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Providing Internet Connectivity and QOS of Reactive and Proactive Protocols Using Gateway Discovery in Mobile Ad Hoc Networks

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***Abstract*– Mobile Ad hoc Network (MANET) is a collection of nodes which are connected by wireless links. MANET is a self configuring network in which nodes are free to move. This paper used two ADHOC routing protocols i.e. reactive and proactive Protocols. In this paper, we have use only two categories Ad Hoc routing protocols AODV (Ad Hoc on demand routing protocol) that act as reactive protocol and DSDV (Destination sequenced Distance Vector) act as a proactive protocol. Using AODV, The routes are created only when source wants to send data to destination. AODV builds and maintains routes that are needed to reduce overheads. A mobile node requests a route only when it needs one. Each node does not need periodic route table update. Destination-Sequenced Distance-Vector Routing is a table-driven routing scheme for ad hoc mobile networks based on the Bellman-Ford algorithm. This algorithm is used to solve the Routing Loop problem. DSDV requires a regular update of its routing tables. Both Protocols use Gateways for connectivity between MANET node and internet. The Gateway had been selected for communication with source node and destination node. The Interface Queue Occupancy Algorithm and Gateway Selection Algorithm had been used for selecting a particular gateway and run under the Network simulator (NS2). The purpose of gateway used in this paper for providing internet connectivity. The internet connection provides communication between local to remote area and QOS (Quality of Service) means the data used in the simulated scenario sent or not and measures from the End to End performance. The performance metrics has been calculating by various scripts namely Perl and Python scripts to measure the delay variance. This Paper presents the results of throughput of both AODV and DSDV protocols and shows that AODV performs well over DSDV protocol when the nodes communication over internet. The simulation performed over 802.11 networks and supports MANET.**

***Index Terms*– AODV, DSDV, MANET, Throughput and Delay**

I. INTRODUCTION

A Mobile node is a collection of mobile nodes which forms a temporary network. Some of the nodes in an ad hoc network may want access to an external network, such as internet [1].

Protocol architecture is used for connectivity of MANET with Internet. TCP/IP suite and MANET Protocol Architecture use different languages. The Mobile devices in MANET share limited storage and less computational capabilities. They heavily depend on other hosts and resources for data access and information processing [22]. A MANET uses multi hop communication. MANETs are also characterized by a dynamic, random and rapidly changing topology [17]. MANET is used in various applications. It is suitable for applications like emergency regions, natural disasters and military operations. Another application is Bluetooth which is designed for personal use and enables printers, scanners, mobile phones and music players to be connected wireless to a personal area network this creates a tremendous flexibility because it enables devices to move freely between different networks [24].

A Gateway, that must be able to translate between these "two languages", must understand both [6]. These networks are autonomous where a number of mobile nodes equipped with wireless interfaces communicate with each other directly or through other nodes [7]. In general, MANET topology is dynamic, because of node departure and new node arrival during the connectivity time among the nodes and asymmetrical; because the nodes communicate over wireless links have a different transmission range [18]. AODV is an On Demand and reactive routing Protocol. A route is established only when it is required by the source node for transmission of packets. AODV uses a distributed approach, meaning that source nodes do not maintain a complete sequence of intermediate nodes to reach the destination [9].

The sender node broadcasts the RREQ packet in the network for appropriate route. Now when a source node initiates a route discovery procedure by flooding RREQ messages, each node receiving an RREQ will rebroadcast it adding its own interface queue length [12]. RREP message is sent to the source node by the destination node. Gateway is used to communicate mobile nodes with fixed wired node. There are three methods to find the optimum gateway for connection between mobile node and fixed wired node. Proactive Gateway Discovery:

The Proactive Gateway Discovery is initiated by the gateway itself [2]. The Gateway broadcasts a gateway advertisement after an interval of time. In Reactive Gateway approach, A mobile node broadcasts a route request RREQ_I to the IP address. This IP address contains address for group of all gateways. If a mobile node receives RREQ_I message, they further rebroadcast it. When a link or route break. Link failure can be due to node's movement or exhausting the energy [23]. Neighbourhood nodes send RERR message to Source node. The Proactive and Reactive gateway discovery approaches are combined to make hybrid gateway discovery. Some Ad hoc nodes are gateways which can be used by other nodes to seamlessly communicate with hosts in the fixed

network [10].The Sequence numbers are used in AODV. A destination sequence number is Zero if source does not know the sequence number of destination. A RREQ packet is uniquely identified by the combination of source sequence number and broadcast ID [11].

Destination Sequenced Distance Vector Protocol is a Proactive Routing Protocol. DSDV is a Table Driven Routing Protocol. In Distance Vector Protocols, every node I maintains for each destination x a set of distances {dij(x)} for each node j that is a neighbor of i [8]. The cost metric used is the hop count, which is the number of hops used for the packet to reach its destination [3]. The sequence number is incremented by 1 of a disconnected node or a broken link, if another node wants to send an update for the expired route to the neighbors. Due to this odd sequence number, the neighbor nodes remove the entry from the routing table for the disconnected node. The broken link may be detected by the layer-2 protocol, or it may instead be inferred if no broadcasts have been received for a while from a former neighbor [19]. Generally mobile node uses multiple network protocol to transmit entire routing table (full dumps) to its neighbors periodically. Incremental update packets are transmitted between the full dumps for partial changes of the routing table such as receiving new sequence numbers and fewer significant route changes [13]. The Security threats in DSDV are the manipulation of sequence numbers and the manipulation of cost metrics. Specifically, a misbehaving node can poison other nodes routing tables or affect routing operations by advertising routes with fraudulent sequence numbers or cost metrics [21].

In DSDV, whenever a node request for a data to the destination. The routing table of all the neighborhood nodes automatically updated. Due to this, traffic increases in the queue of nodes. Load along the particular path increases. So congestion increases. To overcome these problems, two algorithms "Interface Queue Occupancy Algorithm" and "Gateway Selection Algorithm" are used. The first algorithm checks the queue occupancy level of all nodes, gateways. The second algorithm is used to select a particular gateway to communicate with destination. The Gateway is selected in that way so that traffic along the path is lesser. The Performance comparison of AODV and DSDV is also checked.

II. METHODOLGY USED

The two algorithms used are "Interface Queue Occupancy Algorithm and Internet Gateway Selection Method". The given Equation is used in Interface Queue Occupancy Algorithm.

$$Avg\_q\_occupancy = \frac{q\_occupancy + \sum nb\_q\_occupancy}{N+1}$$

This algorithm computes the *avg_q_occupancy* (congestion at a node along a path) of every node in the network. Firstly, *nb_occupancy* of all neighbor nodes of a particular node is calculated. The sum of all neighbor nodes occupancy and a particular node's own occupancy is calculated. Here, N suggests number of nodes. This equation is further used in `Internet Gateway Selection Algorithm. A mobile node receives non duplicate advertisement. This node updates the value of *rt_qlen_metric* in its routing table and compares it with *gateway_adv_queue* in gateway advertisement message and that node selects a particular gateway. It is to be noted that for every fresh gateway advertisement received from the same gateway, the value *of rt_qlen_metric* in a mobile node routing table is replaced only when *gateway_adv_queue* field value of gateway advertisement is less than the *rt_qlen_metric* field value in the routing table [5].

III. LITERATURE SURVEY

The Authors [1] described the Protocols used in Mobile Ad hoc Network. The gateway is used to communicate MANET nodes with Internet. The Authors surveyed the AODV and DSDV protocols. The Protocols are analyzed and Performance of AODV is better as compared to DSDV Protocol.

The Authors [2] suggested the modified Ad hoc routing protocol which is used to communicate mobile devices in ad hoc networks with gateway using multi hop connections with neighboring nodes.

The Authors [3] perform implementation and testing on DSDV Protocol. They provide the explanation of components and how each class interacts with other classes. They analyzed DSDV implementation in varying node densities. The results of performance of DSDV are compared with performance of OLSR and AODV.

The Authors [4] described extension of approach for gateway selection scheme. The path is updated to the gateway on the request of mobile node which facilitates handoff from one gateway to another gateway. This scheme also maintains continuous connectivity to the fixed host. Another extension is that routing queue length and minimum hop count metric is not only used to discover the routes to the gateway but also for routing in the local ad hoc domain among ad hoc host. The occupancy level of each of node is updated after a short interval of time. This reduces the delay and increase packet delivery ratio.

The Authors [5] discussed about minimum hop metric. A Mobile node uses minimum hops to communicate to a fixed host using gateway. Sometimes, a minimum hop path is not sufficient if there are some waiting packets in the queue. The Authors analyzed existing load aware routing protocols in MANET and devise a proactive load aware routing scheme. This scheme uses the interface queue occupancy and min hop metrics. The Handoff from one gateway to other gateway is also discussed. When a mobile node receives gateway advertisements based on interface queue interface queue and minimum hop, the node updates its default route to the gateway.

The Authors [6] described the maximal benefit coverage Algorithm. This is used for minimum consumption of network resources i.e. battery power and bandwidth in MANET.

The Authors [7] analyzed that users require huge amount of resources and services from the internet and for increasing the coverage area of MANET. So there is a need for integration ad hoc networks to the internet. The gateways are used which acts as bridges between these two protocol architectures. The gateway discovery scheme in hybrid network is a complicated task. The complexity increases due to greater number of sources. So AODV reactive routing protocol is extended to provide communication between MANET and Internet. The

number of received packets increases with more number of sources, so traffic increases. The number of sources and number of gateway discoveries results the increase in traffic. These further results in higher routing load. The hybrid approach is a combination of proactive and reactive approaches, the routing load lies between these protocols.

The Authors [8] said that routers are free to move in a Mobile Ad hoc networks. So the wireless topology may change rapidly. This network operates in larger internet.

The Authors [9] discussed about energy efficiency in static and dynamic ad hoc networks. The Power failure of any mobile node reduces the overall network lifetime. They combined the existing solutions for more energy efficient routing approach. They compared the energy consumption of DSR, AODV and WRP.

The Authors [10] described the interconnection between Mobile Ad hoc Network with fixed internet. They discussed the approaches for interconnecting MANET and internet. The Performance of network is calculated and different mobility models are generated.

The Authors [11] proposed a novel channel adaptive routing protocol. It extends the Ad hoc on Demand Multipath Distance Vector routing protocol to accommodate channel fading. This proposed channel aware routing protocol uses the channel average non fading duration as a routing metric to select links for path discovery. It applies handoff strategy to maintain reliable connection for sending channel state information. Using this same information, the paths can be reused. The Authors provide new results for the path systems.

VI. EXPERIMENTATION SCENARIO

Our Proposed work is for Interface Queue Occupancy Algorithm and Internet Gateway Selection Algorithm. The Throughput of AODV and DSDV is calculated. The Scenario of AODV and DSDV is shown in the given Fig. 1.

A screenshot of the simulation scenario is shown in Fig. 1. The 20 small circles represent the mobile stations. The two hexagonal stations at each side of the figure are the gateways and the four square stations are the two hosts and the two routers.

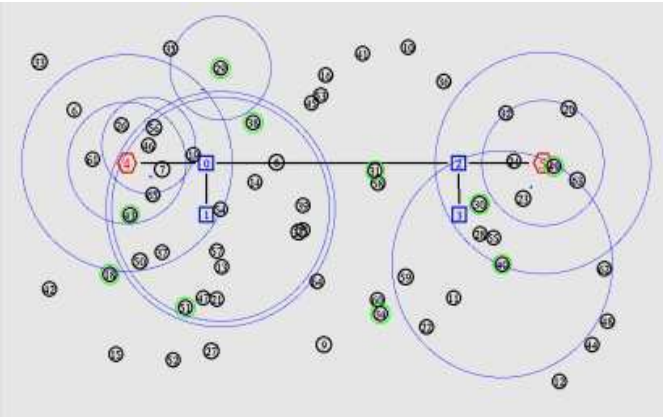

Fig 1: Scenario of AODV and DSDV

The mobile stations move according to an improved version of the commonly used random waypoint model. It has been shown that the original random waypoint model can generate misleading results. With the improved random waypoint model, the mobile station speed reaches steady state after a quick warm-up period.

Each mobile station begins the simulation by selecting a random destination in the defined area and moves to that destination at a random speed. The random speed is distributed uniformly in the interval [1,18] m/s. Upon reaching the destination, the mobile station pauses for ten seconds, selects another destination, and proceeds as described. This movement pattern is repeated for the duration of the simulation. The movement patterns are generated using the movement generator tool set dest and the traffic connection pattern is generated. If the gateways use proactive or hybrid gateway discovery, they broadcast GWADVs periodically every ADVERTISEMENT INTERVAL seconds, ADVERTISEMENT ZONE, which is set to three, is used for the hybrid gateway discovery method and defines the zone within which proactive gateway discovery is used. Outside this zone the reactive gateway discovery is used.

The Following figure 2(a) shows the results of Throughput vs. Time of AODV Protocol with Delay Variance.

The delay at sender side is approximate to 0.2 and throughput is 20 k bytes. The Throughput is calculated as total bytes received per second. Transmitting the second packet, both the throughput and delay increases. When the simulation time is reached to 90 seconds, the delay approaches to null value. The data is more stable when AODV Protocol runs. Though Network Topology changes, Data remains stable in AODV.

The Fig. 2 (b) shows the throughput vs. Time with Delay variance of DSDV protocol over internet connectivity. The delay decreases as the simulation time increases. The throughput of sending and receiving packets at a particular time is same. In the given figure shown, when the first packet is sent and received by other node, the throughput at both sending and receiving sides is same i.e. 14.3 k bytes. The delay produced is 1.2 seconds. The throughput of second

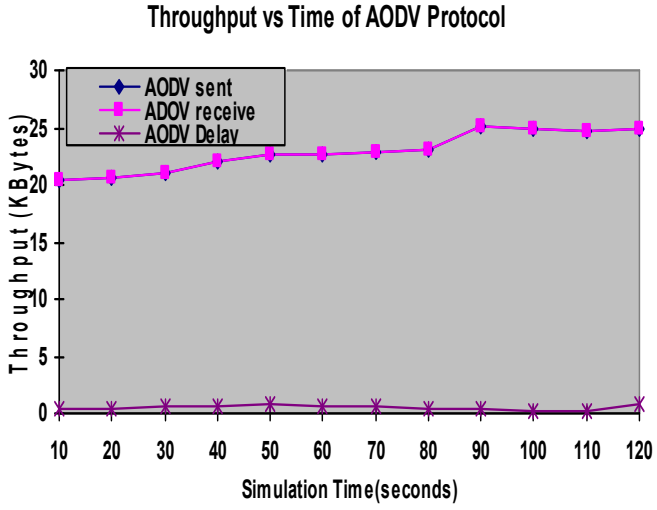

Fig. 2 (a): Throughput vs. Time with Delay variance of AODV Protocol

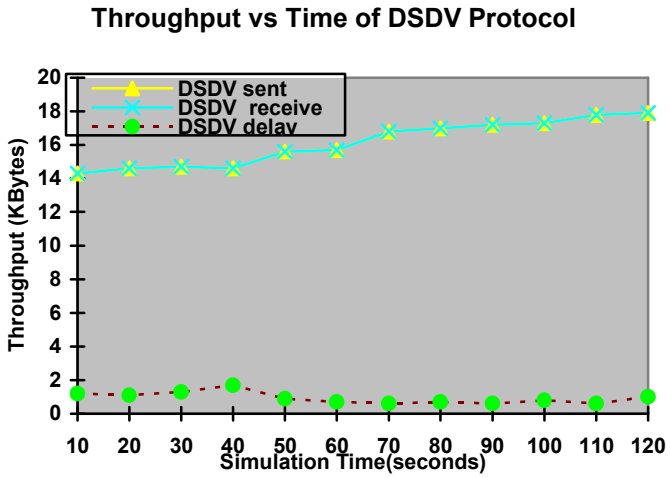

Fig. 2 (b): Throughput vs. Time with Delay variance of DSDV Protocol

packet at sending and receiving packets is also same. The throughput for second packet is 14.6 k bytes but delay reduced to 1.1 seconds. As the throughput increases, delay is reduced. The traffic reduces in DSDV using the algorithms of Interface Queue Occupancy and Internet Gateway Discovery Algorithm.

From the scenario shown in Fig. 1, it is concluded when NAM tool runs then 5 nodes move along each other and communicate with host at different times as shown in Fig. 3.

In given scenario, the two hosts, host 1 and host 2 are used. When Source Mobile node 8 communicates to host 2, the time taken by mobile node 8 is 7.14 ms. After that, Mobile Node 13 takes time of 0.66 ms to communicate with host 2. Similarly, Mobile node 12 communicates with host 2 taking time duration of 4.55 ms. Mobile Nodes 14 and 19 communicates with host. They take the time of 0.38 ms and 4.99 ms respectively.

V. CONCLUSION

In this Paper, we introduce the Interface Queue Occupancy Algorithm and Internet Gateway Discovery Method. The congestion level at every node is checked. The problem of congestion level and traffic in DSDV is solved using these algorithms. The combination of these Algorithms is also algorithms. The combination of these Algorithms is also implemented in MANET using AODV Protocol. Delay in AODV is approximately zero. The Throughput of AODV Protocol is better than DSDV Protocol.

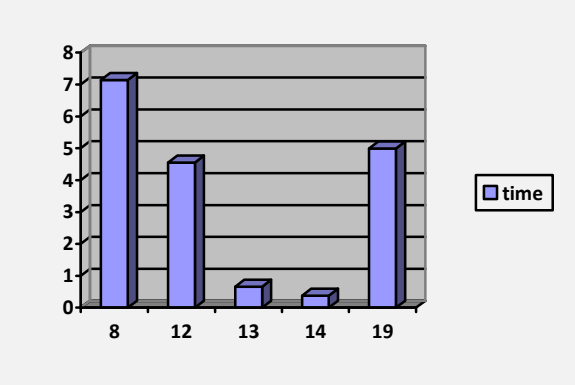

Fig 3: Mobile Node Vs Time Graph

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