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Effect of Using Different QoS Parameters in Performance of AODV, DSR, DSDV AND OLSR Routing Protocols In MANET

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***Abstract*— Many routing protocol methods have been proposed in Mobile Ad-Hoc Network but still the challenges are to improve the routing performance. In small or medium ad hoc networks flat protocols can be used but in case of large networks more complicated routing protocols are needed to be used in order to be suitable with them. Since the Ad-hoc networks have many constrains in bandwidth and battery life so the routing protocol which is used must be done its work correctly without using much resources of network by its overhead traffic. This paper, focus on investigation the performance analysis of four important routing protocols in mobile Ad hoc networks such as AODV (Ad- Hoc On-Demand Distance Vector), DSR (Dynamic Source Routing Protocol), DSDV (Destination Sequenced Distance-Vector), and OLSR (Optimized Link State Routing Protocol). The analysis of performance is made on QoS parameters such as the basis packet delivery ratio, throughput, and end-to-end delay, the simulator used is NS-2.**

Keywords—Mobile Ad-hoc Network, Routing Protocols Metrics Analysis, AODV, DSDV, DSR, OLSR Simulation.

I. *Introduction*

With the great development of cellular Phones and its Bluetooth application which is considered one type of Ad hoc application the importance of mobile Ad-hoc network is increased which is known as a network that doesn't need for any fixed infrastructure,

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In Ad Hoc network no central control is needed, any node can enter and leave the network at any time, so if a node fall down it never effect on the network work. So that this flexibility lead to use Ad-hoc network in many communication systems, military, emergency, conventions and meetings fields etc. [1,2,3,4].

Ad-hoc network have many features like fast utilization, flexible structure, high mobility, the limitation of battery power and limited capacity of its devices [5]. Routing has been one of the main challenges in Mobile Ad-hoc Networks and these challenges become more difficult when the network size has increased [6]. Many multi path routing protocols have been proposed for Ad Hoc Networks [7].

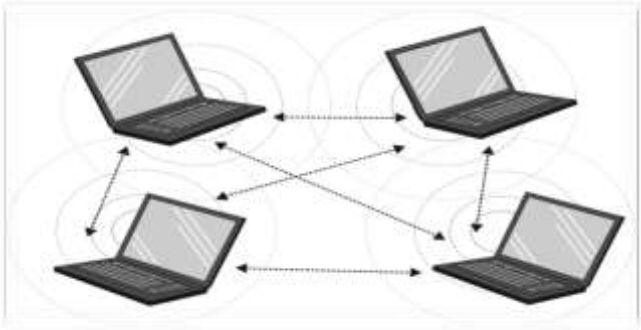

Figure 1.Adhoc networking

In the 1990s, Ad-hoc networks are also wireless by nature as there is communication among the nodes through the multi-hop links[8]. There is an absence of static infrastructure or base station to meet communication purposes. The individual node works as a router; it forwards and receives packets to, or from, other nodes. Ad-hoc network routing has been a complex task to undertake ever since the birth of these wireless networks, mainly caused by the constant change persistent in the inter-network topology owing to the high mobility of the node. To respond to this, several protocols have been constructed for this task to be done successfully, and these include the Destination-Sequenced Distance-Vector (DSDV), AODV and DSR routing protocols [9].The basic idea of this work is to measure the performance of these four protocols when the complexity of the network increased this means when the number of mobile nodes increased so different scenarios has implemented to calculate the QoS

performance different parameters, these parameters are: Packet delivery, average throughput, End-to-End delay and number of dropped packets.

II. THEORETICAL BACKGROUND

A. Routing protocol

Routing is the act of carrying a piece of information from a source to a destination in an inter-network. There is an encounter of a minimum of one intermediate node inside the Internet works in this process. Since routing was already employed in the networks in the 70s, this concept is no longer a novelty in the field of computer science. However, this concept has slowly been gaining popularity from the middle of the 1980s as the earlier networks, despite being less complicated and functioning in homogeneous environments; high-end and large-scale internetworking strives in the most updated development [10]. Fundamentally, the routing concept deals with two activities: firstly, making sure that the routing paths are optimal and secondly, moving the information groups or more specifically termed as packets along and across an internetwork. The latter concept is termed as packet switching which is very easy to understand, and the path determination can possibly become rather complicated. Routing protocols adopt several metrics for calculating the best path before the packets are sent to their intended destination. This metrics is a standard measurement using a number of hops, normally used by the routing algorithm to decide on the optimal path that should be used by the packet towards its destination. The path determination process suggests that the routing algorithms kick-start and retain the routing tables, which have the entire route information for the packet that varies across the routing algorithms. Routing tables contain a wide range of information generated by the routing algorithms[11]. Most common entries emerging in the routing table appears in a form of IP address prefix and the next hop. Routing tables destination or next hop associations suggests to the router that a destination can be reached in an optimal manner by having the packet sent to a router, at the same time representing the "next hop" on its way to the final destination, and the IP address prefix searches for a set of destinations for which the routing entry is valid. Switching is relatively simpler than the path determination, where a host is determined to send some packets to another server. The host is needed by the router address, and it will send the packet addressed specifically to the writers of the MAC address, with the protocol address from the host to the destination given.
The protocol address is then analyzed by the router and verified in terms of whether it knows how the data reach the destination. If the answer is positive, then the packet is forwarded to its destination, and if it is negative, the packet would be dropped. Routing is sub-categorized into static routing and dynamic routing. The former indicates the routing strategy being stated through a static, manual manner, in the router. This kind of routing keeps intact a routing table typically written by a network administrator, and it is not relying on the network status, whether the destination is found active or otherwise. Dynamic routing or the latter is the routing strategy that is being learnt by either the interior or exterior routing protocol. It largely depends on the state of the network, meaning that the routing table is impacted by the destination in an active manner. One great flaw evident in static routing is that if a new router is brought into, or extracted from the network, then it is the administrator job to revise the changes taking place in the routing tables. However, this is not the case with the dynamic routing, as each router is confirmed to be presented through the flooding of the information packet into the network, and subsequently propelling every router within the network to learn about the 'new visitor' and its entries.

B. Ad-hoc On-demand Distance Vector Routing (AODV)

It is one type of demand routing protocol .In AODV the routes are established only when needed in order to reduce traffic overhead. AODV can efficiently repair Link failures [12].Its algorithm allows multi-hop routing between system nodes which are wanted to establish an Ad-hoc network. And it also allows mobile nodes to get routes quickly for any destination nodes which are available in active communication, In AODV each node has t its neighbor nodes the distance to every other nodes in network, so every node has maintained a routing table with all known nodes, if a node in an active communication circle is loosed its communication with the other nodes it can either locally repair the route by sending a Route Request to find a new route to the destination node or it send a route error this means that the destination node is unreachable but the main problem of AODV is count-to-Infinity [13].

C. Dynamic Source Routing (DSR)

It is an On-Demand routing protocol in this protocol the sequence of nodes which are needed by a packets to travel through are calculated and processed in packet header. When a packets are sent, the route-cache within the specific node is compared with the actual route. If the result is correct, the packets are forwarded else route discovery process will be initiated again. In another mean the source node specifies the entire route to be follow by a packet, not only the next hop. If the source node does not have a route, it send Route Request to any node which has a path to the specific destination if it can reach it reply with a Route Reply to the source node. This reply contains the full path embedded in the Route Request packet, the main advantages of DSR is there is no need to any private mechanism to reduce loops, the route caching which is used in DSR can be used to eliminate the

overhead of route discovery however DSR has many advantages it also has many disadvantages like collisions between the huge number of route requests which are made by neighbor nodes and. [14].

D. Destination Sequenced Distance Vector (DSDV)

it is a table driven routing protocol .it Adds Sequence number to distance-vector routing and it keeps all short duration changes. in this protocol each node transfers its own routing table updates and important link status changes and its sequences number to other nodes periodically. When two routes to a destination node has received from two different nodes. it will be select the one with highest destination sequence number but if the two numbers are equal, it will be selected the smaller hop count. DSDV always reduce the overhead of control by Incremental update and settling time. In DSDV the routes are maintained by periodic exchanges which have been made to routing table, always the settling time and incremental dumps is used to reduce overhead of DSDV control[15].DSDV maintains only the best path instead of maintaining multiple paths to every destination. With this, the amount of space in routing table is reduced it can used to avoid extra traffic with incremental updates instead of full dump updates. The problem of count to infinity is also reduced in DSDV [16].

E. Optimized Link State Routing (OLSR)

It is a link state routing protocol. The main attribute of OLSR is its ability to be used multipoint relays. The multipoint relays can be used to reduce the flooding of broadcast messages in the network by reducing duplicate retransmissions of the data. Each node in the network chooses a number of neighbor nodes that will retransmit its broadcast packets to them. These selected neighbor nodes is called the multipoint relays of that node. Each node chooses its multipoint relay set in a convenient way in order to cover all the nodes that are two hops away from it. The other neighbors' nodes which are not in the multipoint relay set will also receive broadcast packets, but they can't retransmit them [17] OLSR considered as a one of flat routing protocols , so it does not need central control system to manage its routing process. It's also considered as a proactive routing protocol so OLSR has all the routing information to all hosts in communication area OLSR protocol is well suited for the application which does not allow the long delays in the transmission of the data packets. The best working environment for OLSR protocol is a dense network, where the most communication is concentrated between a large number of nodes[18].

The routings in Ad-hoc are classified as flat routing, hierarchical routing and geographic position assisted routing both the table-driven and source initiated protocols are placed under the flat routing [17]. as shown in Figure 2.

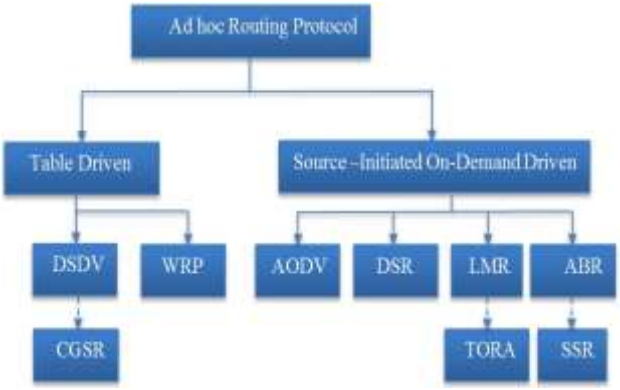

Figure 2. Classification of Ad-hoc Routing Protocols

III. Network Simulation

This study is to measure the performance of four routing protocols of wireless Ad-hoc networks which are Ad-hoc on Demand Distance vector (AODV), Dynamic Source Routing (DSR), Destination Sequenced Distance Vector (DSDV) and Optimize Link State Routing(OLSR) , and make a comparison on the basis of QoS parameters like packet delivery ratio (PDR),average throughput, End to End Delay, then providing the best routing protocol among these four protocols.

The simulations were performed using network simulator-NS2 with the CBR (continuous bit-rates) as a traffic sources. The source-destination nodes has been moved randomly over the network. The mobility model has been used square area of (800m x 800m) with10,20, 60 nodes. The simulation time is 150 seconds. The model parameters that have been utilized in this work are shown in table. I.

TABLE I. SIMULATION PARAMETERS

Simulation Parameters	Value
Routing Protocol Type	AODV, DSR,DSDV AND OLSR
Simulation Time(sec)	150
Number of Nodes	10,20,60
Simulation Area(m)	800*800
Name of Traffic	CBR
MAC Type	802.11
Simulation Model	Two Ray ground
Packet Size(bytes)	512
Simulator	NS2

IV. METRICS PARAMETERS

A. Packet delivery ratio: It is defined as the ratio between the total delivered data packet number and the sent data packet number. This ratio is used to illustrate the level of delivered data to the destination node.

∑ Total Number of packet receive / ∑ Total Number of packet send. When the packet delivery ratio is great it means that the protocol successes in delivering all packets to the destination node so it indicates that the performance of the protocol is good [19].

B. Average Throughput: It's defined as the ratio of a received data to the simulation time. It always measured in data packets/second or data packets /time slot.

C. End-to-End Delay: This is defined as the time which has been taken by the data packets to be reached to the destination nodes. It can be calculated by divided The summation of all time differences between sending and receiving of packets, low average end to end delay in network is a good indicator for performance of the routing protocol.

D. Number of Dropped Packets: in a network layer when a packet has reached, it is forwarded to the destination is known this case happened when a valid route is available, otherwise it is buffered until it reaches the destination if the buffer is full A packet will be dropped [20].

v. *Analysis and Result*

Packet Delivery Ratio: As ahown in Table.II and Fig.3,The packet delivery ratio of AODV is the best one as compared to other three protocols DSDV, DSR and OLSR. Even in case of increasing number of nodes in AODV the packet delivery ratio will be also increased so AODV performs better than other in context to packet delivery ratio .

TABLE II. PACKET DELIVERY RATIO OF AODV, DSR, DSDV and OLSR

No. of Nodes	AODV	DSR	DSDV	OLSR
10	93.52	83.98	94.20	85.64
20	95.61	85.10	94.38	86.79
60	98.07	82.30	91.50	91.32

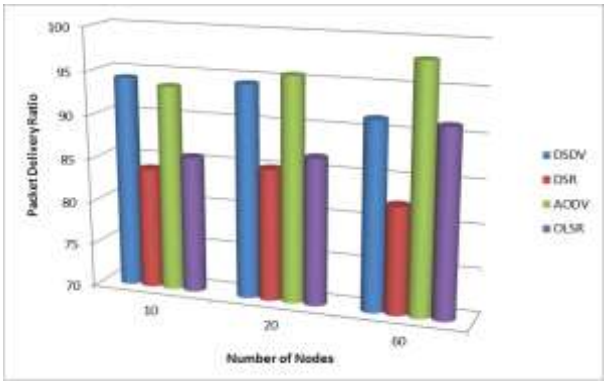

Figure3. Packet Delivery Ratio for AODV, DSR, DSDV and OLSR

Throughput: The throughput of DSDV is the highest and it increased when the number of nodes decreased then it followed by DSR and OLSR but the least one in throughput is AODV, As ahown in Table.III and Fig.4.

TABLE III. THROUGHPUT OF AODV, DSR, DSDV and OLSR

No. of Nodes	AODV	DSR	DSDV	OLSR
10	320.00	552.00	463.31	539.21
20	341.31	590.23	660.34	515.20
60	341.20	619.00	641.63	601.32

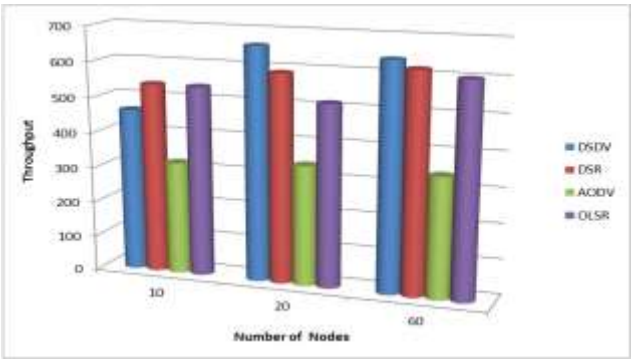

Figure4. Throughput for AODV, DSR, DSDV and OLSR

End-to-End Delay: As ahown in Table.IV and Fig.5,The least end to end delay can be obtained in OLSR, in this protocol when the number of nodes decreased the end to end will be increased and vice versa and the highest delay is calculated in AODV.

TABLE IV.END TO END DELAY OF AODV,DSR, DSDV and OLSR

No. of Nodes	AODV	DSR	DSDV	OLSR
10	376.25	205.32	216.32	172.21
20	346.14	178.32	218.60	125.65
60	246.23	145.45	115.64	113.08

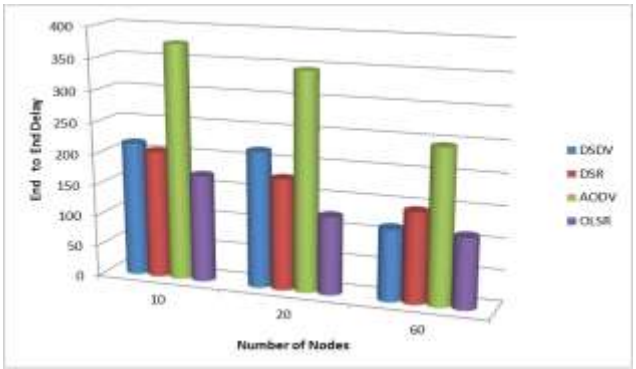

Figure5. End-to-End delay for AODV, DSR, DSDV and OLSR

Number of Dropped Packets: As ahown in Table.V and Fig.6,The least number of dropped packets can be calculated in OLSR and it has been decreased by increasing number of nodes then it followed by DSDV and DSR, but the greater number of dropped packets has obtained in AODV routing protocol and this great number always increased by increasing the number of nodes.

TABLE V.NUMBER OF DROPPED PACKETS AODV, DSR, DSDV and OLSR

No. of Nodes	AODV	DSR	DSDV	OLSR
10	17	15	11	9
20	58	32	23	7
60	77	45	35	3

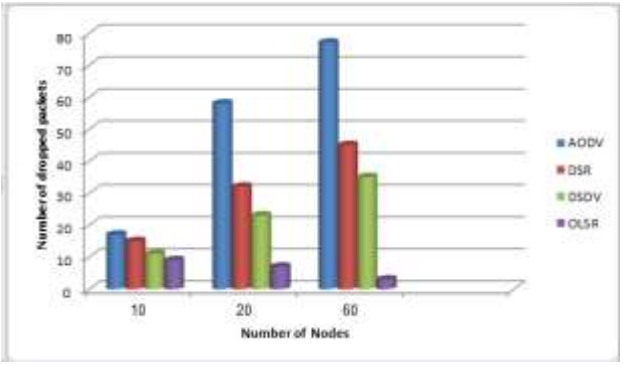

Figure6. Number of Dropped packets for AODV, DSR, DSDV and OLSR

VI. *Conclusion*

The evaluation has shown that the DSR protocol always has a less normalized routing load compared to AODV. On the other hand AODV has exceed the other protocols in case of packet delivery ratio . Because it has registered a highest packet delivery ratio DSR seems to be much better suited to smaller high load networks as it does not need to flood the network with table update requests in table driven protocols such as AODV. As the number of nodes increases, AODV can handle the increase in nodes arriving and leaving with its structured table approach as long as the overall bandwidth can cope with the other head of table sharing. DSR has to store the whole route in the header, so when a network increases in nodes, this extra overhead increase exponentially. DSDV exceed other protocols in case of throughput. The OLSR is least one in end to end delay so DSDV is the best routing protocol when taking all things into account, because DSDV give the highest throughput even when the number of nodes is became greater and its delay is always medium in all cases of different number of nodes .

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