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ENHANCING THE PERFORMANCE OF AODV PROTOCOL

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ABSTRACT

In this paper, a routing algorithm is presented in Mobile Ad hoc Networks using modified AODV by calculating the load on different routes using parameters like nodes remaining energy and aggregate interface queue length. Ad hoc on Demand Distance Vector Routing Protocol (AODV) is one among the effective Reactive Routing Protocol in MANET. The objective of this paper is to enhance the network performance of AODV, when frequent link failure in network due to mobility of the nodes in the network. The performance analysis and simulation are evaluated network performance using Network Simulator (NS-2), based on the quantitative metrics packet delivery ratio and average end to end delay Throughput. The main idea behind this is to increase the performance of AODV protocol and compare it with other routing protocols.

Keywords*: Ad hoc Network, AODV, Enhanced AODV, Packet delivery Ratio, End to End Delay, Throughput.*

I. INTRODUCTION

Wireless network is a network without connecting cables. It is generally implemented and administered using a transmission system called radio waves. It can be classified into two types: infrastructured or infrastructure less. In infrastructured wireless networks, the mobile node can move while communicating, the base stations are fixed and as the node goes out of the range of a base station, it gets into the range of another base station. In infrastructureless or adhoc wireless network, the mobile node can move while communicating, there are no fixed base stations and all the nodes in the network act as routers. The mobile nodes in the adhoc network dynamically establish routing among themselves to form their own network 'on the fly'.

II. ROUTING PROTOCOLS FOR MANET

Routing is the process to send information from one host to another host. Routing means route packet to its destination using efficient path. Protocols are set of rules. Ad-Hoc network is known as Mobile Ad-Hoc Network (MANET) because of motion of nodes in network. They are IBSS (Independent Basic Service Set), because they do not need AP (Access Point) for communication in nodes [38]. MANETs is a self-constructing network and form an unaware topology. Every node acts as routers in network to route the packet. MANETs are used in those areas where wire and wireless infrastructures are unreachable i.e. disaster area, war zone. Due to rapid change of topology in MANETs, MANETs routing protocols are required. The routing protocol is required whenever the source needs to communicates with destination.

MANETs routing protocols are classified as:-

- Reactive protocols
- Proactive protocols
- Hybrid protocols

2.1 Reactive Routing Protocols

The reactive routing protocols are based on some sort of query-reply dialog. Reactive protocols proceed for establishing route(s) to the destination only when the need arises. They do not need periodic transmission of topological information of the network.

2.2 Proactive Routing Protocols

Proactive protocols continuously learn the topology of the network by exchanging topological information among the network nodes. Thus, when there is a need for a route to a destination, such route information is available immediately. If the network topology changes too frequently, the cost of maintaining the network might be very high. If the network activity is low, the information about actual topology might even not be used.

2.3 Hybrid Routing Protocols

Often reactive or proactive feature of a particular routing protocol might not be enough; instead a mixture might yield better solution. Hence, in the recent days, several hybrid protocols are also proposed.

Based on the method of delivery of data packets from the source to destination, classification of MANET routing protocols could be done as follows:

- **Unicast Routing Protocols**: The routing protocols that consider sending information packets to a single destination from a single source.
- **Multicast Routing Protocols:** Multicast is the delivery of information to a group of destinations simultaneously, using the most efficient strategy to deliver the messages over each link of the network only once, creating copies only when the links to the destinations split. Multicast routing protocols for MANET use both multicast and unicast for data transmission.

III. AODV PROTOCOL

AODV is reactive protocol, when a source wants to initiate transmission with another node as destination in the network, AODV use control messages to find a route to the destination node in the network. AODV will provide topology information (like route) for the node. Fig:: 4.5 shows the message routing for AODV protocol. Node “A” wants to send messages to another node “F”. It will generate a Route Request message (RREQ) and forwarded to the neighbors, and those node forward the control message to their neighbors’ nodes. Whenever the route to destination node is located or an intermediate node have route to destination. They generate route reply message (RREP) and send to source node. When the route is established between “A” and “F”, node then they communicate with each other.

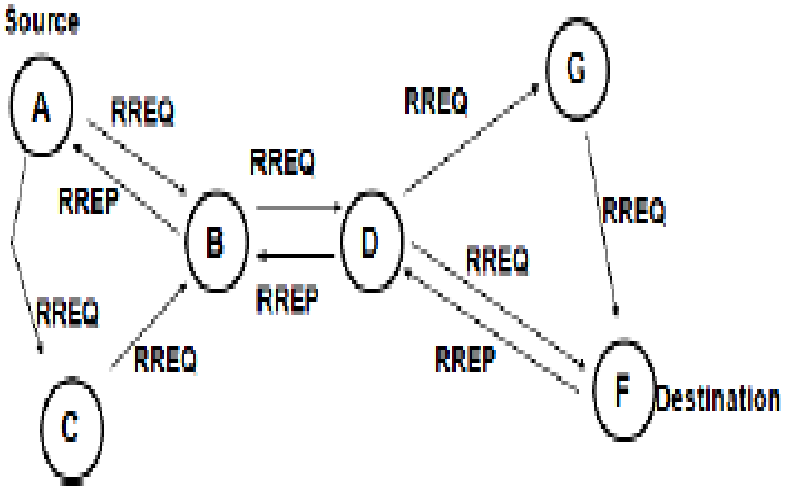


Fig: 3.1: Message Routing in AODV Protocol

AODV is an on-demand routing protocol. The AODV algorithm gives an easy way to get change in the link situation. For example if a link fails notifications are sent only to the affected nodes in the network. Since the routes are build on demand so the network traffic is minimum. AODV does not allow extra routing which is useless. If two nodes wish to establish a connection in an ad hoc network then AODV is responsible to enable them to build a multihop route. AODV uses Destination Sequence Numbers (DSN) to avoid counting to infinity that is why it is loop free. This is the characteristic of this algorithm. When a node send request to a destination, it sends its DSNs together with all routing information. It also selects the most favorable route based on the sequence number.

SThere are three AODV messages i.e. Route Request (RREQs), Route Replies (RREPs), and Route Errors (RERRs). By using UDP (user datagram protocol) packets, the source to destination route is discovered and maintain by these messages. For example the node which request, will use its IP address as Originator IP address for the message for broadcast. It simply means that the AODV not blindly forwarded every message. The number of hops of routing messages in ad hoc network is determined by Time-To-Live (TTL) in the IP header.

3.1 Aodv Process

The both RREQ and RREP Process Mechanism of AODV are as follows:

- The source node (S) tries to send a packet to destination D.
- If (S) does not know the next hop for (D) then it broadcasts a route request message.
- The RREQ message propagates in all the directions to reach the destination (D).
- In intermediate nodes that receive the RREQ message forward the packet to its entire one hop adjacent nodes.
- If Destination (D) receives RREQ message through a node N then it sends a RREP to (S) by forwarding it to (N) since (N) may contain at least one routing table entry for (S).
- On receiving RREQ Message through different nodes, the destination (D) will send the RREP message through different nodes and they may reach the source node through different possible paths.

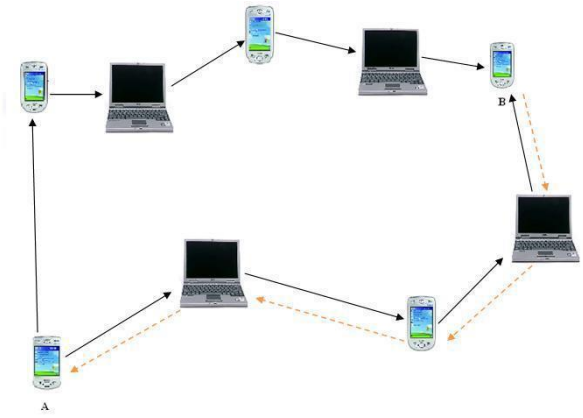
- At the end the source node (S) will have different possible resolved paths to select from based on defined criteria.

IV. PROPOSED WORK

In this work we have modified the AODV routing protocol by adding a new field to the AODV packet format. The modification discards the nodes that have energy lower than the threshold energy it increases the node lifetime resulting increased network lifetime.

4.1 Proposed Algorithm

1. The source node (S) tries to send a packet to destination D.
2. If (S) does not know the next hop for (D) then it broadcasts a route request message.
3. The RREQ message propagates to a selected subset of the neighbor nodes to reach the destination (D).
4. If intermediate nodes that receive the RREQ message have energy > th
   Then forward the packet to its entire one hop adjacent nodes.
   Else
   Discard the node and go to step 2.
5. If Destination (D) receives RREQ message through a node N then it sends a RREP to (S) by forwarding it to (N) since (N) may contain at least one routing table entry for (S).
6. On receiving RREQ Message through different nodes, the destination (D) will send the RREP message through different nodes and they may reach the source node through different possible paths.
7. At the end the source node (S) will have different possible Paths.
8. The path that consumes minimum amount of energy will be selected and used to transmit the data.



This figure represent RREQ and RREP message transformation in given network.

V. PERFORMANCE METRICES and RESULTS

The modified AODV is compared with other protocol using various parameters that are explained below.

1. Packet Delivery Ratio (PDR): The number of delivered data packet ratio to the destination and this also illustrates the level of delivered data to the destination.

$$\sum \text{Number of packet receive} / \sum \text{Number of packet send}$$

2. End-to-end Delay: The average time taken by a data packet to arrive in the destination and it also includes the delay caused by route discovery process and the queue in data packet transmission and only successfully data packets that delivered to destinations that counted.

$$\sum (\text{arrive time} - \text{send time}) / \sum \text{Number of connections}$$

3. Throughput: The amount of data transfer from source mode to destination in a specified amount of time i.e. average number of bits delivered per second(Kbps)

Calculated as: Throughput = (Packet Size/ (stopTime - startTime))*(8/1000)

4. Routing Overhead: The total number of routing packets transmitted during the simulation i.e. the sum of all transmissions of routing packets sent during the simulation.

Calculated as Routing Overhead= Σ Transmission of routing packets

Table 5.1: Performance Comparison of Various Protocols on 10 Nodes

Name of protocol	PDR	E2EDELAY(ms)	Throughput(kbps)	Normalized Routing Load
DSDV	98.98	34.89	377.67	.070
DSR	99.15	34.75	387.03	0.026
AODV	99.17	34.71	398.60	0.021
NAODV	99.21	34.70	399.58	0.002

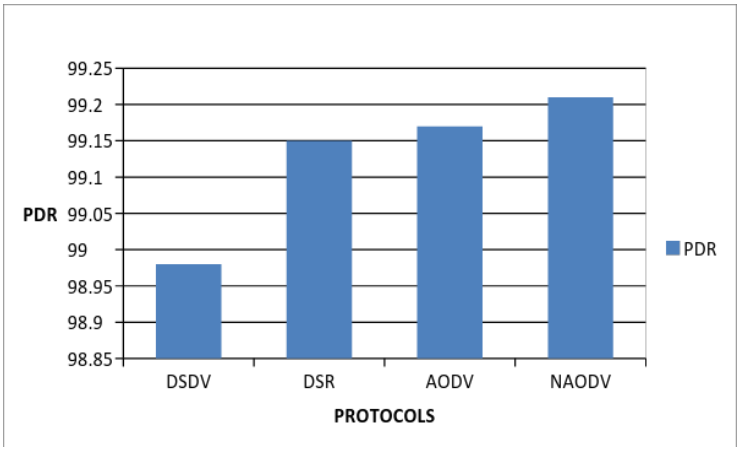


Figure 6.1: PDR Values of Different Protocols on 10 Nodes.

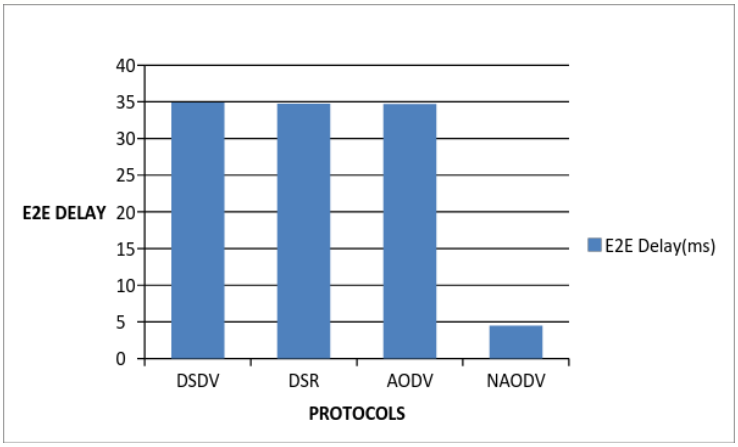


Figure 6.2: E2Edaley of Various Protocols on 10 Nodes

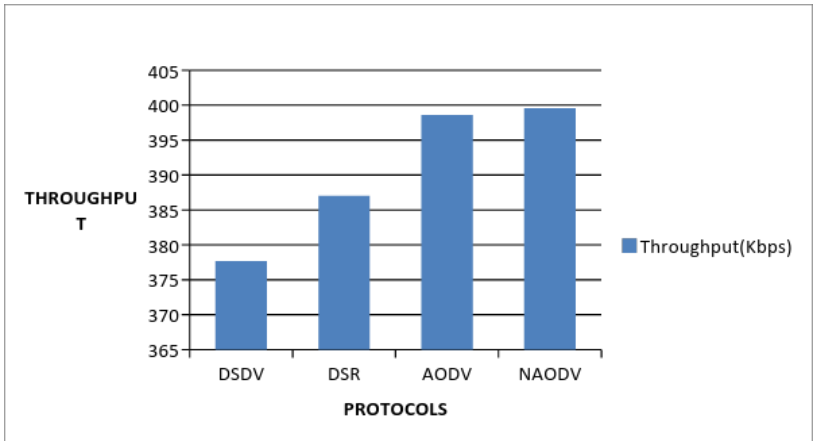


Figure 6.3: Throughput of Various Protocols on 10 Nodes

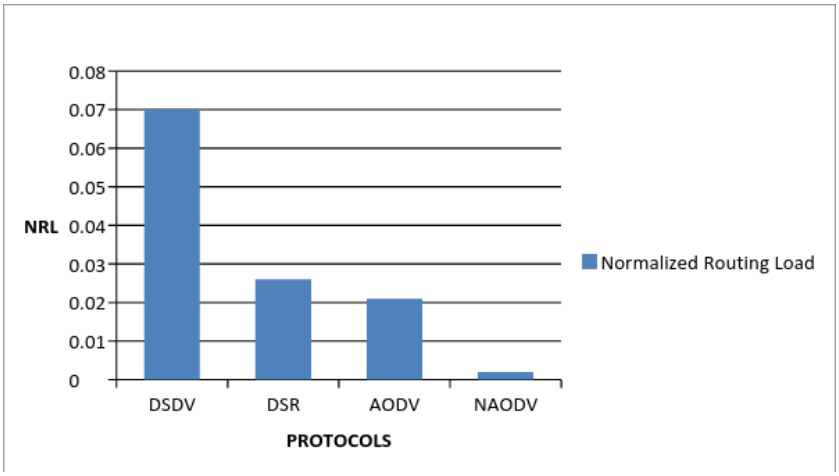


Figure 6.4: Routing Overhead of Various Protocols on 10 Nodes

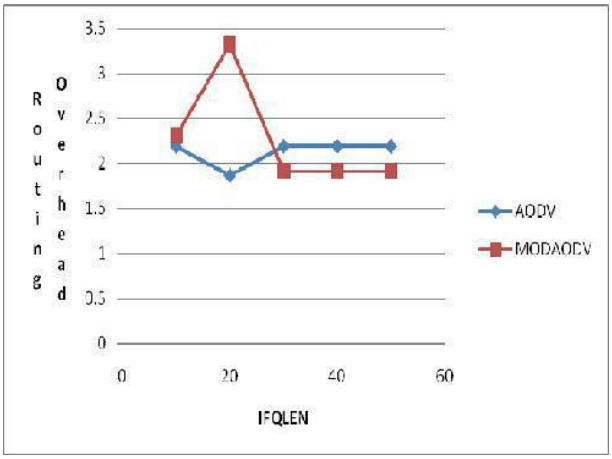


Fig 6.5 Routing Overhead of Modified AODV and Original AODV.

VI. CONCLUSIONS

In this research paper an efforts have been made to the study of various protocols like proactive and Reactive protocol and analysis of these protocol in Qualitative and Quantitative metrics. The main idea and aim of this paper is to compare the performance of routing protocols using network simulator NS2. The performance evaluation of various routing protocols will help to make proper selection of routing protocol in ad-hoc networks according to the traffic, size of the network, and QoS requirement. This will positively decrease the computational cost by a large amount and reduce the protocol overhead to improve the network utilization as well as fulfill the QoS requirements for packet.

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