Performance Comparison between Different Routing Protocols Using Various Parameters in Manet

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Abstract:

Mobile ad hoc networks have become very popular in recent years and many works on various aspects of MANET because in the field of remote systems, mobile ad hoc networks (MANETs) have developed another measurement. It allows any number of hubs to talk openly without supporting each other. This paper provides a detailed division classification and comparison of different routing protocol. Mobile Ad Hoc Networks (MANET)-a mobile node system (laptops, sensors, etc.) without central infrastructure (access points, bridges, etc.). The network nodes or hosts are mobile and self-configurable. At the same time, they serve as routers to supply data to their destinations from sources. The routers must work together efficiently to meet the performance requirements of this type of network. This paper presents evaluations and analyzes of performance of comparison for three types of flat routing protocols: Proactive and Reactive routing & Hybrid routing. This paper also shows the results of the simulation evaluation of a MANET's overhead, throughput and end-to-end delay, Energy consumption, normalized routing load, packet delivery fraction, packet drop ratio

IndexTerms **- Manet, AODV(), DSR(Dynamic source routing), DSDV(Destination Sequence Distance vector), ABR(Associatively Based routing), CGSR(Cluster Gateway Switch routing), DDR(), ZRP(Zone routing Protocol).**

I. INTRODUCTION

MANET is a type of wireless ad hoc network and is a self-configuring network of mobile routers connected to wireless links. The routers are free to move randomly and arbitrarily organize themselves, leading to a dynamically changing topology. Each node sends the packets to the destination as a router. If the errors in the bit cannot be corrected by the error correction mechanism of the communication system, the whole data packet must be discarded. It has external noise and interference in bandwidth. The main problem is that it has no predefined limit, nodes are free to move. There is no defined area for the network. Knowing the new nodes and informing the existing ones is different in the case of device discovery. Links in MANETs are duplicitous because of flexibility and power constraints. Link failures can occur during the packet transmission process at any time.

A MANET is generally used in places where for certain reasons, such as disaster areas, war zones and emergency sites, a fixed infrastructure cannot be formed. All manet hosts are mobile and can be installed in temporary networks in cars, soldiers, ships, buses, aircraft and emergency response teams.

Some research has been carried out in recent years on the subject of MANET Routing Protocol Design. For example, routing algorithms have already been simulated and compared for Ad hoc On-Demand Distance Vector (AODV), DDR, WRP (Wireless Routing Protocol), Destination Sequence Distance Vector (DSDV), and Dynamic Source Routing (DSR).

Description about the type of routing Protocol

The routing protocol can be divided into three categories i.e. reactive protocol (AODV, DSR, and ABR), proactive protocol (DSDV, WRP, CGSR) and hybrid routing such as (ZRP, DDR).

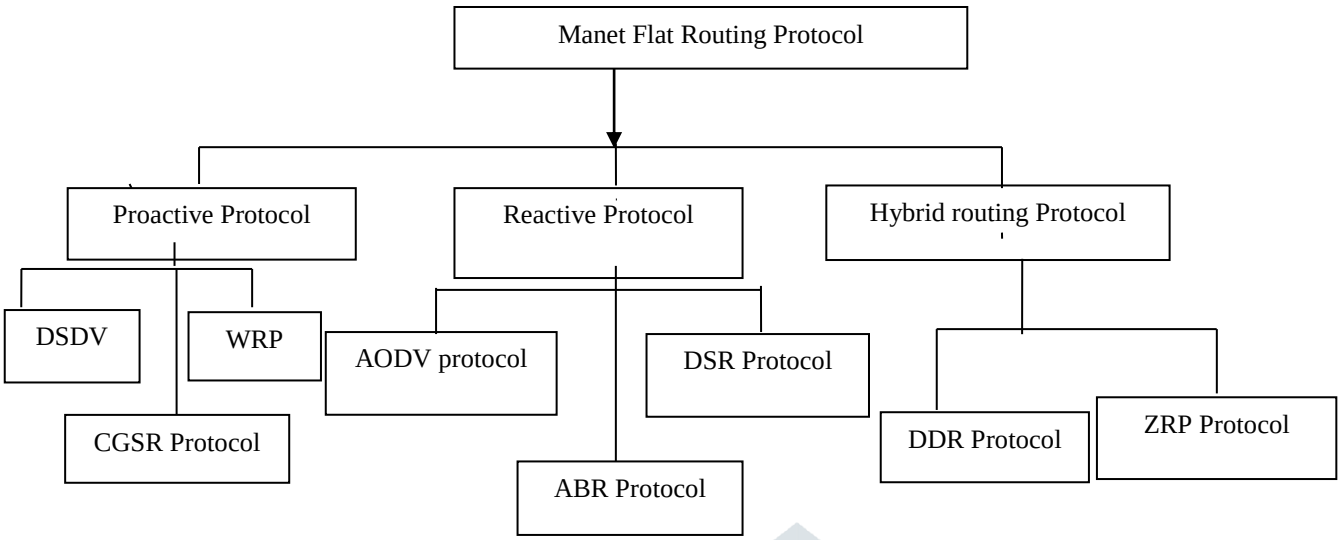

Fig:1

Reactive routing protocol

The user wants to send the message to the receiver, this protocol creates a path, the route is provided in this way whenever. It creates a multi-hop routing between the nodes everywhere. The route has not kept all the time, it is only created on the need basis, and the route has been discovered. When traffic is lower and the topology does not change frequently, the overhead of routes is reduced. All information is stored in data packets, all sources routing information is stored in them, and the information stored in the data packet header is the information of intermediate nodes. For each intermediate node, communication and updating is not necessary.

Advantages: 1. the periodic updating of nodes is eliminated.

2. It dynamically adjusts the network.

Disadvantages: 1. Distribution of traffic.

2. Road latency

The reactive protocol can be divided into various types as follows:

1. AODV Routing Protocol

AODV is an on-demand routing protocol that initiates the route search process between the source node and the destination node as required. Each node keeps routing information in the form of a routing table with one entry per destination in this protocol. AODV uses the sequence number of the destination to guarantee the freshness of the route and the freedom of the route.

The AODV protocol uses four types of control messages. Route Request (RREQ) and Route Reply (RREP) are used to find routes. Route error messages (RERR) and HELLO messages are used to repair the route. When one of the nodes wants to send packets, the route discovery process begins. This node sends packets to its neighbors for Route Request (RREQ). Neighbors return RREP, if they have a route to the destination. However, if they do not have the corresponding route, RREQ packets will be forwarded to their neighbors, except for the origin node. They also use these packets to create reverse paths to the source node. This process takes place until a route has been found [5]. Each mobile node maintains a next hop routing table that includes the destinations it currently has a route to. In AODV, sa route discovery process is initiated when a source node wants to send packets to the destination but no route is available. The reactive property of the routing protocol implies that it only requires a route when it needs one and does not require the mobile nodes to maintain routes to destinations that do not communicate. If the intermediate node cannot forward the packet to the next hop or destination due to the failure of the link, the message of the route error (RERR) is generated by a higher destination. When the RERR message is received by the sender node, a new route discovery for the target node is initiated.

Advantage: Route are established on demand and destination sequence numbers are used to find latest route to the destination.

Disadvantage: 1. Aodv requires more time to establish a connection.

2. Periodic beaconing leads to unnecessary bandwidth consumption.

2. DSR routing protocol

DSR uses "source routing," i.e. the transmitter node knows the entire hop-by-hop route to the destination and these routes are stored in its route-cache. There may be a number of routes to the destination in the route cache. If the destination is unknown, node caches the packet and sends route queries to all nearby nodes to find the routing information to the destination. The route-replies are then sent back to the source. Therefore, overhead bandwidth is reduced, battery power is maintained and large routing updates are avoided. However, for the discovery of a link failure, MAC layer support is required. The DSR routing protocol uses two main mechanisms to detect routes and keep the route information from one node to another. There are two main phases in DSR:

• Discovery of routes

Discovery of the route -to discover the route between source and destination and maintenance of the route -another route is invoked from the destination in the event of a route failure.

• Maintenance of routes

DSR has a distinctive advantage that is routing the source. Since the route is part of the packet, short-lived or long-lived routing loops cannot be quickly detected or removed.

Advantage: The intermediate nodes also efficiently use route cache information to reduce overhead control.

Disadvantage: Increasing complexity.

3. ABR (Associatively Based Routing Protocol)

The ABR algorithm which considers route stability as the most important factor in selecting a route. Routes are discovered by broadcasting a broadcast query request packet. Using these packets, the destination becomes aware of all possible routes between itself and the source. The ABR algorithm maintains a “degree of associatively” by using a mechanism called associatively ticks. Each node maintains a tick value for each neighbor, which increases by one each time the neighbor generates a regular link layer HELLO message. So when the tick value reaches a specified threshold value, it means that the route is stable. If the neighbor usually leaves the range, the value of the tick is reset to zero. A tick level above the threshold value is rather an indicator of a s ABR uses an exclusive technique to keep routing information in wireless ad-hoc networks, on-demand routing protocol and essential for connectivity to discover routes to a mobile node through the flooding of request messages. Generally, reactive protocols never maintain routing information at mobile nodes when there is no network functionality. ABR uses the old style routing table.

Advantage: 1. Avoids packet duplicates.

2. No route construction.

Disadvantage: 1.Operation complexity.

2. Communication complexity.

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Proactive Routing Protocol

Routing protocols keep the network topology updated by creating a routing table and having the routing information before it is necessary. They are therefore also called protocols for Table Driven. All the nodes in the network create and maintain routing information to all other nodes in the network.

1. Destination-Sequenced Distance-Vector Routing (DSDV)

A proactive routing protocol is based on the Bellman-Ford routing mechanism DSDV. It is an algorithm of loop-free routing. Each mobile node in the network has a routing table that maintains data on all feasible network destinations and the number of hops to reach each destination. Each entry is marked with the destination node assigned a sequence number. Updates to the routing table use two methods: full dump and incremental. The neighbor receives the entire routing table in full dump while the neighbor only receives entries requiring incremental update changes.

Advantage: 1.To develops a few nodes ad-hoc network.

2. DSDV was one of the early methodologies available.

Disadvantage: DSDV requires regular updating of its routing tables using battery power and Small bandwidth, even when the network is running.

2. WRP (Wireless routing protocol)

The Wireless Routing Protocol, as proposed by Murthy and Garcia-Luna-Aceves is a table-based protocol similar to DSDV that inherits the properties of Bellman Ford Algorithm. The main goal is maintaining routing information among all nodes in the network regarding the shortest distance to every destination. Wireless routing protocols (WRP) is a loop free routing protocol. WRP is a path-finding algorithm with the exception of avoiding the count-to-infinity problem by forcing each node to perform consistency checks of predecessor information reported by all its neighbors. Each node in the network uses a set of four tables to maintain more accurate information: Distance table (DT), Routing table (RT), Link-cost table (LCT), Message retransmission list (MRL) table. In case of link failure between two nodes, the nodes send update messages to their neighbours. WRP belongs to the class of path-finding algorithms with an important exception. It counters the count-to-infinity problem by forcing each node to perform consistency checks of predecessor information reported by all its neighbours. This eliminates looping situations and enables faster route convergence when a link failure occurs.

Advantage: It also has faster convergence and fewer updates to the table.

Disadvantage: High mobility.

3. CGSR (Cluster Gateway Switched Routing)

The Cluster head Gateway Switch Routing protocol differs from the other protocols as it uses hierarchical network topology, instead of a flat topology. As proposed by Chiang, it organizes nodes into clusters, which coordinate among the members of each cluster entrusted to a special node named cluster head. Least Cluster Change (LCC) algorithm is applied to dynamically elect a node as the cluster head. Each node must keep a cluster member table where it stores the destination cluster head for each mobile node in the network. These cluster member tables are broadcast by each node periodically using the DSDV algorithm. CGSR is an extension of DSDV and hence uses it as the underlying routing scheme. It has the similar overhead as DSDV. However, it modifies DSDV by using a cluster (hierarchical) routing approach to route traffic from source to destination. CGSR improves the routing performance by routing packets through the cluster heads and gateways.

Hybrid Protocol

Hybrid Routing Protocol acquires the characteristics of proactive protocols and reactive protocol. This is used to give hierarchical routing at different levels. For the system with fewer nodes, proactive and reactive conventions are used. The main purpose of the design of this routing protocol is to use the proactive and reactive routing protocol for a larger and more complex network. In order to avoid latency and routing overhead problems in the network [4], it implements the route discovery mechanism and the table maintenance mechanism of the reactive protocol proactive protocol. It uses proactive protocol in the zone and reactive external zone Hybrid protocols are used to perform higher performance as the system's hubs are expanded. This convention uses a reactive routing methodology at network level and uses a proactive procedure at local neighborhood level. Examples are the protocol for zone routing (ZRP).

ZRP (Zone Routing Protocol)

The Zone Routing Protocol (ZRP) combines reactive and proactive routing protocols in order to make routing more scalable and efficient. Wireless ad-hoc networks with bi-directional links are essentially proposed. This routing protocol is based on zones, i.e. different zones can consist of nodes to create more reliable routing discovery and maintenance. Each node has a default zone.

Advantage: 1. it reduces the control traffic produced by periodic flooding of routing information packets (Proactive scheme).

2. It reduces the wastage of bandwidth and control overhead compared to reaction Schemes.

Disadvantage: The large overlapping of routing zones..

II. Literature Survey

A number of routing protocols have been proposed and implemented for Manets to improve bandwidth utilization, higher throughputs, lower overheads per packet, minimum energy consumption and others. In certain circumstances, all these protocols have their own advantages and disadvantages**.**

Zuraida Binti et. al. purposed a technique that includes minimum route acquisition delay, quick routing reconfiguration, loop-free routing, distributed routing approach, minimum control overhead and scalability.

Walid Abushiba et. al. has been done investigation on the two most prominent routing protocols, AODV and DSR Protocol. The performance metrics in this study include: Packet loss, Energy Consumption, Throughput, Packet delivery fraction and Average end-to-end delay. Their performance has been simulated using NS-2 and evaluated for varying packet sizes against a range of network sizes.

Mayur Bhalia et. al. has been discussed various characteristics of Manet and various routing challenges like security, bandwidth, energy etc.

Dr. Sivakumar et. al. posses routing is the way toward choosing ways in a network along which to send traffic. Routing is a vital part of network correspondence which influences the execution of any network, since different qualities of the network like throughput; reliability and congestion directly depend on it.

N. Adam, et. : Mobile ad hoc networks have become very popular in recent years and many works on various aspects of MANET because in the field of remote systems, mobile ad hoc networks (MANETs) have developed another measurement. It allows any number of hubs to talk openly without supporting each other. This paper provides a detailed division classification and comparison of different routing protocol. Mobile Ad Hoc Networks (MANET)-a mobile node system (laptops, sensors, etc.) without central infrastructure (access points, bridges, etc.). The network nodes or hosts are mobile and self-configurable. At the same time, they serve as routers to supply data to their destinations from sources. The routers must work together efficiently to meet the performance requirements of this type of network. This paper presents evaluations and analyzes of performance of comparison for three types of flat routing protocols: Proactive and Reactive routing & Hybrid routing. This paper also shows the results of the simulation evaluation of a MANET's overhead, throughput and end-to-end delay,Energy consumption, normalized routing load, packet delivery fraction, packet drop ratio **al.** Proposed work on “Effect of Node Density on Performances of Three MANET Routing Protocols, AODV, OSLR, and OPNET. In which we have been purposed the AODV and OLSR for mobile ad hoc network are compared on the basis of delay, network, load and throughput. OLSR has highest throughput, least data dropped.

Barakovi et. al. Have been evaluated all but one protocol currently considered in the IETF MANET working group, in addition to more traditional link state and distance vector protocols. Steady state performance in terms or fraction of packets delivered, delay and routing load have been considered as the performance metrics.

NISHANTHINI, C., et. al.[4] Enhanced AODV is suggested by Nishanthini, et al. In first step it calculates total nodes and actual power of those nodes in the route, later on if any path or link failure is found it checks for number of hops data so far travelled and remaining number of hops to reach the destination. In addition, an alternate data path is utilized for improving data delivery ratio. However, there is no mechanism in Enhanced AODV to deal with error as there is reporting for nodes in error also it calculates hops and node energy in path selection and in high mobility network model it creates the delay.

D. JOHSON ET. AL.[2] have analyzed throughput, delay and routing load for some of the major routing protocols. They simulated a 50 node network in NS2 and compare the performance of routing protocols for various workloads. Their results depict that DSR is more effective at low network load whereas AODV works better at higher network load.

J. BROCH ET AL[3] carried out performance analysis of four routing protocols for ad hoc networks. They carried out simulations in Network Simulator version 2 (NS2), their work is focused on medium sized networks comprising of around 50 nodes, 10 to 30 traffic sources and seven different pause times. Their results show that in medium sized networks, DSR protocol gives best performance at different mobility rate.

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III. **PARAMETERS FOR ANALYSIS PERFORMANCE**:

1. **Throughput:** It means how many bits have been received from sender to receiver. The amount of data received by the recipient is referred to as throughput. Throughput in bits /sec or bytes / sec. If we change the network, the communication between the sender and the receiver is not correct, the bandwidth is much lower and the power constraint is more important than everything that can affect the output. If the network is correct, the transmission will also be correct [3].
2. **Packet Delivery Ratio**: -Packet delivery ratio is defined as the number of packets delivered to the destination for the number of data packets to be received. The better the packet delivery ratio, the more complete and correct the routing protocol.
3. **Normalized Routing Load (NRL)**: The ratio of the number of packets de and the number of packets received at the destination.
4. **Packet Delivery Fraction**: The delivery fraction of packets or PDF stands for the fraction of packets delivered to the destination. This is the ratio of the number of packets received to the percentage of packets sent. It is a measure of the network's efficiency without taking the time limit into account.

5. **Bandwidth:** The transmission of data from the sender to the receiver at a given time.
6. **Jitter Delay**: when the packets are received from the sender. The delay in the variance between source and receiver.
7. **Transmission Delay**: How much data from sender to receiver is transmitted?
8. **Network delay:** The delay of a network specifies how long it takes for a bit of data to travel across the network from one node or endpoint to another. It is typically measured in Multiples or fractions of seconds.
9. **No. of mobile node**: An IP node capable of changing its point of attachment to the network. A Mobile Node may either a Mobile Host or a Mobile Router.

10. **End-to-end delay:** The average end-to-end delay of data packets is the interval between the data packet generation time and the time when the last bit arrives at the destination. A low end-to-end delay is desired in any network.
11. **Drop ratio:** Packet drop rate is one of the indicators for network congestion. In wireless Environment, due to the physical media and bandwidth limitations, the chance for packet dropping is increased.

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IV. Review Table

Since there are number of routing protocols and their different parameters as discussed above.

Therefore there is a need to compare different routing protocols to judge the performance and their usage over different networks. The comparison done here is based on a given set of parameters such throughput, end to end delay, Packet miss ratio, packet delivery ratio. Performance analysis with varying node density and node mobility.

Throughput vs. no. of nodes

As the no. of nodes increase, the throughput decrease. This is due to the fact that packet delivered to the destination are lost during transmission. For higher speed AODV perform better than DSR.

Parameters	**AODV**	**DSDV**
Throughput	High	Low
End to end delay	Modest	Highest

Energy consumption	Low	High
Packet delay	Low	High
Drop ratio	High	Low
Normalized Routing Load	High	Low

Parameters	**DSR**	**WRP**
Throughput	High	High
End to end delay	High	Low
Packet delay	High	Low
Packet delivery ratio	High	Low
Drop ratio	Low	High
Normalized Routing Load	Low	High

V. Conclusion

After this survey we conclude that have got represented variety of routing algorithms and broadly speaking classified routing protocols-Table driven, on-demand, Hybrid and compared the assorted routing protocols of mobile ad-hoc networks and given within the kind of a table for a given parameter. There's no outlined single protocol that may be excellent for usage MANET routing protocol. We show the comparison between different parameters in it. Each protocol introduced in this chapter has its own advantage and disadvantages in different MANET settings or environments. The reactive protocols (especially the AODV routing algorithm) are dominant in all performance classes, whereas the packet size impact is negligible. we tend to hope to indicate the performance of the routing protocols in world MANET applications within the future.

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