A Comparative Study of Current Routing Protocol in Wireless Ad-Hoc Network

Arti Gupta [1], Manish Pradhan [2]

[1,2](Department of ECE, Mahakal Institute of Technology Ujjain)

ABSTRACT

A mobile ad hoc network (MANET) is a wireless network that offers multi-hop peer to-peer routing mechanism in place of static network infrastructure which provide network connectivity. The network topology in a MANET usually changes with time. An Ad hoc network is a set of network in which all peripherals have same status on a network and have   ability to maintain link status information for any number . With this approach certain challenges arises in different routing protocol in wireless trasmission.This paper gives a review of existing routing protocols and their comparative   study   by   giving   their   characteristics, functionality, advantages, disadvantages and limitation among them .

KEYWORDS

 Mobile Ad Hoc Networks(MANET), Routing protocols, Dynamic Source Routing(DSR), Ad Hoc On Demand Routing vector(AODV) Destination sequence distance vector(DSDV),TORA

1.INTRODUCTION

Wireless communication is an updating technology that will permit users to retrieve   information and services electronically, irrespective of their geographic location. There are solutions to these demands, one being wireless local area network (based on IEEE 802.11standard). However, there is increasing demand for connectivity in situations/places where there is no base station / infrastructure available. This is where ad hoc network came into existence.There are two types of network exist mainly in Wireless networks one is infrastructure networks and another one is infrastructure less networks or mobile ad hoc networks (MANETs)[1]. The basic requirement of Routing protocols is to find routes to deliver data packets. Routing is the most axiological research trends in MANETs. The merit can be analyzed through metrics-both qualitative and quantitative. Some of the desirable attributes of routing protocol for MANETs can also be   accomplished   as   Spread operation, Cyclic-freedom, requirement-based operation, Sefty, Rest period operation and unidirectional link support.   For performance issue of any routing protocol Some quantitative metrics can be assess as End-to end delay, throughput, PDF, NRL and Route Acquisition Time etc.[2] For ad hoc networks, Routing protocols must deal with

limitations such as high error rates,scalability, security, quality of service, energy efficiency, multicast, aggregation and node cooperation etc.

2. RELATED WORK

In the recent era many works researches, that analyzed the performance of the routing protocols include the comparision between AODV, DSR, DSDV and TORA. Reference [2] describe the performance between DSR and AODV with DSDV which focus on high mobility case under low, medium and high density scenario for MANET Routing protocol. On the other hand reference [3] compared the performance of DSR, AODV and AntHocNet protocols to devloped the higher computing features that include average end-to end delay and Packet Delivery ratio to attempt greater thoughput in transmission of data packets. Similarly reference [4] specifies the simulation analysis for Variable Bit Rate(VBR) among various protocols. Which describes that reactive protocols performs better than proactive protocols.Further DSR has performed well for the performance parameters namely delivery ration and routing overload while AODV performed better in terms of average delay.

The reference [5] examines two routing protocols for mobile ad hoc networks– the Destination Sequenced Distance Vector (DSDV), the table- driven protocol and the Ad hoc On-Demand Distance Vector routing (AODV), an On –Demand protocol and evaluates both protocols based on packet delivery fraction and average delay while varying number of sources and pause time.

3.CLASSIFICATION OF AD-HOC ROUTING PROTOCOLS

The classification of Routing protocol in MANET can be accomplished into various ways which depends on their state information, routing strategy, communication model, and network structure and so on but most of these are done depending on routing strategy and network structure. Numerous routing protocols have been proposed and developed for ad hoc networks. Such protocols must deal with the limited resources available with these networks, which include high power consumption, low bandwidth and high mobility. Existing routing protocols can be Based on the routing strategy the routing protocols can be classified into two parts:

 1.Table driven and 2. Source initiated (on demand) while depending on the network structure these are classified as flat routing, hierarchical routing and geographic position assisted

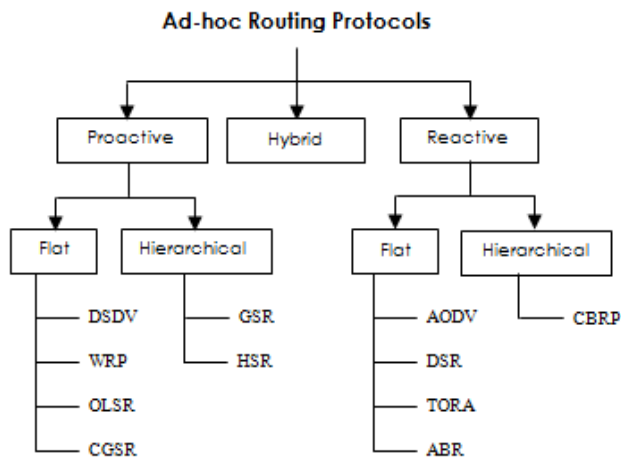routing Flat routing covers both routing protocols based on routing strategy.

Figure 1. Classification of Routing Protocols

3.1 Table-driven Routing Protocols (Proactive)

Table-driven routing protocol is a protocol in which try maintains routing information froms neighbors on periodic basis. It is also called pro-active ,these protocol respond when the network topology changes by propagating periodic updates thoughout the network in order to maintain a consistence in the network.The main advantage and disadvantage of procative routing protocol .

Advantage :-

1) Minimal initial delay.
2) Quickly establish a session .
3) Hosts can quickly obtain route information

Disadvantage:-

1) High storage requirement .
2) Periodic update is required in proactive .
3) Slow reaction on restricting and failure.
4) Bandwidth wastage is observed because of unnecessarily control message are sent out even when there is no data traffic.

Destination Sequenced Distance Vector -

Destination sequenced distance vector routing(DSDV) described in [6] is a table driven algorithm based on distributed Bellman – Ford (DBF) algorithm . These DBF includes freedom of loops in routing table , uses sequence numbers generated and updated by the destination, to avoid the looping problem caused by state routing information . In DSDV each node in the network maintains a routing table that contains a list of all the possible destinations within the network and number hop to each destination are recorded. Each entry contains destination address, the number of hop to reach the destination and the sequence number of the information received at that destination, as originally stamped by the destination.The sequence number are used to distinguish stale routes from new ones, there by avoiding routing loops. DSDV is distance vector routing algorithm, these upadate are periodically transmitted throughout the

network. In order to maintain a table that contains the next hop to reach all destination . These occasionally transmission of packet are get advertised by broadcasting or multicasting.
To prevent form larger traffic in a broadcast message two type of method are possible :

i. Full dump: This packect carries all routing information
ii. Smaller incremental packect : This is used to transmit that information which changed information in the last full dump.

Advantages of DSDV

1) Simple to implement
2) No latency caused by routing discovery
3) Avoid the routr loop problem
4) Sutible for small networks

Disadvantage of DSDV

1) High traffic congestion
2) Highest byte overhead because the routing table updates often contain the entrie routing table
3) High power comsumption and bandwidth wastage.
4) New sequence number is required whenever the topology change .
5) Not suitable for highly dynamic networks so scalability is the disadvantage
6) Packects delay increase with mobility
7) Throughput is decreased when mobility is increased.
8) Highest byte overhead because thr routing table updates often contain the entire routing table .
9) Large number of packets deopped due to invalid route.
10) Larger amount of memory is required.

3.2 On demand routing protocol(Reactive)

To reduce the overheads problems, proactive protocols is designed by maintaining information for all alert routes only.It specifies that routes are basically determined and maintained for various nodes whenerver it is essential to send a packet to a desired destination. Reactive protocols can be classified into two categories: source routing and hop-by-hop routing. In source routed on-demand protocols, each data packets carry the complete source to destination address. Due to which, each intermediate node send these data packet corresponding to the information kept in the header of each packet. It describes that the intermediate nodes do not need to maintain and update routing information for each active route in order to forward the packet towards the destination.
The main advantage and disadvantage of procative routing protocol are:

Advantage:-

1) The routes are adaptable to the dynamically changing environment of MANETs, since each node can update its routing table when they receiver fresher topology information and hence forward the data packets over fresher and better routes.

Disadvantage :-

1) In Reactive routing protocols large networks do not perform well . This is due to two main reasons; firstly as the number of intermediate nodes in each route grows, then so does the probability of route failure

There are two types on demand source routing

1.DSR (Dynamic source routing)
2.AODV (Ad-Hoc on demand distance vector routing

DSR :DSR is presented in [7] is a on demand routing protocol is based on the concept of source routing protocol **.** In source routing data packet contain complete information to reach its destination . these protocol composed of the two main phenomema of ' route discovery' and 'route maintenances ' which work together to allow nodes to discover and maintain routes to arbitrary destinations in the network.

In DSR when a source mobile station wants a send a packect ,it initially check for an entry of each route in route cahe .If the route is found to be valid route for that destination then it will send the packet . On the other hand if node does not found such a type of route, it start a route discovery process by means of broadcasting a route request (RREQ) packet to neighbor to neighor and so on .these broadcasting shown in fig .[2] Each and every route request packet consist of a unique identification of source node as well as destination node . At the receiver end if it is recently seen this request id from the sender, is discard the REQUEST .Otherwise, it attach to its own address to the record in the request and retransimit the REQUEST.When the RREQ is recevied by destination node ,the destination node sends reply unicasting the route reply (RREP) towards the source node. when the REPLY reaches the source of the REQUEST , it cache the new route in its Route Cache.
There the fig indicate the path of the RREP from the destination node ro source node.

Advantage :
1) Does not require symmetric links.
2) Intermediater nodes need not to keep routing information because path is explicitly specified in the data packets .
3) Route caching reduce the cost to the route discovery.
4) A single route discovery may yield many route to the destination due to intermediate nodes may reply route from local caches.

Disadvantage :

1) With time passing and node moving ,cached may become invalid .
2) Inefficieny , packect header size grows with route length due to source routing
3) Route reply packet fooding .
4) Route reply may collide at the targeted node.
5) Mess up routing and forwording an intermediate node may send route Route reply using a stale cached , thus polluting other nodes caches .
6) Degrades rapidly with increasing mobility.

AODV: Ad hoc distance vector is a distance vector routing technology that discovers routes whenever it is needed.It does not matain routes from every node other node in the network but it improve the system performance by minimizing wide brocasting of packets in the extreme networks. When a source node want to transmit information to a destination nodefor which it has no entry in their routing table ,So it sends a RREQ (Route Request) packect to its neighbors[8][9] they checks their own table. A RREQ includes address of the source and the destination ,IP address ,the broadcast ID which is used to uniquely identify each request ,the last is sequence number of the destination as well as the source node sequence number.Sequence number is used to avoid looping problem and provide the path as up–to-date routes as possible . If a node sees that it is in the destination field of a RREQ, first it checks the detination sequence number it currently knows and the specified the RREQ register. If ther is no entry in their routing table , it broadcast the packets and also records in its routing table which is received RREQ.the RREQ is forwared from node to node until it reaches to its destination, after reaching to destination node it sends the message back and creates the route reverse replying with a RREP (Route Reply) packet to confirm the p**a**th**.**
Performance of comparsion in manet is describe as below

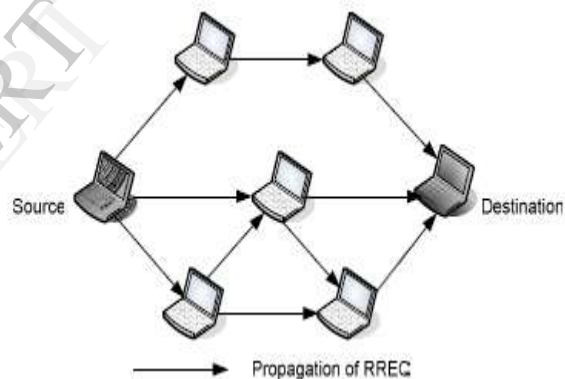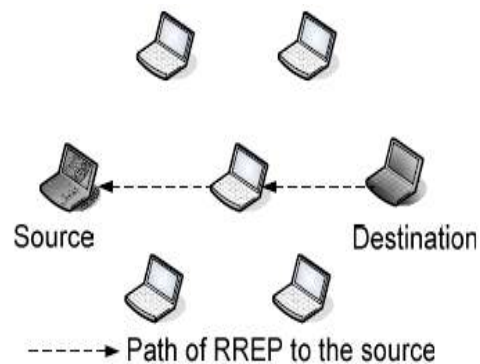

Fig 2: Propagation of RREQ Packet

Fig 3: Route Reply through RREP Packet.

Advantages:

1) AODV is highly scalable in nature.
2) It transmit HELLO message when an information is Propagated.

3) It supports multicasting .

4) In AODV the route metric follows the freshest and shortest path.

5) It required the less amount of memory storage

6) Route are maintained by maintaining there routing table

Disadvantage:

1) In AODV the routing information is occurs only when it is required so there is not a reliable technique for route maintaince .

2) AODV consist of high latency problem .

3) In AODV whenever a more number route reply request is forwaded then larger number of control overheard are generated for single route .

TORA (TEMPORALLY ORDERED ROUTING ALGORITHM): The Temporally ordered routing Algorithm is highly adaptive and high degreeof scalablity .It is a source initated on demand routing protocol which uses a link reversal algorthim and provide a loop free transmission of routes to reach the destination nodes. TORA has the unqiue properties which enhances the propeties procative routing is that it does not show any effect when topology get changes. It effect only when all node to the destination are lost. The protocol has three main function:

1) Establishing 2) Maintaining 3) Erasing route

Route Creation

Initially , all nodes start with a zero height. When a nodes need a route to a destination ,it creates route by query packets are transmited to reach possible destination.When these packet reaches to destination ,then destination replies with an update packet. When the node receives update packet it provide the dedicated route for a node to reach the destination .

Route Maintenance

TORA provides the multiple nodes to reach the destination quickly. Whenever a link establishes between node , creating a directed acyclic graph (DCG)and all nodes will have a route to destination . Route maintenance when nodes are loses all its outgoing link,the node broadcast an update packet to each node ,the direct acyclic graph updates the topology of network in order to reach the destination of each node . TORA is based on the link revesal algorthim down ward link to reach destination node .It provide the path from source to destination node and revert DAG back to destination oriented state

The route maintance function of TORA is the main problem of congesting the network

Route Erasure:

1) When a network does not contain a route todestination ,the route is erasured .During the above process ,the node sends update packets through partial Revesal links from node to node in order to reach destination .It is possible to find the presence of a network partition if the same update packet is brodcasted to other nodes ie all the node are not

capable to retrace route the only the way can retrace by its source node.So route eraser process occur in which clear packet are propagated between the node in order to eraser those node which are not possible to reach destination .

Advantages:

1) It supports the multiple routes

2) It follows the shortest routing loops

3) It provides attractive features when larger number of nodes maintain direct route to a perfered destination.

4) It is reliable and scalable in nature .

5) Good in dense network.

Disadvantages :

1) TORA is same as on-demand routing protocol

2) It is not much usedsince DSR and AODV out perform TORA

3) NOT scalable by any means.

4. COMPARATIVE STUDY

This paper gives a comparative study between different routing protocol.The performance analysis is describe in below section .The stucture defines which type of frame work is supports to routing protocol .Also the minimum no. of hops to reach the destination metrics. The loop free parameter is also have significance for proactive routing protocol in MANET. DSDV predict the shortest path to reach the destination with the help of sequence no it avoid the looping problem .DSDV is periodically updates the routing .Another type is Reactive routing protocol is to reduce the traffic problem.

Performance parameter	DSDV	AODV	DSR	TORA
Structrer	Proactive	Reactive	Reactive	Reactive
Protocol type	Distance vector	Distance vector & source vector	Source routing	Source routing
Loop free	Yes	Yes	Yes	Yes
Route metric	Shortest path	Freshest and shortest path	Shortest path	Neighbours
Hello message	Yes	Yes	No	No
Memory requried	Normal	Low	Low	High
Multiple route possibility	No	No	Yes	Yes
Route maintained in	Route table	Route table	Route cache	Route table
Route availability	Available	Dertermine when it required	Available	Dertermine when it required
Scalability	Good	Good	Bad	Good
Updated transmitted to	Neighbours	Source	Source	Neighbours
Frequency of upadates	Periodic	Aperiodic	Aperiodic	Aperiodic

5. CONCULSION

In this paper we have describe and compared various routing protocol. our article onto this described the classification of several routing schemes according to the routing strategy. The important characteristics of the two routing strategies (table-drive and on-demand) also discussed . Table 1 highlighted few differences between them.

In this paper, an effort has been made to concentrate on the comparative study of DSDV, AODV, DSR& TORA. Moreover, a single routing protocol can't perform best in all situations. So, the selection of routing protocol should be choosen carefully according to the requirements of the specific application. The focus of the study in our future research work is to propose an extension of the existing conventional routing protocols which will be better in terms of security, throughput, efficient utilization of limited resources and quality of service.

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