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RESEARCH ARTICLE

A Comparative Analysis of Pro-active Routing Protocols in MANET

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ABSTRACT: A mobile ad hoc network (MANET) is a collection of mobile nodes that is connected through a wireless medium forming rapidly changing topologies. A collection of mobile nodes that form a network without any fixed infrastructure. Therefore, routing in MANET is a critical task due to highly dynamic environment. Efficient Routing Protocols will make MANET reliable. The routing protocols in MANET classified into three categories proactive (Table driven), reactive (On demand) and Hybrid routing protocols. But we will discuss Proactive routing protocols DSDV and WRP. In This paper provides an overview of these protocols by presenting their characteristics, functionality, benefits and then their comparative analysis parameters. These protocols will be measured with suitable metrics.

Keywords: - MANET, DSDV, WRP

Introduction

Mobile Ad-hoc Networks (MANET) are specific network configurations that appear in the context of these networks. They provide a powerful paradigm for modeling self-configuring wireless networks which make them so appropriate to use in the fourth generation mobile networks. In recent years, Ad-Hoc Networks have seen a significant explosion of activities due to their ease of deployment in response to some application needs together with the availability of low cost peripherals equipped with wireless interfaces. The proactive protocols are appropriate for less number of nodes in networks, as they need to update node entries for each and every node in the routing table of every node. It results more Routing overhead problem. There is consumption of more bandwidth in routing table.

Proactive routing Protocols (Table driven):

Proactive routing protocols maintain consistent and up to date routing information about each node in the network[1]. These protocols require each node to store their routing information and when there is a change in network topology the entire network has to be updated. The main advantage is to minimize the delay in obtaining a route when initiating traffic to a destination and quickly determines whether a destination is reachable. This process can also consume significant network resources.

Some of the existing table driven protocols are given below.

- Destination sequenced Distance vector routing(DSDV)
- Wireless routing protocol (WRP)

Destination sequenced distance vector routing (DSDV)

DSDV is a table driven algorithm based on Bellmand-Ford routing mechanism (Ford Jr, and Fulkerson, 1962). In DSDV, packets are routed between nodes within a network, using routing tables stored at each node. Every node in the network has a routing table, which specifies all possible destinations in the network and the number of hops to each destination is recorded. Each entry is marked with the sequence numbers, which helps to identify the stale routes from new ones. To maintain consistency updated table are transmitted periodically. Figure 1 illustrates the routing procedure of DSDV[2]. Consider a packet which needs to be sent from node 1 to node 3. From node 1, the next hop for the packet is node 4. When node 4 receives the packet, it looks up the routing table with the destination address (node 3). As per the routing table entry in node 4, it transmits the packet to the next hop as specified by node 5. This procedure repeats until the packet finally reaches the destination. To reduce the network traffic overhead, updation can employ two possible types of packets. The first is known as full dump. This type of packet carries all routing information and can require multiple network protocol data units. During the periods of occasional movement, these packets are transmitted infrequently. Incremental packets are used to relay the information, which has changed since the last full dump. These broadcasts should fit into a standard size Network Protocol Data Unit (NPDU), thereby decreasing the amount of traffic generated. The mobile nodes maintain an additional table where they store the data sent in the incremental routing information packets (Perkins and Bhaqat 1994). New routes, which are broadcasted, contains the address of the destination, the number of hops to reach the destination, the sequence number of the information received during the destination, as well as new sequence number unique to broadcasts (Royer and Toh 1999. The route labelled with the most recent sequence number is used. If two updates have the same sequence number, the one with the smaller metric is used to shorten the path.

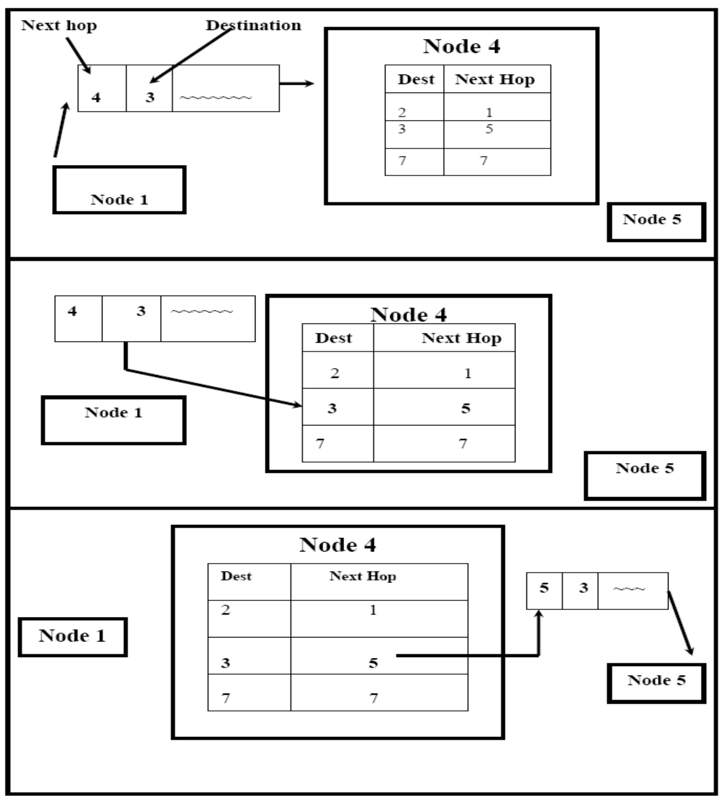

Figure:1 Destination sequenced distance vector routing

To avoid nodes and their neighbours generating conflict sequence numbers when topology changes, nodes generate even sequence numbers for themselves and neighbours responding to link changes generate odd sequence numbers[3]. DSDV has more procedures for handling network layer addresses, dealing with non-mobile stations, damping fluctuations caused by topology changes.

Advantages: By delaying the broadcast of updation and length of settling time, mobiles can reduce network traffic and optimize routes by eliminating those broadcasts that would occur if a better route was discovered in the near future.

Disadvantages: DSDV requires broadcasting periodic updates, regardless of network traffic. As the number of nodes in the network grows, the size of the routing table and the bandwidth required to update also grows. This remains as overhead, which has been found in simulation with the network consisting of 50 nodes (Broch et al 1998). DSDV does not perform well when there is a high rate of node mobility.

Wireless routing protocol (WRP)

Wireless routing protocol is a table-based protocol where it maintains the routing information at all nodes in the network (Murthy, and Garcia, 1996)[4]. Each node in the network maintains four tables.

- Distance table
- Routing table
- Link cost table
- Message retransmission list table (MRL)

The distance table of a node x contains the distance of each destination y via each neighbour z of x. It also contains the distance information of downstream neighbor of z through which the path is realized. The routing table of node x contains the distance of each destination node y from node x, the predecessor and successor of node x on this path. It also contains a tag entity to determine whether the entry is a simple path, a loop or invalid. Storing predecessor and Successor in the table helps to detect loops and avoid count to infinity problems. The link cost table contains cost of link to each neighbour of the node and the number of time-outs since an error free message was received from that neighbour[5]. Each entry of MRL contains the sequence number of update message, a retransmission counter, an acknowledgement required flag vector with one entry per neighbour, lists of updates sent in the update message. MRL keeps a record of which updates in an update message has to be retransmitted. The neighbours should acknowledge the retransmission. Mobiles inform each other about the link changes with an update message. Update message are sent between the neighbouring nodes, it contains a list of updates, list of responses specifying which of the mobiles should acknowledge the update.

Update messages are sent when there is a change in link and when there is a loss of link. The neighbours then update their distance table entries and check for new possible paths through other nodes. If any new paths are relayed back to the original nodes then they can update their tables accordingly[6]. The existence of neighbours is known through the receipt of acknowledgement and other messages. To ensure connectivity a node must send a hello message, within a particular period of time. Lack of message from the node indicates a failure of link, which causes a false alarm. When a hello message is received from a new node, the new node is added to the mobile routing table and the mobile sends the new node a copy of its routing information.

In Figure 2 there is a short example showing how WRP updates node's routing tables, when a link failure occurs. Link costs are as indicated in the figure[7]. The arrows next to links indicate the direction of update messages and the label in parentheses gives the distances and the predecessor to destination J. The figure focuses on update messages to destination J only.

Advantages: Wireless routing protocol belongs to path finding algorithm. It eliminates looping situation and provides faster route convergence when a link failure event occurs.

It enhances distance vector routing in four ways:

- When there is no link change, wireless routing protocol exchanges hello messages rather than exchanging the whole route table.
- If there are topology changes, only the path vector tuples that reflect the updates are sent. The path vector tuple contains destination, distance, and the predecessor node id
- To improve reliability while delivering update message, every neighbor must send an acknowledgement for the update packets received[8]. Retransmissions are made if positive acknowledgements are not received within the particular period.
- The predecessor node id information allows the protocol to recursively calculate the entire path from source to destination[9]. With this information, wireless protocol reduces looping situation, reduces the time for convergence and is less prone to count to infinity problem.

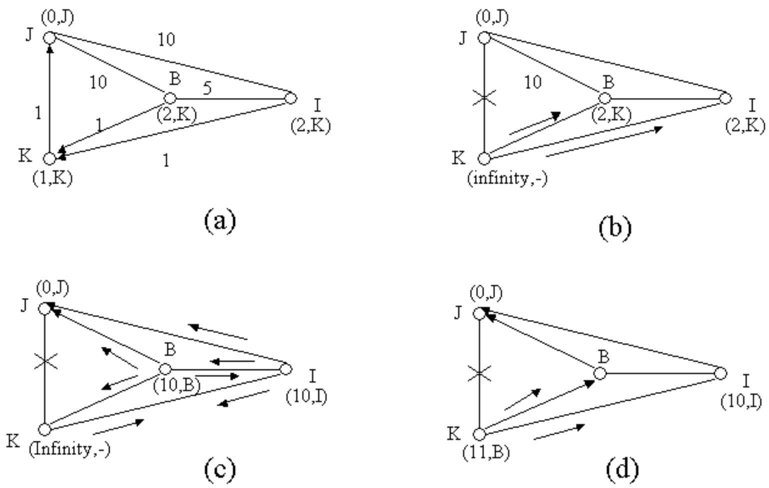

Figure 2: An example of WRP-routing protocol's operation

COMPARISON OF PROTOCOLS

In this section we have presented a comparison between existing routing protocols. Table 1 below provides an overall comparison of the two categories of routing protocols property[10]. The comparisons basically consider the characteristic properties of routing protocols in high load networks. In order to make flat addressing more efficient, the number of routing overheads introduced in the networks

Protocol Property	**DSDV**	**WRP**
Routing Philosophy	Flat	Flat
Loop free	Yes	Yes, But not instantaneous
Multicast Capability	NO	NO
Number of Required tables	Two	Four
Frequency of Updates transmission	Periodically and as needed	Periodically and as needed
Update transmitted	Neighbours	Neighbours
Utilizes sequence numbers	Yes	Yes
Utilizes hello messages	Yes	Yes
Critical Nodes	No	Yes
Network size	Small	Small-Medium
Support for mobility	Poor	Poor-Fair

Special Advantages	Memory requirement is moderate and guarantees loop free paths at all instants	It eliminates looping situation and provides faster route convergence when a link failure event occurs.
Special disadvantages	Scalability is poor	Memory requirements periodic hello messages
Routing metric	Shortest path	Shortest path

Table :1 Comparison of characteristics of table driven protocols

Conclusion

There is vast number of different kinds of protocols. Each of these protocols has some common goals. Every protocol has the ability of distributed routing calculations and every protocol try to manage the consequences caused by mobility of nodes. DSDV protocol requires each mobile node in the network to advertise its own routing table to its current neighbors. In WRP nodes learn of the existence of their neighbors form the receipt of acknowledgements and other messages. WRP reduces the number of cases in which a temporary routing loop can occur. Since WRP, like DSDV, maintains an up-to-date view of the network, every node has a readily available route to every destination node in the network. It differs from DSDV in table maintenance and in the update procedures. WRP has the same advantage as that of DSDV. In addition, it has faster convergence and involves fewer table updates. But the complexity of maintenance of multiple tables demands a larger memory and greater processing power from nodes in the ad hoc wireless network.

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