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Performance Evaluation of Multipath Routing Using AODV and DSR Protocol

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Abstract

The key impartial of the paper is to increase the throughput thereby reducing the Network Load and end to end delay between nodes. To attain this, it is proposed to go for reactive routing protocols (AODV). The Mobile Ad-hoc network (MANET) is a dynamic wireless network in which each mobile node acts as a router. One of the major challenges in mobile ad hoc networks (MANETs) is link failures due to mobility. The Performance evaluation of the two popular routing protocols of MANET namely AODV and DSR. Based on extensive simulations, the comparative analysis covering the performance metrics such as Total Packets received, end to End delay, control overhead and throughput. Based on the given factors the AODV achieved the best protocol for Load Balancing.

Keywords: MANET, AODV, DSR, Network Load.

I INTRODUCTION

Mobile ad-hoc networks (MANET) have had a profound impact in the world of computer networks. Ad-hoc networks do not requisite any fixed groundwork to operate and support dynamic topology in which no wired infrastructure exists. A mobile user can act as a routing node and a packet can be routed from a source to destination without having any static router in the network. Two classes of routing strategies in ad-hoc networks are table-driven routing protocols and source initiated routing protocols. Security of ad-hoc networks is a key issue [1].Ad-hoc networks are, their nature and vulnerable to attacks.

In MANET, intruder can easily attack ad-hoc networks by loading available network resources and disturbing the normal operation of routing protocols by modifying packets. Ad-hoc networks must possess several unique features. One is automatic discovery of available services. Each time a new package becomes available, an ad hoc networking device has to configure use of the new service. In common, nodes should be able to enter or leave the network as they wish. Thus, every one acts as both a host and a router, and the network must be intelligent enough to handle network dynamics. This property is called self-stabilization [2].

A MANET is a group of wireless computing devices such as mobile phones, laptop, Personal Digital Assistant (PDA) or other similar devices which capable to communicate directly with one another without a central controller. The MANET is an autonomous system of mobile routers and hosts connected by wireless links. It do not require fixed network infrastructure due to their wireless nature and can be deployed as multi hop packet networks rapidly with low expense [3].

The Mobile adhoc networks are self-organizing and self-configuring and therefore to maintain communication between nodes in the network, each node behaves as a transmitter, a host and a router. MANET has dynamic topology and each mobile node has limited resources such as processing power, battery and on-board memory. MANET is a temporary network without any infrastructure. In MANETs mobile nodes communicate with each other in a multi hop fashion i.e. mobile node sends a packet to a destination through intermediate nodes and each node can act as a router and also can act as an end system [4].Mobile Ad hoc networks are obtain importance due to its wide range of applications .Mobile Ad hoc networks are used in military communication and operations, home appliances, emergency services, educational applications and entertainment. There are several routing protocols available in MANET, which can be categorize as proactive (table driven), reactive (on demand) and hybrid routing protocols [5].

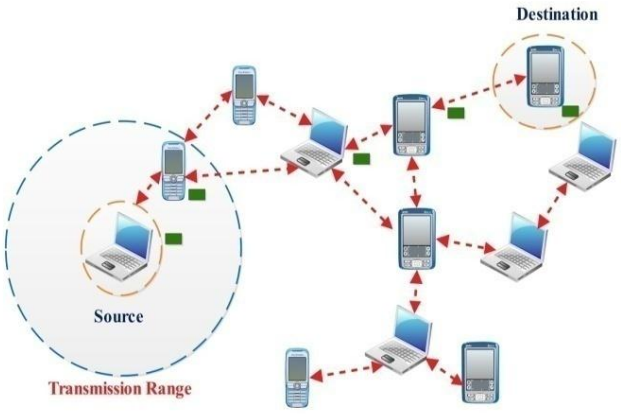

Figure 1: Overview of an ad-hoc network

1.1 Adhoc On Demand Routing Protocol

The Ad-Hoc On Demand Vector routing protocol [Perkins 1999] is an enhancement over DSDV and is source initiated routing pattern capable of both unicast and multicast routing. AODV creates a required route only when it is desirable as opposed to maintaining a complete list of routes with DSDV.

AODV offers rapid meeting, when a network topology changes because of any link breakage or movement node in such gears, AODV notifies all nodes so that they can invalidate the routes using the link or lost node. AODV is a Loop free [6].

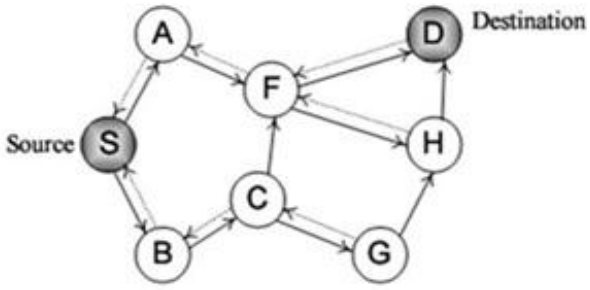

Figure 2: RREQ Broadcast

AODV is a self-starting and knobs large numbers of mobile nodes along with it allows mobile nodes to respond to link breakages and changes in network topology in a timely manner. AODV establishes a requisite route only when it is needed as opposed to maintaining a complete list of routes, with DSDV [7]. Ad Hoc on Demand Distance Vector AODV routing protocol is a reactive routing protocol which establish a route when a node required sending a data packets. AODV is proficient of both unicast and multicast routing. The operation of the AODV protocol is divided in two functions: route discovery and route maintenance. When a route is required for destination, the protocol starts the route discovery to discover the destination. After discovering the destination, the source node sends route request message to its neighbor's node. If those nodes do not have any information about the destination node then they will send the message to all its neighbors and if any neighbor node has the information about the destination node immediately the node sends route reply message to the route request message initiatorFig2.

According to this process a path is recorded in the intermediate nodes. This path identifies the route and it is known as reverse path. Each and every node forwards route request message to all of its neighbors and more than one copy of the inventive route request message can arrive at a node. A unique id is allocated when a route request message is created. When a node received then it will check this id and the address of the initiator and discarded the message if it had already processed that request. The Node that has information about the path to the destination and it sends route reply message to the neighbor from which it has received route request message. This neighbor does the same. Owing to the reverse path it can be possible. Then the route reply message travels back using reverse path Fig 3. When the route reply messages reach the initiator and the route is prepared and the initiator can start sending the data packets [8].

Step1: s denotes as Source node and D for destination.

Step2: The route request is received by its entire neighbor node. Here, the neighbors are A and B.

Step3: when neighbor node receives the request from source node or any node. It checks whether the request is new or old with the help of ID.

Step4: If the ID is new, then it checks whether the destination address matches its own address.

Step5: If the ID is old then it discards the duplicate request.

1.2 DSR Dynamic Source Routing

The dynamic source routing (DSR) broch 1998, Johnson 1996 algorithm is an innovative approach to routing in a MANET in which nodes communicate along paths stored in source routes carried by the data packets.DSR is Simple and efficient routing protocol designed explicitly for use in multi-hop wireless adhoc networks of mobile nodes. DSR allows the network to be completely self- configuring and self-organizing, without the need for any existing infrastructure network or administration.

The protocol consists of two major stages: route discovery and route maintenance. Route discovery is the mechanism by which. The source sends a broadcast packet which covers source address, request id, destination address and path. If a host adage the packet before it discards. The DSR protocol permits nodes to dynamically discover a source route across multiple network hops to destination in the ad hoc network.

When node S wants to send a packet to node D but it does not know a route to transmit packet to D, node S initiates a route discovery. Source node S floods Route Request (RREQ) [6].

Each node appends own identifier when forwarding RREQ. Route Maintenance is the mechanism ensures that the transmission path remains optimum and loop-free as network conditions change, even if this requires changing the route during a transmission. The DSR protocol is mainly designed for mobile ad hoc networks of up to about two hundred nodes and is designed to work well even with very high rates of mobility.

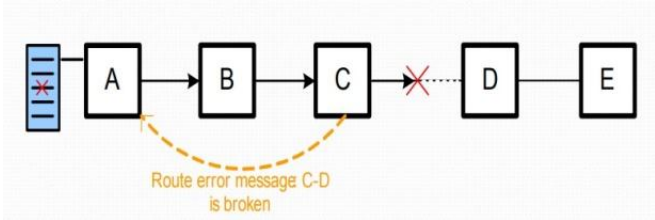

Figure 3: Route Maintenance

II LIERATURE REVIEW

Rajiv Mishra and C.R. Mandal presented the performance comparison of DSR and AODV. The multiple data streams were sent to general destination. Constrained circumstances have lead to congestion in network. DSR is a high

performance than AODV in constrained situation where multiple constant bit rate sources to single destination with use of the proposed algorithm performance of AODV improved by 10%. For the simulation settings 1000m*1000m terrain area was taken with CBR data traffic using random waypoint model. DSR showed high packet delivery ratio (PDR). In an additional work Abdul Fatau Adam obtainable method for improving performance of AODV over DSR and then compared the performance of both AODV and DSR protocols. End to end delay and Packet delivery ratio were used as performance metrics. Here the Simulation area was 800m*800m with 50 numbers of node and CBR data traffic sources. DSR is high delay than AODV but better packet delivery ratio than AODV [9].

S.Venkatasubramanianan and Dr.N.P. Goplan, the QoS based ROBUST Multi-path Routing (QRMR) protocol for mobile ad hoc networks was developed. The mobile ad-hoc networks to allot weights to, depending on the metrics link quality, individual links channel quality and end-to-end delay. The individual link weights are mutual into a routing metric to validate the load balancing and interference between links using the same channel [11].

S.Venkatasubramanianan and Dr.N.P. Goplan, single path QoS routing protocol for Load Balancing is detrimental since it may cause interference, collision, fading and link failures. For QoS routing protocol, load balancing is necessary since it allows a router to take benefit of best multiple paths to a given destination. It can maximum and minimize utilization while supporting the same traffic demands. It reacts quickly to fluctuations in traffic demands, traffic spikes and link failures and also it avoids congestion within the network. Consequently, considering the advantages of load balancing, a multi-path routing for load balancing MQRLB is proposed in this paper [3].

Pranav M. Pawar, Smita Shukla, et al, theSimulation and Proportional Evaluation of AODV and DSR in Different Environment of WSN. The comparison of the routing protocols for network topology holds a significant position in the performance assessment of wireless networks. In this paper, the discusses done about the performance of evaluation of Ad-hoc on demand Distance Vector, and Dynamic Source Routing (DSR), routing protocols using NS-2 Simulation. The latency, Energy efficiency, throughput and fairness characteristics in different conditions are investigated under different load conditions on two-hop and multi-hop network. The comparison results provides the performance of AODV and produces better in network with requirement on time, whereas the DSR is more adaptable in the networks with high throughputs and energy constraints.

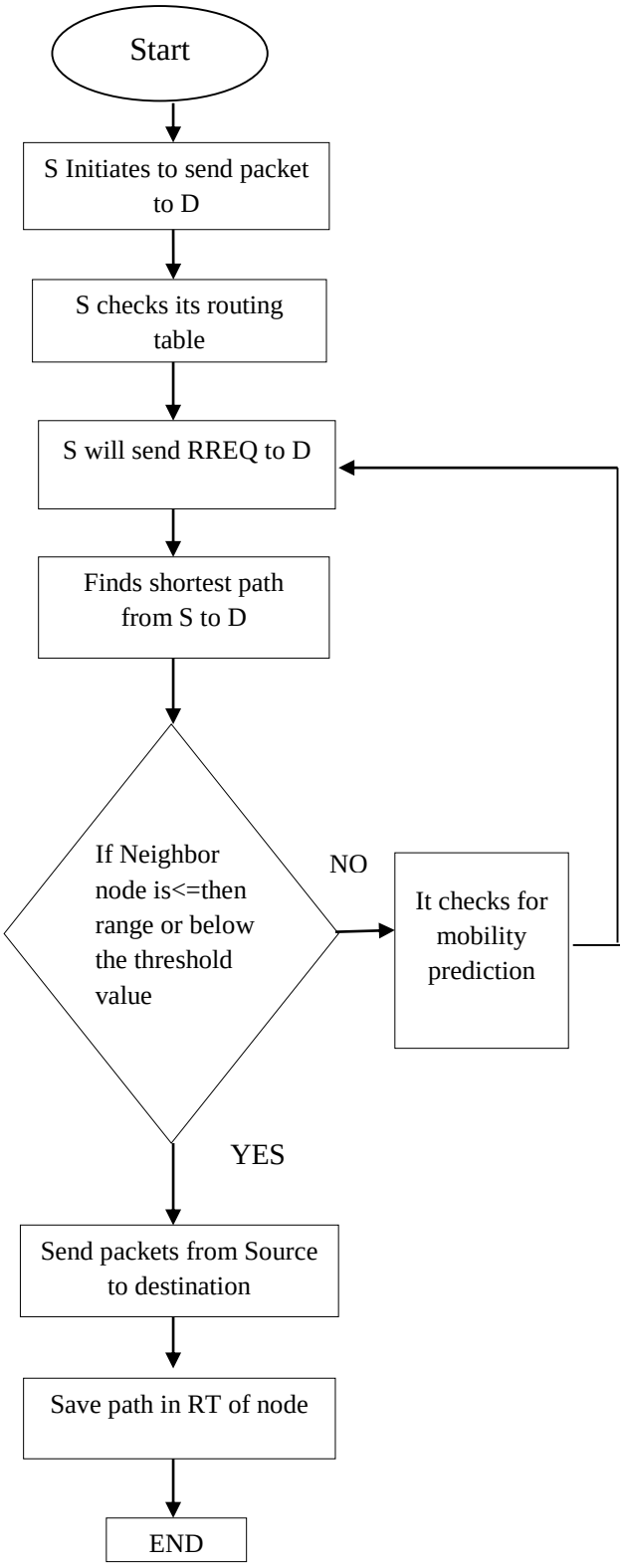

Figure 4: Flowchart for MMQRLB Method

III SIMULATION SETTINGS

The simulation has been done for 50 nodes using Network Simulator 2.34 in an area of size 1000 m x 1000 m. The performance metrics such as end to end delay, throughput and Packet Delivery ratio are evaluated against pause time for

AODV Routing protocols and are shown below Table 1. The red color curve represents the DSR. While the green color curve represents the AODV [10] .The graphs which are shown below are Xgraph. NS-2 Xgraph is used to show the graphical representation of results. At different pause time the performance metrics are measured. The nodes are set to move within the topology area at a maximum speed. At a pause time of 5, 10, 15 and 20 seconds [11].

Table 1: Simulation parameters

Platform	Ubuntu
Ns Version	Ns 2.34
No. of Nodes	50
Area Size	1000*1000m
MAC	802.11
Simulation time	100sec
Traffic source	CBR
Rate	Kbps
Packet size	512 bytes
Protocol	AODV
Transmission Range	250 m
Mobility Model	Random way point

IV PERFORMANCE METRICS

The evaluation of performance of routing protocols can be measured under the below metrics.

- ✓ End to End delay.
- ✓ Packet Ratio Delivery.
- ✓ Control Overhead
- ✓ Throughput

Average Packet Delivery Ratio: It is the number of packets received successfully and the total number of packets transmitted to the destination.

$$Packet\ dedlivery\ ratio = \frac{packet\ received}{packet\ send}$$

Average end-to-end delay: The average end-to-end delay is averaged over all lasting data packets from the sources to the destinations.

$$Endto\ End\ delay = \frac{last\ packet\ tranmission\ time}{No.of\ packets\ received}$$

Control Overhead: The control overhead is glowing demarcated as the total number of routing packets normalized is controlled by the total number of received packets.

$$Packet\ loss\ ratio = \frac{Ratio\ of\ the\ number\ of\ lost\ packets}{Total\ no.of\ transmitted\ packets}$$

Throughput: It is the number of packets successfully received by the receiver at the receiver end.

$$Average\ energy\ Consumption = \frac{Initial\ energy - final\ enegy}{Total\ No,.of\ Nodes}$$

Here, comparing the performance of AODV and DSR protocol. Here, the performance of the protocols by varying the no. of nodes as 15, 25 and 50.

Evaluate the performance according to the following metrics: Throughput, Packet Delivery Ratio, Control Overhead and End to End Delay.

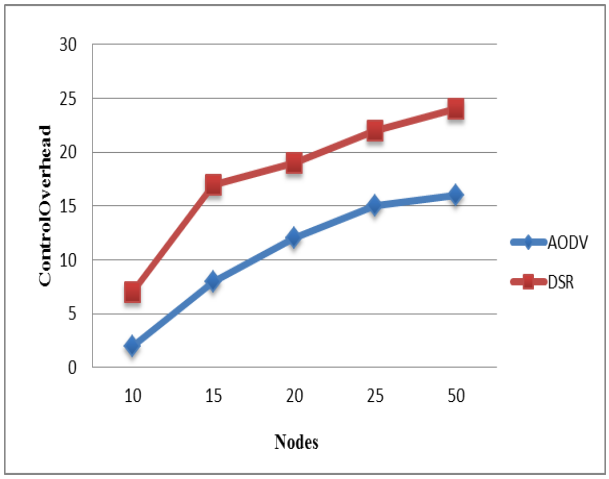

Figure 5: Node vs.Control Overhead

In figure 5 the Control Overhead is less when compared with AODV and DSR. Here, the performance of the protocols by varying the no. of nodes as 15, 25 and 50.

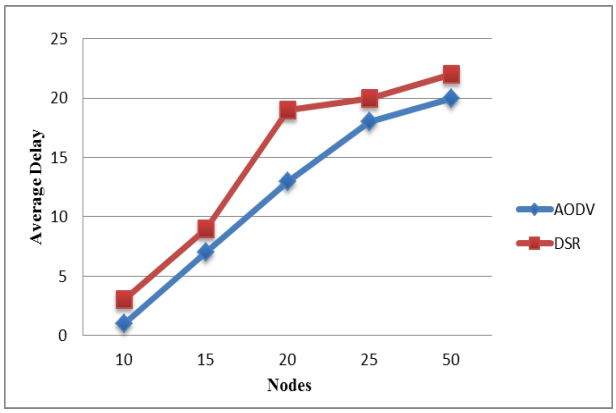

Figure 6: Node vs. Average Delay

In figure.6 shows the Average Delay of AODV is less when compared with the DSR protocol. The delay of a network specifies how long it does take for a bit of data to travel diagonally the network from one node to another. Moreover, it consumes lesser along the routes.

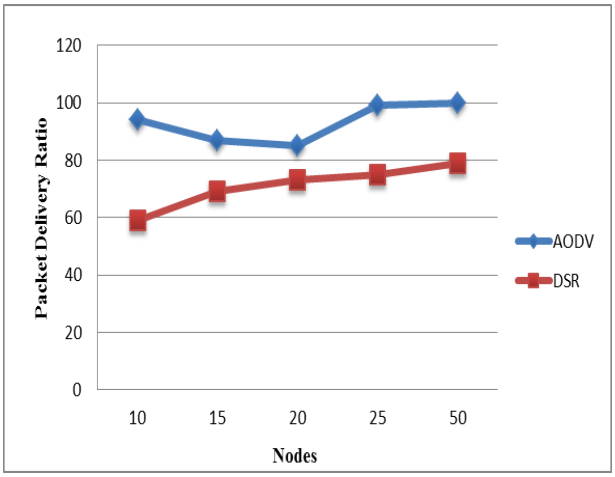

Figure 7: Node vs.Packet delivery ratio

In figure 7 Shows the Packet Delivery Ratio are higher when compared with the DSR. Here, the performance of the protocols by varying the no. of nodes as 15, 25 and 50.

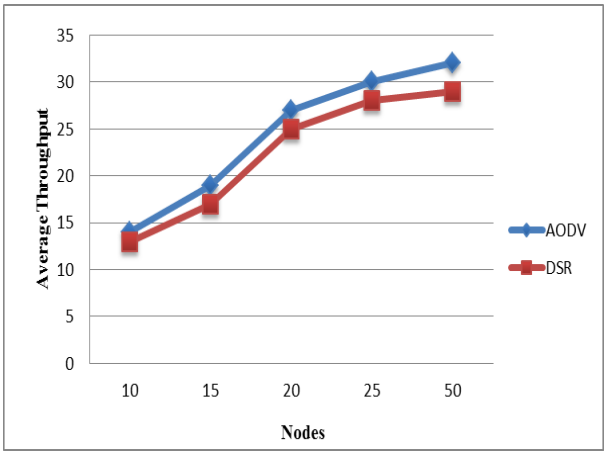

Figure 8: Node vs.Pause Throughput

In figure 8 shows the Average Throughput are high when compared with the DSR protocol using multipath load balancing.

IV CONCLUSION& FUTURE WORK

In this paper,the compartive of both AODV ad DSR is done. Here, the performace of AODV is better than DSR. In MANET,congestion and packet dropping are the major drawbacks in dynamic network topology. To solve this kind of issue, load balancing is required to avoid the congestion during transmission. The load balancing helps to distribute the packet inorder to avoid the congestion and to improve the speed simultaneously. The metrics like Throughput, Packet Delivery Ratio, Delay, and Control Overhead are used to measure the quality of the load balancing. From the above analysis it is concluded that the AODV method works better than the when compared to DSR routing protocol. Hence the delay in packet delivery is higher for AODV. Both AODV and DSR protocols give identical results with respect to fairness.Therefore in topologies with changing node density both protocols behave identically. The future work can be added on load balancing in multipath routing is traffic splitting. Which helps to clear traffic or congestion in multipath routing protocol. Here the load distributed process, the success probability and the failure probability can be calculated in future work.

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