International Journal of Scientific Engineering and Research (IJSER)
ISSN (Online): 2347-3878
Index Copernicus Value (2015): 62.86 | Impact Factor (2015): 3.791

Survey On Different Types of Routing Protocol in Mobile Ad Hoc Networks

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Abstract: ***In recent years mobile ad hoc networks have become very popular and lot of research is being done on different aspects of MANET. MANET is a dynamically reconfigurable wireless network with no fixed infrastructure. Each node acts as a router and host and it moves in an arbitrary manner in many ad hoc networks. There are different aspects which are taken for research like routing, synchronization, power consumption, bandwidth considerations etc. There are different routing protocols proposed for MANETs which makes it quite difficult to determine which protocol is suitable for different network conditions. There are a number of issues which affect the reliability of Ad - hoc networks and limit their viability for different scenarios; lack of centralized structure within MANET requires that each individual node must act as a router and is responsible for performing packet routing tasks; this is done using one or more common routing protocols across the MANET therefore the routing in MANETs is a key issue. The major reason for this is the constant change in network topology because of high degree of node mobility. A number of protocols have been developed to accomplish this task. In this paper we will investigate and compare the performance of DSDV, DSR, ZRP routing protocols on basis of various parameters. In this paper I have chosen each category routing protocol. Our aim is to compare all the Routing protocols based upon parameter and provides an overview of different routing protocols proposed in literature.***

Keywords: DSDV, MANET, DSR, ZRP

1. Introduction

Adhoc Networks:
A wireless ad hoc network is a decentralized type of wireless network. The network is ad hoc because it does not rely on a preexisting infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless network [8]. Ad Hoc networks do not have a certain topology or a central coordination point. Therefore, sending and receiving packets are more complicated than infrastructure networks.

Figure 1: Illustrates an Ad Hoc network

Nowadays, with the immense growth in wireless network applications like handheld computers, PDAs and cell phones, researchers are encouraged to improve the network services and performance. One of the challenging design issues in wireless Ad Hoc networks is supporting mobility in Mobile Ad Hoc Networks (MANETs). The mobility of nodes in MANETs increases the complexity of the routing protocols and the degree of connection's flexibility. However, the flexibility of allowing nodes to join, leave, and transfer data to the network pose security challenges

A MANET is a collection of mobile nodes sharing a wireless channel without any centralized control or established communication backbone. MANET has dynamic topology and each mobile node has limited resources such as battery, processing power and on - board memory. This kind of infrastructure - less network is very useful in situation in which ordinary wired networks is not feasible like battlefields, natural disasters etc [17]. The nodes which are in the transmission range of each other communicate directly otherwise communication is done through intermediate nodes which are willing to forward packet hence these networks are also called as multi - hop networks.

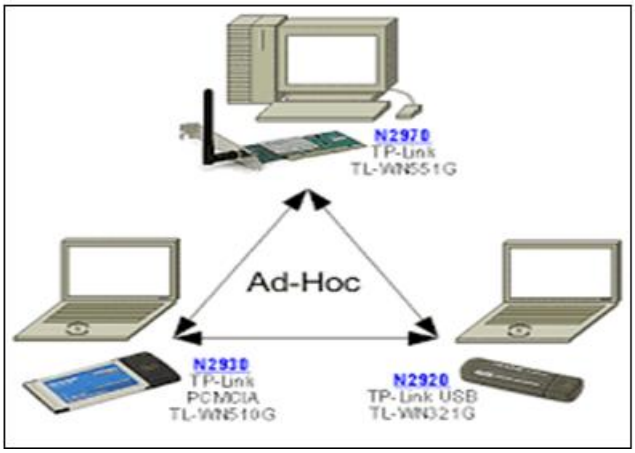


Figure 2: Illustrates a MANET

2. Characteristics of MANET

Mobile ad hoc network nodes are furnished with wireless transmitters and receivers using antennas, which may be highly directional (point - to - point), omnidirectional (broad - cast), probably steerable, or some combination. At a given point in time, depending on positions of nodes, their

transmitter and receiver coverage patterns, communication power levels and co channel interference levels, a wireless connectivity in the form of a random, multihop graph or "ad hoc" network exists among the nodes [1]. This ad hoc topology may modify with time as the nodes move or adjust their transmission and reception parameters. The characteristics of these networks are summarized as follows:

1) Communication via wireless means.
2) Nodes can perform the roles of both hosts and routers.
3) Bandwidth - constrained, variable capacity links.
4) Energy - constrained Operation.
5) Limited Physical Security.
6) Dynamic network topology.
7) Frequent routing updates.

3. Classification of Routing Protocols

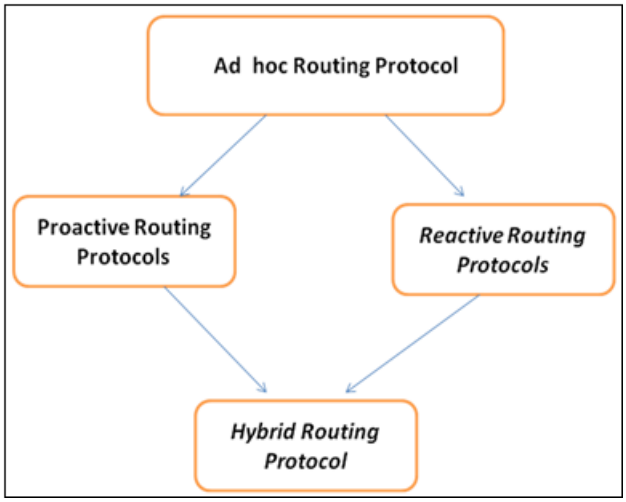


Figure 3: Illustrates an Basic Classification

Routing protocols define a set of rules which governs the journey of message packets from source to destination in a network.
In MANET, there are different types of routing protocols each of them is applied according to the network circumstances.

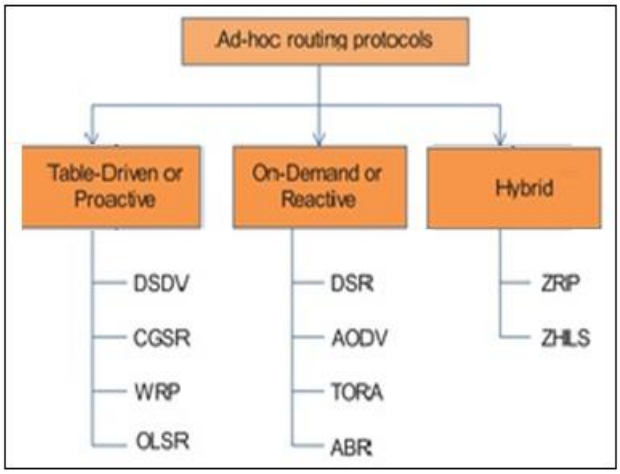


Figure 4: Illustrates a Ad hoc Routing Protocol

3.1 Proactive Routing Protocols

The Proactive Routing protocol is also called table driven protocol. In Proactive Routing each node updates and maintains its routing protocol every time the topology changes in the network. Therefore, it is obscure task to store and maintain entries of each node. So this routing is not appropriate for large networks. Most proactive routing protocols proposed for mobile ad hoc networks have inherited properties from algorithms used in wired networks. In this every node maintain routing table which contains information about the network topology even without requiring it. This feature although useful for datagram traffic, incurs substantial signaling traffic and power consumption. The routing tables are updated periodically whenever the network topology changes. Proactive protocols are not suitable for large networks as they need to maintain node entries for each and every node in the routing table of every node. These protocols maintain different number of routing tables varying from protocol to protocol. There are various well known proactive routing protocols. Example: DSDV, OLSR, WRP etc. I. Destination - Sequenced Distance - Vector Routing Protocol (DSDV)

DSDV is developed on the basis of Bellman–Ford routing algorithm with some modifications. The main contribution of the algorithm was to solve the routing loop problem [14]. In this routing protocol, each mobile node in the network keeps a routing table. Each of the routing table contains the list of all available destinations and the number of hops to each. Each table entry is tagged with a sequence number, which is originated by the destination node. Periodic transmissions of updates of the routing tables help maintaining the topology information of the network. If there is any new significant change for the routing information, the updates are transmitted immediately. So, the routing information updates might either be periodic or event driven. DSDV protocol requires each mobile node in the network to advertise its own routing table to its current neighbors. The advertisement is done either by broadcasting or by multicasting. By the advertisements, the neighboring nodes can know about any change that has occurred in the network due to the movements of nodes. The routing updates could be sent in two ways: one is called a full dump and another is incremental. In case of full dump, the entire routing table is sent to the neighbors, where as in case of incremental update, only the entries that require changes are sent. If a router receives new information, then it uses the latest sequence number. If the sequence number is the same as the one already in the table, the route with the better metric is used. Stale entries are those entries that have not been updated for a while. Such entries as well as the routes using those nodes as next hops are deleted.

3.2 Reactive Routing Protocol

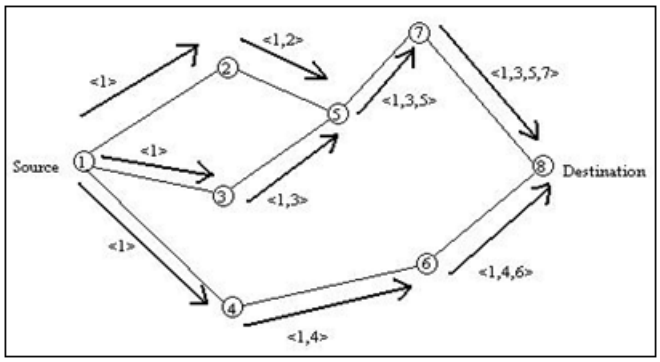
Reactive routing protocol is also known as on demand routing protocol. In this protocol route is discovered whenever it is needed nodes initiate route discovery on demand basis. Source node sees its route cache for the available route from source to destination if the route is not available then it initiates route discovery process. The on - demand routing protocols have two major components.

Route discovery: In this phase source node initiates route discovery on demand basis. Source nodes consult its route cache for the available route from source to destination

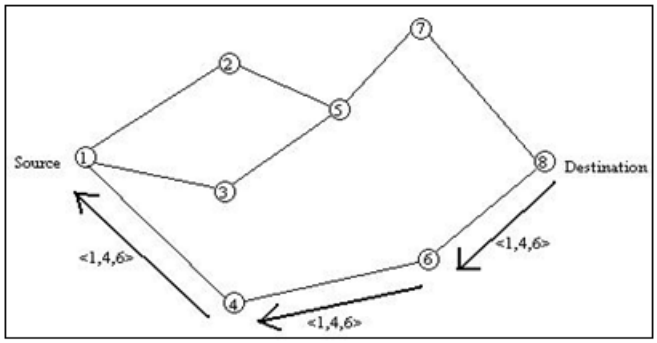
otherwise if the route is not present it initiates route discovery. The source node, in the packet, includes the destination address of the node as well address of the intermediate nodes to the destination [7].

Route maintenance: Due to dynamic topology of the network cases of the route failure between the nodes arises due to link breakage etc, so route maintenance is done. Reactive protocols have acknowledgement mechanism due to which route maintenance is possible. Reactive routing protocols are acquiring routing information only when it is needed they are on - demand protocol. In reactive routing, a route determination process is invoked on demand when a source node request for a route to destination node.

1) Dynamic Source routing (DSR)



(a) Building Record Route during Route Discovery



(b) Propagation of Route Reply with the Route Record

Figure 5: Dynamic source routing

DSR is a type of reactive routing protocol. DSR is composed of two main mechanisms route discovery and route maintenance. Route Discovery: It is the method in which the source node receives the end node source destination path. In DSR to further reduce the cost of route discovery, the RREQs are initially broadcasted to neighbors only by zero - ring search, and then to the entire network if no reply are received [18]. When an intermediate node forwarding a packet detects through Route Maintenance that the next hop along the route for that packet is broken, if the node has another route to the packets ´s destination it uses it to send the packet rather than discard it. Route maintenance: In route maintenance a routing entry contains all the intermediate nodes information not only the next node information. The source node has entire routing path, and the packet is sent through that routing path. If the source node does not have entire routing path, then it executes route discovery mechanism by sending the route request (RREQ) packets in the network. Then in reply the route reply (RREP) packet is send by the node which has path to destination node.

3.3 Hybrid Routing

Hybrid protocol is association of the advantage of the both proactive and reactive routing protocol. Hybrid protocol is turned - out to overcome the limitations of both Proactive and Reactive protocol.

1) The Zone Routing Protocol (ZRP)

The Zone Routing Protocol (ZRP) combines the qualities of the proactive and reactive approaches by maintaining an up to - date topological map of a zone centered on each node. ZRP uses proactive approach for routing inside the zone i. e. intra - zone routing protocol (IARP) and reactive approach for routing outside the zone i. e. inter - zone routing protocol (IERP) [5]. Fig.6 represents the Architecture of ZRP.

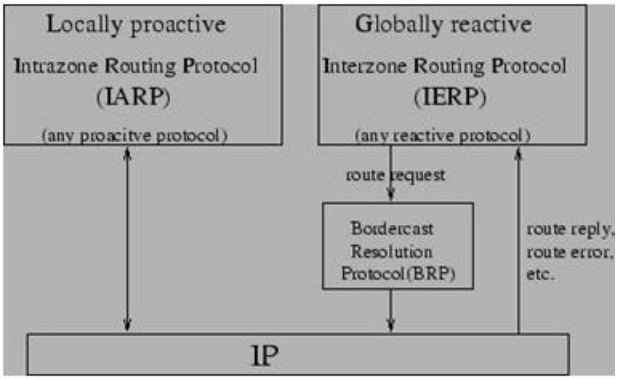


Figure 6: ZRP

2) Routing in ZRP

In the route discovery mechanism, the source initiates the route discovery, it first checks whether the destination is inside or outside the zone. If the destination node is within the zone, the packet is routed using proactive approach and if the destination node is outside the zone, reactive routing is used [7]. Reactive approach for routing the packet to the destination outside the zone includes two phases: route discovery phase and route reply phase. In route discovery phase, using Border cast Resolution Protocol (BRP), the source node sends a RREQ (route request) packet to its peripheral nodes. If the node receiving the RREQ packet knows the destination sends a route reply to the source, otherwise the process continues by border casting the packet. A node that can provide a route to the destination node sends a route reply to the source node.

Table 1: Parametric Comparison of All Protocols

Parameters	Proactive Protocol	Reactive Protocol	Hybrid Protocol
Routing Philosophy	Flat\Hierarchical	Flat	Flat\Hierarchical
Routing scheme	Table driven	On demand	Combination of both
Topology dissemination	On demand	Periodical	Both
Route latency	Available when needed	Always available	Both
Communication Overhead	Low	High	Medium
Scalability	Low	Suitable for small Networks	Designed for large Networks
Storage capacity	High	Low	Depend on the zone
Types	DSDV, WRP, FSR	AODV, DSR, TORA	ZRP, WARP

Table 2: Characteristic Summary of DSDV, DSR, ZRP

Protocol	Destination Sequenced Distance Vector Routing	Dynamic Source Routing	Zone Routing Protocol
Category	Proactive protocol	Reactive protocol	Hybrid protocol
Metrics	Shortest Path	Newest path, Shortest Path	Shortest path
Route Recovery	Notify source	Notify source, local repair	Start repair at Failure point
Route repository	Routing table	Routing table	Inter zone and Intra zone table
Broadcasting	Simple	Simple	Simple
Multiple path	Yes	No	Yes
Communication overhead	Low	High	Medium
Feature	Update are localized	Only keep track of next hop	Routing range defined In the hop

4. Conclusion

Routing is very essential component in MANETs. These are dynamic networks where topology is changing very rapidly. Every time the topology changes the source to destination path also change, so our routing protocol must able to handle the all challenges of routing. We have discussed the three types of routing protocols. The proactive, reactive and hybrid routing protocol, with the help of taking example of each protocol. The DSDV shows least communication than DSR and ZRP. The DSDV perform well for static network, whereas DSR perform better for dynamic networks. The ZRP protocol is suitable for large networks, for small networks DSDV is better. ZRP is not an independent protocol but rather a routing framework. Further, any evaluation of the ZRP version with support for unidirectional links could not be found. Nevertheless, tests made in verify that ZRP with proper configuration of radius performs more efficiently than traditional routing protocols without need for centralized control. It is especially well adapted to large networks and diverse mobility patterns. Overall answer of research paper is that, the mobility, traffic pattern and the network size play a key role in choosing the protocol. It is quite natural that one particular solution cannot be applied for all sorts of situations and, even if applied, might not be optimal in all cases. Often it is more appropriate to apply a hybrid protocol rather than a strictly proactive or reactive protocol as hybrid protocols often possess the advantages of both types of protocols.

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