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Analysis QOS Parameters for MANETs Routing Protocols Using AODV And DSR

Raja S R[#1] , Dr.K.Alagarsamy[*2]
[#1]Department of MCA, KLN college of Engineering, India
[*2]Department of Computer Centre, Madurai Kamaraj University, India

ABSTRACT — A Mobile Ad-Hoc Network (MANET) is a development of computer networks it is an infrastructure less (wireless) network. In wireless network it changes the network topology randomly and communication can be done by anyplace, anywhere and anytime. In this research to analysis of QoS parameter for reactive routing protocols for different Routing protocols used in mobile ad hoc networks. The reactive routing protocols are Dynamic Source Routing (DSR) Protocol and Ad-hoc On Demand Vector (AODV) protocol. To analysis different parameters such as Packet Delivery Fraction, Average end to end delay, Routing overhead and Normalized Routing[2] are used for anglicizing these parameters. The analysis is done Network Simulator 2 and graphs are generated for performance of these parameters. The performance report is DSR is better when compared to AODV when nodes are minimum. Suppose nodes are high AODV perform better.
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KEYWORDS: MANET, Ad Hoc, QoS, Parameters, Wireless, DSDV, AODV

I. INTRODUCTION

MANET (Mobile Ad hoc Network) is a collection of Autonomous Self -configuring network of mobile devices. There is no wireless link between any other nodes. The mobile nodes are having no fixed infrastructure through wireless link mobile nodes are communicating. In MANET all the nodes are move freely and any time can connect to other nodes. In wireless communication nodes are behave like a router and it transferring one node to another node. Routing of this network structure is complex. We selected two routing protocols AODV and DSR[1]. We can compare the performance analysis of these protocols. The transmission of packets from source to destination by nodes, node can communicate with other nodes. But all the nodes cannot communicate directly with other nodes. In MANET routing is very important because to select the correct path to perform data transmission in a network. Routing is very important role in wireless Type of network Ad Hoc network, to select the best path for data transmission between nodes. Routing is the major problem in MANET.

II. QUALITY OF SERVICE

QoS routing requires finding a route from a source to a des- tination with required bandwidth. The bandwidth calculation scheme developed above only provides a method to calculate the available bandwidth for a given route.Real-time applications (such as video and audio transmissions) need QoS (quality of service) support. Two widely used QoS constraints are bandwidth and delay requirements. It is not a routing protocol, and needs to be used together with a routing protocol to perform QoS routing. The routing protocol chosen here is AODV. AODV is a pure on-demand routing protocol and uses a broadcast (i.e. flooding) route discovery mechanism. The reason for selecting AODV is that its route discovery mecha- nism matches the bandwidth calculation scheme very well and is suitable for bandwidth constrained routing.This protocol maintains the end-to-end state information at every node for every possible destination. Quality of service (QoS)[3] is the performance level of a service offered by the network to the user.The size of the ad-hoc network is directly related to the quality of service of the network. If the size of the mobile ad-hoc network is large, it might make the problem of network control extremely difficult. The goal of QoS provisioning is to achieve a more deterministic network behavior, so that information carried by the network can be better delivered and network resources can be better utilized. These QoS parameters, however, are generic and their calculations depend on specific networks. The QoS measure used here is bandwidth.

In this research we have concentrate only two protocols namely, 1.Dynamic Source Routing (DSR) and 2. Ad-hoc On Demand Vector (AODV)[2]

QOS FACTORS

1. **Packet Delivery Fraction**

It is a ratio of source deliverer the data packets to the destination. The formula for find the Packet delivery Fraction is, [4]

$$PDF = (P_d/P_s)*100$$

Where P_d is total Packet delivered and P_s is the total Packet sent.

2. **Routing Overhead**

The simulation routing protocol generated by the total number of routing packets (RTR).

Overhead = Number of RTR packets

3. **Normalized Routing Load**

Number of routing packets “transmitted” per data packet “delivered” at destination. Each hop-wise transmission of a routing is counted as one transmission. It is the sum of all control packet sent by all node in network to discover and maintain route.

NRL = Routing Packet/Received Packets

4. **Average End-to-End Delay**

This includes all possible delay caused by buffering during route discovery latency, queuing at the interface queue, retransmission delay at the MAC, propagation and transfer time. It is defined as the time taken for a data packet to be transmitted across an MANET from source to destination.

$$D = (Tr - Ts)$$

Where Tr is receive Time and Ts is sent Time.

III. DYNAMIC SOURCE ROUTING

In MANET, Dynamic Source Routing (DSR) protocol is an Ad Hoc routing protocol it is based on source-based routing protocol and it it is an reactive protocol. Some of the protocols are hop by hoop but Dynamic Source Routing (DSR) protocol is source based. Dynamic Source Routing (DSR) protocol is designed for multi hope wireless and it does not require any network infrastructure.[4]

Dynamic Source Routing (DSR) having two parts route discovery and route maintenance. The route discovery is used to find the route between source to destination and then sending a packet between nodes. The route maintenance is used to find the route failure of nodes. The MAC layer is used to identify link failure in nodes. If any connection problem in DSR, it is detected by the data link layer and ROUTE –ERROR[3] packet is generated and the packet is sent backward to the source and the source initiate a route discovery. When ROUTE-ERROR is got the link route is released from the cache.

All nodes maintain a cache to store recently discovered paths. When a node desires to send a packet to any other node, it first checks its entry in the cache. If it is there, then it uses that path to transmit the packet and also attach its source address on the packet. If it is not there in the cache or the entry in cache is expired (because of long time idle), the sender broadcasts a route request packet to all of its neighbors asking for a path to the destination. The sender will be waiting till the route is discovered. During waiting time, the sender can perform other tasks such as sending/forwarding other packets. As the route request packet arrives to any of the nodes, they checkfrom[4] their neighbor or from their caches whether the destination asked is known or unknown. If route information is known, they send back a route reply packet to the destination otherwise they broadcast the same route request packet. When the route is discovered, the required packets will be transmitted by the sender on the discovered route. Also an entry in the cache will be inserted for the future use. The node will also maintain the age information of the entry so as to know whether the cache is fresh or not. When a data packet is received by any intermediate node, it first checks whether the packet is meant for itself or not. If it is meant for itself (i.e. the intermediate node is the destination), the packet is received otherwise the same will be forwarded using the path attached on the data packet. Since in Ad hoc network, any link might fail anytime. Therefore, route maintenance process will constantly monitors and will also notify the nodes if there is any failure in the path. Consequently, the nodes will change the entries of their route cache.

Benefits and Limitations of DSR

The benefit of DSR protocol maintains routing with the help of data packet header. It does not maintain a routing table. The limitations of DSR protocol is that this is not scalable to large networks and even requires significantly more processing resources than most other protocols. Basically, In order to obtain the routing information, each node must spend lot of time to process any control data it receives, even if it is not the intended recipient.

IV. ADHOC ON DEMAND DISTANCE VECTOR ROUTING

An AODV is derived from Destination-Sequenced Distance-Vector (DSDV)[3] and Dynamic Source Routing (DSR) and it is a reactive protocol it includes the advantages of both the protocols. Their route discoveries are same in DSR. When a node has a packet to send to a particular destination and if it does not know a valid route, it broadcasts a route request packet by specifying the destination address. The neighbors without a valid route to the destination establish a reverse route and rebroadcast route request packet. The route maintenance is done by exchanging beacon packets at regular intervals. This protocol adapts to highly dynamic topology and provides single route for communication. In AODV Route maintenance is like a DSR. An unwanted link can be detected through link layer acknowledgement or periodic hello messages to neighbors. Hello messages used to discover the neighbors. The link is only particular time period is valid otherwise it is an invalid. The active neighbors of the link, notify that the active neighbors of the route link are reached. The main ideas of AODV are

A. Route Discovery

When a node wants to send a data packet to a destination node, the entries in route table are checked to ensure whether there is a current route to that destination node or not. If it is there, the data packet is forwarded to the appropriate next hop toward the destination. If it is not there, the route discovery process is initiated. AODV initiates a route discovery process using Route Request (RREQ)[3] and Route Reply (RREP)[3]. The source node will create a RREQ packet containing its IP address, its current sequence number, the destination's IP address, the destination's last sequence number and broadcast ID. The broadcast ID is incremented each time the source node initiates RREQ.Basically, the sequence numbers are used to determine the timeliness of each data packet and the broadcast ID & the IP address together form a unique identifier for RREQ[4] so as to uniquely identify each request. The requests are sent using RREQ message and the information in connection with creation of a route is sent back in RREP message. The source node broadcasts the RREQ packet to its neighbours and then sets a timer to wait for a reply. To process the RREQ, the node sets up a reverse route entry for the source node in its route table. This helps to know how to forward a RREP to the source. Basically a lifetime is associated with the reverse route entry and if this entry is not used within thislifetime, the route information is deleted. If the RREQ is lost during transmission, the source node is allowed to broadcast again using route discovery mechanism.

Route discovery A route between two nodes consists of a list of nodes (n1,n2,...,nm), $m \geq 2$, where n1 denotes the source node, nm denotes the destina- tion node, and a link exists between each two adjacent nodes in the list. Using this route, each packet from node n1 with node nm as destination will be sent to node n2, which itself will send the packet to node n3 and so on, until it reaches node nm. These routes have to be discovered, either in advance or while sending the packet. If it is there, the data packet is forwarded to the appropriate next hop toward the destination. If it is not there, the route discovery process is initiated.

Routing is a basic functionality for multihop mobile ad hoc networks MANET.These networks are decentralized, with nodes acting both as hosts and as routers, forwarding packets for nodes that are not in transmission range of each other.

There exist different strategies for route discovery in routing proto- cols. For source routing, the source node determines the route a packet will take on its own; for that, the node needs su_cient knowledge about the network's topology. While this is no problem in small- to middle-sized networks with static topology or low dynamics, it is in most cases not suitable for MANETs with higher dynamics due to scarce bandwidth for exchange of topology information and long propagation 4 times.

AODV does not put any additional overheads on data packets as it does not make use of source routing. The limitation of AODV protocol is that it expects/requires that the nodes in the broadcast medium can detect each others' broadcasts. It is also possible that a valid route is expired and the determination of a reasonable expiry time is difficult. The reason behind this is that the nodes are mobile and their sending rates may differ widely and can change dynamically from node to node.

An Route Discovery, packet send from source to destination with the help of source node, the source node checks the path between source to destination if exists transfer a packet to the next hop and so on. Otherwise it does not transfer a packet because there is no link between source to destination node.

AODV starts a route discovery process by Route Request (RREQ) and Route Reply (RREP). The source node will create a RREQ packet containing its IP address, its current sequence number, the destination's IP address, the destination's last sequence number and broadcast ID. The broadcast ID is incremented each time the source node initiates RREQ. Basically, the sequence numbers are used to determine the timeliness of each data packet and the broadcast ID & the IP address together form a unique identifier for RREQ so as to uniquely identify each request. The requests are sent using RREQ message and the information in connection with creation of a route is sent back in RREP message. The source node broadcasts the RREQ packet to its neighbours and then sets a timer to wait for a reply. To process the RREQ, the node sets up a reverse route entry for the source node in its route table. This helps to know how to forward a RREP to the source. Basically a lifetime is associated with the reverse route entry and if this entry is not used within this lifetime, the route information is deleted. If the RREQ is lost during transmission, the source node is allowed to broadcast again using route discovery mechanism.

B. *Expanding Ring Search Technique*

The source node broadcasts the RREQ packet to its neighbours which in turn forwards the same to their neighbours and so forth. Especially, in case of large network, there is a need to control network-wide broadcasts of RREQ and to control the same; the source node uses an expanding ring search technique. In this technique, the source node sets the Time to Live (TTL) value of the RREQ to an initial start value. If there is no reply within the discovery period, the next RREQ is broadcasted with a TTL value increased by an increment value. The process of incrementing TTL value continues until a threshold value is reached, after which the RREQ is broadcasted across the entire network.

C. Setting up of Forward Path

When the destination node or an intermediate node with a route to the destination receives the RREQ, it creates the RREP and unicast the same towards the source node using the node from which it received the RREQ as the next hop. When RREP is routed back along the reverse path and received by an intermediate node, it sets up a forward path entry to the destination in its routing table. When the RREP reaches the source node, it means a route from source to the destination has been established and the source node can begin the data transmission.

D. Route Maintenance

A route discovered between a source node and destination node is maintained as long as needed by the source node. Since there is movement of nodes in mobile ad hoc network and if the source node moves during an active session, it can reinitiate route discovery mechanism to establish a new route to destination.Conversely, if the destination node or some intermediate node moves, the node upstream of the break initiates Route Error (RERR) message to the affectedctive upstream neighbors/nodes. Consequently, these nodes propagate the RERR to their predecessor nodes. This process continues until the source node is reached. When RERR is received by the source node, it can either stop sending the data or reinitiate the route discovery mechanism by sending a new RREQ message if the route is still required.

E. Benefits and Limitations of AODV

The benefits of AODV protocol are as under:

a. The routes are established on demand and destination sequence numbers are used to find the latest route to the destination. The connection setup delay is lower.

b. It favors the least congested route instead of the shortest route and it also supports both unicast and multicast packet transmissions even for nodes in constant movement.

c. It also responds very quickly to the topological changes that affects the active routes.

d. It does not put any additional overheads on data packets as it does not make use of source routing. [3]

The limitations of AODV protocol are summarized below:

a. The intermediate nodes can lead to inconsistent routes if the source sequence number is very old and the intermediate nodes have a higher but not the latest destination sequence number, thereby having stale entries.

b. The multiple Route Reply packets in response to a single Route Request packet can lead to heavy control overhead. The periodic beaconing leads to unnecessary bandwidth consumption.

c. It expects/requires that the nodes in the broadcast medium can detect each others' broadcasts. It is also possible that a valid route is expired and the determination of a reasonable expiry time is difficult. The reason behind this is that the nodes are mobile and their sending rates may differ widely and can change dynamically from node to node.[7]

d. The various performance metrics begin decreasing as the network size grows.

e. It is vulnerable to various kinds of attacks as it based on the assumption that all nodes must cooperate and without their cooperation no route canbe established.

V. SIMULATION SETUP

A) Simulation Setup

The Simulation was performed in NS 2 Simulator. The simulation set is given below

Parameter	**Value**
Routing Protocol	AODV, DSR
MAC Layer	802.11
Packet Size	1640 Bytes
Terrain Size	1500m *1500m
Nodes	10 and 40
Data Traffic	Tcl
Max.Packet	60
Simulation Time	60 Sec

VI. RESULTS AND DISCUSSIONS

The results are generated by AODV and DSR. The work is based on these two protocols during the simulation in NS2. The results are taken from the micro soft excel based on same number of parameters and random traffic are used.

The following graph display the result performance of the two protocols AODV and DSR. The DSR is performing better in packet delivery and speed.[2]

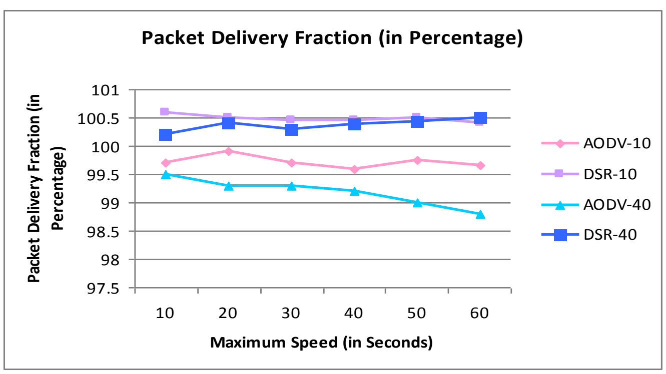

Figure 1: Packet Delivery Fraction vs. Speed

The following graph display the result performance of the two protocols AODV and DSR In average end-to-end delay, AODV perform better in all conditions when compare to DSR.

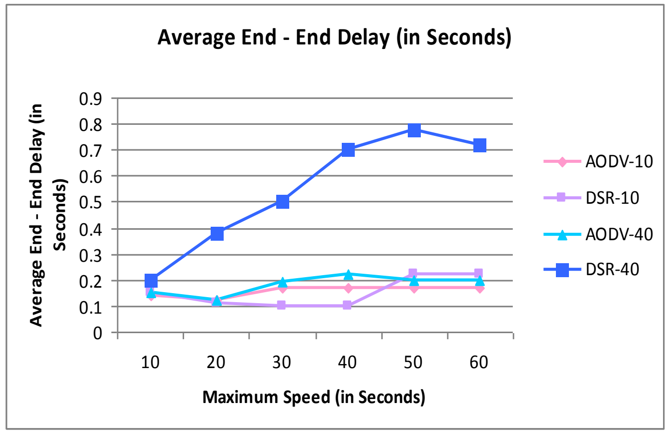

Figure 2: Average end-to-end delay vs. speed

The following graph display the result performance of the two protocols AODV and DSR In terms of routing overhead, DSR also performs better because it has a lower routing overhead than AODV.

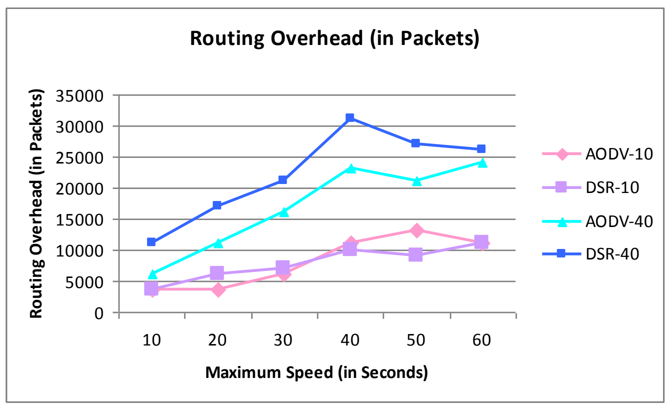

Figure 3: Routing overhead vs. speed

The following graph display the result performance of the two protocols AODV and DSR The network load is low both protocols performance are similar. But the load is high DSR perform worst and AODV perform better.[5]

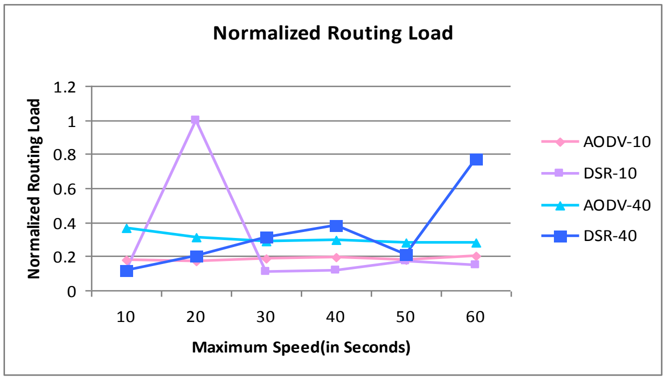

Figure 4: Normalized Routing Load vs. speed

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VII. CONCLUSION

These research to analysis the two protocols AODV and DSR for MANET. The performance was analyzed in NS 2 Simulator. The Terrain size as 1500m * 1500m and the maximum packet size as 60. The performance of DSR and AODV reactive routing protocols was analyzed. When compare to AODV, DSR performance was better[6]. If the nodes become low the AODV work better. In feature we can use more number of routing protocols and to compare the performance of each protocols. This is very complex to implement for many number of routing protocols were used. In MANET we have many number of reactive protocols are used. In future to concentrate to develop a new protocols.

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