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A Comparative study of DSR, EDSR, DSDV and WRP Routing Protocol in Ad Hoc Networks

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Abstract— Ad hoc network is an infrastructure less and decentralized type of network in which there exist no access point or router to provide service. Each node in Ad hoc network exists as a router in order to forward and receive the packets. Routing protocols in Ad hoc networks can be classified into two categories which are Proactive and Reactive. This paper presents the comparative study of few reactive and proactive routing protocols. In reactive routing protocols, the routes are discovered by the source node at the time of its requirement thus avoiding unnecessary energy consumption in frequent beaconing unlike proactive routing protocols, in which the routes are always available whether the source node needs or not.

Keywords— Ad Hoc Network, DSR, EDSR, DSDV, WRP

I. INTRODUCTION

Ad hoc network is a multi hop network that consists of nodes which are dynamic in nature. The traditional fixed network protocols are not viable for this kind of network. In Ad hoc network there exist no routers and access point, so every node in the network participate in routing for forwarding the data. The Ad hoc networks have advantage of quick and cost effective deployment. The various application areas of Ad hoc networks are military battle field, emergency and disasters operations, tactical networks etc. There are two categories of Ad hoc routing protocols which are Reactive and Proactive. In proactive routing protocol each node is responsible for maintaining and keeping complete information about the topology in the network while as in case of reactive routing protocols, routes are created only when needed. [1][4][7][8][9]

II. ROUTING PROTOCOLS

In this section we present the description and analysis of few routing protocols which include DSR, EDSR, DSDV and WRP.

A. Dynamic Source Routing Protocol

DSR is an On Demand routing protocol, which was designed to operate in multi hop wireless networks. In DSR the information about the path from source to destination is contained in the header of the packet. As the packet traverses through large number of intermediate nodes between the source and destination, the header size of packet grows. The DSR protocol consist two stages which are route discovery and route maintenance. The route discovery phase is used only when the source node attempts to send data packets to the destination node. The source nodes first consult its route cache to determine whether any route up to the destination exists or not. If the route exists, the source node will then uni-cast the route request packet through that path, otherwise it will broadcast route request packets to all its neighbours. The route request packet contains the address of the destination node, source node and the unique identification number. The unique identification number is used to differentiate between the old and new routes or between the stale and fresh routes. Each node on receiving the packet checks whether it has route to the destination. If it does not have then it adds it own address to the route record packet and then forward the packet along its outgoing path until it will reach to the destination. If it has the route available, then it will uncast the route request packet through that route to the desired destination. Once the route request packet is received by destination node, it responds with the route reply packet by reversing the path through which route request was sent. The route maintenance process is started when the breakage of the link occurs in the network. The node at which the failure of the link occurs sends a route error message to the source node which in turn starts searching for alternative path. [2][7]

B. Efficient Dynamic Source Routing Protocol

EDSR was designed to improve the route maintenance process of DSR. EDSR uses two levels of threshold for two purposes, one for the nodes battery power and another for received RF signal. In EDSR, each node periodically checks the battery power and received RF signal in its primary route. If the battery power of any node has reached to higher threshold level then it will immediately inform the source node. The source node consults its cache for checking the freshness of all the backup routes and simultaneously keeps on deleting the routes which are stale. As the route cache

becomes empty, it immediately starts discovering new paths by sending the route request messages. When the energy of node reaches to the lower threshold level, the source node immediately checks its cache for freshness of all back up routes. If any route is present in the cache, then that is considered as a primary route and used for data transmission. If no route is available, then the packets are buffered until any another route is discovered. The protocol is an improvement over basic dynamic source routing. [3]

C. Destination Sequenced Distance Vector Routing Protocol

DSDV is a protocol which belongs to the category of table driven protocols. Basically the protocol is based on the concept of Bell-man Ford routing mechanism and provides freedom from network loops. In DSDV each node maintains the routing table which contains the information sufficient to route packets to the destination without letting packet size to grow. One of the main things related to DSDV is that, the routing information is made always available regardless whether the source node needs it or not. Each path has unique sequence number that differentiates between the stale routes and the new routes, which helps to avoid loops in the network. Each node in the network periodically sends routing update throughout the network and maintains the consistency in the network. The two types of update packets used in DSDV are: full dump update packet and the increment update packet. Full dump update packet is a packet having all the routing information for routing the packets and can involve multiple network protocol data units while as the incremental update packet is used to transmit the information that has been changed while in the last full dump. The routing tables maintained contain the information about the address of the destination node, the number of hops that the packet has to traverse to reach the destination and the unique sequence number. The sequence number of even and odd parameters gives the presence and the absence of the link in the network. [5]

D. Wireless Routing Protocol

A WRP also belongs to the category of table driven protocols. This type of protocol is much similar to that of DSDV protocol. It exhibits the properties of distributed Bellman-Ford algorithm. In WRP all the intermediate nodes which are participating in the communication must periodically send the hello message to each other to ensure the connectivity. If any of the nodes does not send any hello message, then it is declared as a dead node and same may be updated by its neighbours. The WRP protocol is different from the DSDV in a manner that DSDV maintains only one table while as WRP maintains a set of tables. Thus WRP has more accurate information about the network and performs quick and fast routing but is complex. WRP has an advantage of eliminating the loops which can lead to problems in the network. [6] The different tables maintained by WRP are:

Distance Table: It specifies the number of hops between the nodes to the destination.

***Routing Table*:** It contains the record of all feasible paths from the node to the destination.

Link-cost Table: Link-cost table gives us the information about the delay associated with particular link in the network. The cost of broken link is infinity.

Message Retransmission List Table: The sequence number of the updated message is contained in the MRL table. The MRL accounts for which updates are needed to retransmit

TABLE I
COMPARISON OF DSR, EDSR, DSDV AND WRP

parameters	DSR	EDSR	DSDV	WRP
Availability of routing information	On demand	On demand	Always available	Always available
Routing philosophy	Flat	Flat	Flat	Flat
Number of thresholds	-	Two	-	-
Loop-free	Yes	Yes	Yes	Yes but not instantaneous
Beaconing requirement	No	No	Yes	Yes
Periodic route update	No	No	Yes	Yes
Number of tables	-	-	Two	Four
Routes maintained in	Route cache	Route cache	Route table	Route table
Multi cast capability	No	No	No	NO

The comparative study reveals that all these protocols play an important role in avoiding loops in the network. DSDV and WRP make use of the tables to maintain accurate information for efficient routing but at the same time it also consumes large amount of memory and high processing power for maintaining large amount of information. DSR and EDSR were designed to overcome the problem of maintaining the tables but that leads to the growing of packet size at each node in the path and which ultimately leads to the loss of packets. Each protocol has its advantages and disadvantages and accordingly they are used for different applications.

III. CONCLUSION

In this paper we present a comparative study and description of reactive and proactive routing protocols. Reactive routing protocols have less energy consumption than proactive routing protocols but at the cost of high delay. Among the protocols studied, the EDSR is most advanced and reliable as there is minimum path breakage due to the utilization of two threshold levels of energy and communication can be carried for long period of time without any interruption.

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