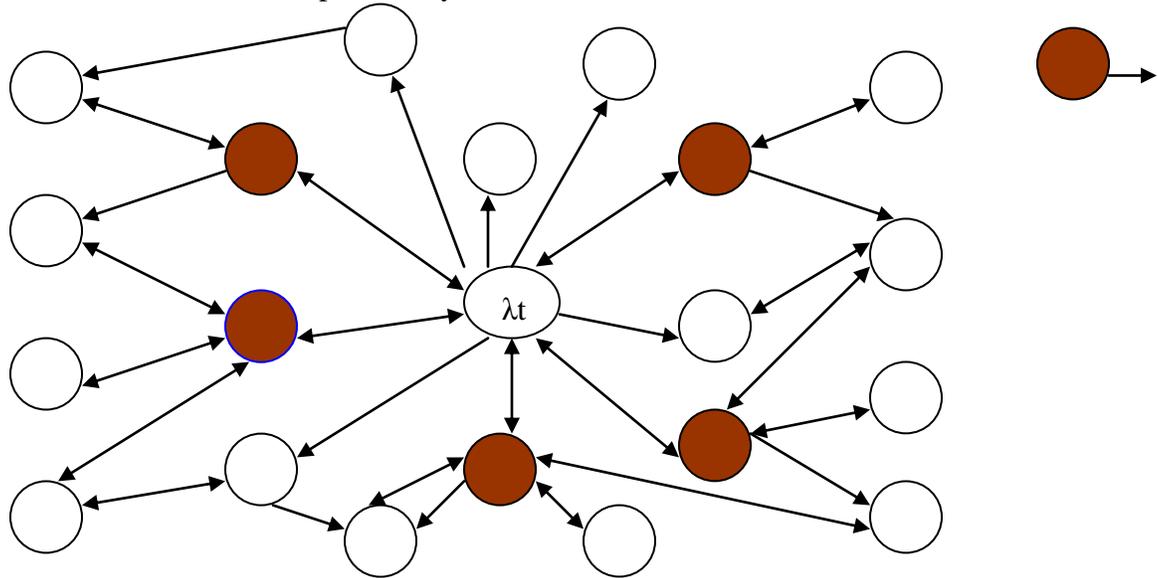


Fig: Multipoint relay selection of node N

Every broadcast message or packet coming from selector nodes is assumed to be retransmitted. This list can change over time which is indicated by the HELLO messages of the selector nodes. MPRs set is the subset of one hop neighbor nodes of node N such that this set covers all the two hop neighbor nodes of node N in terms of radio range. The multipoint relays set of node N is called as MPR (N). It is based on the condition that every two hop neighbor node of node N must have a bi-directional link towards MPR (N). The smaller is the multipoint relay set, more optimality is achieved. Olsr calculates its routes to all the destinations by using MPRs nodes as these nodes act as intermediate nodes in the path. Olsr relies on selection on MPRs set. To implement this scheme, every node has to periodically broadcast the information about its multipoint selector nodes. After receiving this information, each node calculates and updates its routes to all known destinations. Therefore, every route from source to destination is a sequence of hops which are multipoint relays. MPR (N) is one hop neighbor of node N with bidirectional links. So, it automatically avoids the problem of getting acknowledgment of data packet transfer at each hop by using uni-directional links.

Protocol functioning:

The uncertainties over radio propagation may make some links uni-directional. So, all the links must be checked in both directions in order to be considered valid. Each node broadcast its HELLO messages containing information about its neighbors and their link status. These control messages are received by all the one hop neighbors but retransmitted by only those nodes which have bidirectional links. A HELLO message contains the list of addresses of neighbors to which there exists a valid bi-directional link.

Each node can learn the knowledge of neighbors upto two hops by using HELLO messages. The multipoint relays are selected based on the knowledge present in HELLO messages. These multipoint relays are indicated in HELLO messages with their link status as MPR. On the reception of HELLO messages, each node can construct its multipoint relay selector table which are the nodes who have selected it as a multipoint relay. In the neighbor table, each node maintains the list of one hop neighbor, their link status and list of two hop neighbors that these one hop neighbors give access to. The possible values for link status are uni-directional, bi-directional and MPR. Link Status MPR shows that link is bi-directional and this one hop neighbor is selected as multipoint relay by this local node. Every entry in the neighbor table has an associated holding time, upon expiry of which it is no longer valid. The neighbor table also has a sequence number, which specifies the most recent MPRs set that this local node keeping this neighbor table has selected. Every time the node updates its MPRs set, sequence number is incremented to higher value.

Multipoint relay selection:

Each node independently selects its MPRs. In order to build the list of two hop neighbor nodes from a given node, it tracks the list of bidirectional links present in the HELLO messages received by this node as this two hop neighbor information is present in the neighbor table. At network initialization, the MPRs set can be equal to the complete one hop neighbor set. But it should be small enough to achieve optimality over pure link state algorithm. Changes multipoint relays of a given node are declared in the subsequent HELLO messages transmitted by this node, so that this information reaches the multipoint relays themselves. The multipoint relay set is recalculated only when: 1) A change in the two hop neighbor set with bi-directional links is detected. 2) A change in the neighborhood is detected, when either a bi-directional link with a neighbor is failed or a new neighbor with bi-directional link is added. With the information received in HELLO message, a node can construct its multipoint relay selector table. This selector table contains the addresses of the nodes which have selected it as a multi relay along with the associated MPR sequence number of that neighbor node. A node modifies its selector table according to the information it received in the HELLO messages and increments this sequence number on every modification.

MPR information declaration:

Each node periodically broadcasts specific control messages called topology control (TC) messages for building an intra-forwarding database to route packets. TC are forwarded like normal broadcast messages in the entire network. This technique is similar to the link state technique used in ARPANET, but it takes advantage of MPRs which enables a better scalability of the intra-forwarding database. TC message is sent by each node in the network to declare its multipoint relay selector set that is the message contains the list of neighbors who have selected the sender node as a multipoint relay. The sequence number associated to the MPR selector set is also sent with the list. A node can build its topology table with the help of information diffused by these TC messages. A node which is not selected as multipoint relay by any node in the network cannot generate any TC message. Only multipoint relay node can generate TC message. A node with an empty MPR selector set cannot generate TC message.

The interval between transmission of two TC messages depends on whether the MPR selector set is changed or not since the last TC was sent. Some minimum interval is specified for transmitting next TC message. If MPR selector set is changed then TC message can be sent before scheduled time, but after some pre-specific minimum interval time, starting from the time the last TC message was sent. The next TC may be sent immediately only if that much time has elapsed. If MPR point selector set is not changed then subsequent TC messages are sent with normal default interval time. To record topology information of the network each node maintains a topology table. In this table a node stores information about multipoint relays of other nodes. Routing table is calculated based on this topology table information. Each topology entry consists of address of a destination which is address of a MPR selector in the received TC message, address of last hop node to reach that destination which is sender of the TC message and the MPR selector set sequence number of the sender node. This means that destination node can be reached through in the last hop through this last hop node. Each topology entry has an associated holding time, upon expiry of which it is no longer valid.

The following procedure must be adopted to build the topology table after receipt of TC message:

- 1) If there exists some entry in the topology table whose last hop address corresponds to the originator address of the TC message and MPR selector sequence number in that entry is greater than the sequence number in the received message then no further processing of message is done and the message is silently discarded. The case is considered as packets received out of order.
- 2) If there exists some entry in the topology table whose last hop address corresponds to the originator address of the TC message and MPR selector sequence number in that entry is smaller than the sequence number in the received message, then that topology entry is removed.
- 3) For each MPR selector address in the received TC message, if destination address in the topology table entry corresponds to the MPR selector address and last hop address corresponds to the originator address of the TC message, then holding time of that entry is refreshed. Otherwise a new topology entry is recorded in table.

Pros:

- 1) Olsr declares links with only a subset of neighbors which are its multipoint selector. Hence, it reduces the size of control packets.
- 2) It allows only selected nodes to retransmit its broadcast messages in the network called as multipoint relays. Hence, it minimizes the flooding of control traffic by reducing the retransmission of flooding messages.
- 3) In response to link failure and additions, it does not generate any extra control traffic other than normal periodic control messages.
- 4) More dense and large a network is, more optimization is achieved as compared to link state algorithm.
- 5) Due to collision or other transmission problems, some loss of packets can be there. Olsr can sustain that loss.
- 6) It does not require an in-order delivery of control messages.
- 7) It uses bi-directional links as routes, so it automatically avoids the problem of getting acknowledgment of data packet transfer at each hop by using uni-directional links.

8) It does not depend upon any central entity as it works in a completely distributed manner.

Cons:

- 1) MPRs set should be as small as possible to achieve optimality.
- 2) A number of routing tables are required to maintain at each node.

Characteristics summary of OLSR and DSDV

Protocol/characteristics	Olsr	Dsdv
Routing Philosophy	Proactive	Proactive
Type of routing	Hop by Hop	Distance vector
Throughput	High	Low
Delay	Low	High
Frequency of updates	Event/time driven	Time driven
Multiple paths	No	No
Route repository	Routing table	Routing table

IV. Conclusion

In this paper an effort is made to explain two table driven protocols. We conclude that both protocols have their own advantages and disadvantages. Olsr must be used in high dense networks to achieve high optimality. An effort must be made to reduce overhead problem in proactive protocols. Dsdv is very simple to implement but is it suitable to use only in less dense network. Some implementation should be there to make its use convenient in more dense networks. We can compare their performance using different metrics in different situations so as to know which protocol is better to use by using some simulator like opnet,ns-2 etc. This simulation helps in implementation of protocols.

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