Performance Analysis of DSR and AODV Routing Protocols with Variation in Transmission power

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Abstract -Mobile Ad hoc network is a unique paradigm, which can be deployed in the environment where traditional wired network cannot be established due to its required features and their limitation. Transmission power is one of the major concern in case of MANETs. In this paper, effect changes in transmission power of the node has been analysed and its impact on network throughput has been investigated. The results achieved by various variations have been used for proposing the possible improvement in the network performance.

Keywords: Transmission power, network range, overhead, transmission range, MANETs, Routing protocols.

I. INTRODUCTION

In the present technological developments and its applications, almost all the communication systems are going wireless. The wireless communication has various infrastructure and infrastructure less setups, which can be employed depending on its applicability and viability. The network setups with no fixed infrastructure are termed as wireless mobile ad hoc networks. MANET is a unique paradigm for a host, who are mobile in nature. A mobile ad hoc network is a self organized network, formed by group of mobile node. These nodes are directly communicate with those node that directly come in similar radio coverage range, if not they are communicate with multi hop communication. The communication establishes on the basis of connectivity between nodes on the basis of radio range and path established. (1)

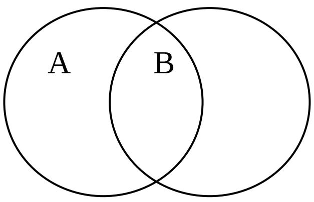

Fig.1.1 Communication between two nodes

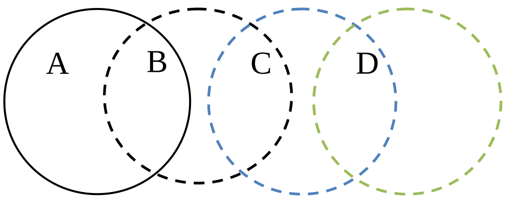

Fig.1.2 Communication between multi nodes

In Fig.1 node A & B are in direct radio range of each other, so whenever node A have to send data to node B it directly transmit to it. Fig 2 depicted the multi hop communication, node B is in direct radio range of node A but C and D is not in direct radio range of node A, and node B & C and C & D are in direct radio range of each other. Whenever node A want to transmit a packet to node C firstly this packet given to node B then node B transmit this packet to node C, similarly when node A want to send data to node D then it firstly will send data to node B and bode B will send data to node C and finally node C will send data to node D, it means this data will be transfer hop by hop to its destination node.

In mobile ad hoc network (MANET) transmission power of the node is powerful feature, if the higher transmission power use in the network, it give the less end to end delay, less overhead, better PDR and better throughput even in the present of higher congestion (2). In mobile ad hoc networks, congestion is a global issue, involving the behaviour of all the hosts, all the routers, the store and forward processing within the routers, and the media and occurs due to limited resources at any stage of path. Congestion results from applications sending more packets than the network devices can accommodate, thus causing the buffers on such devices to fill up and possibility of overflow prevails. This can result in delayed or lost packets and leads to performance degradation of the network. In order to reduce congestion, the routing protocol should reduce the number of packets in the network and use the high transmission power which provides the better performance of the network and better data communication between the nodes.

II. ROUTING PROTOCOLS

To find and maintain routes between nodes in a dynamic topology with possibly unidirectional links, using minimum resources.

A. Proactive Routing Protocol

B. Reactive Routing Protocol

C. Hybrid

2.1 Proactive or Table driven Routing Protocol

Proactive protocols, is also called table driven as the routes are predefined. Packets usually transferred to these predefined routes. As the routes are predefined the packets can be forwarded immediately. Each nodes stores the updated information whenever there is change in its network topology. For eg. Destination sequenced distance vector routing (DSDV).

2.2 Reactive or On-demand Routing Protocol

Reactive or on-Demand Routing protocols, In this routes are not predefined. In this reactive protocols, Nodes maintain there routes on the on-demand process to send its packets to the destination. Nodes sends its packets to all the neighbour or intermediate nodes and this technique is repetitive until packets are reached to its destination. For eg. Ad hoc on-Demand Routing protocol (AODV), Dynamic source Routing (DSR), TORA.

A. AODV Routing protocol description

Ad hoc On Demand Distance Vector (AODV) [14] is a reactive routing protocol which initiates a route discovery process only when it has data packets to transmit and it does not have any route path towards the destination node, that is, route discovery in AODV is called as on-demand. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to avoid the routing loops that may occur during the routing calculation process. All routing packets carry these sequence numbers.

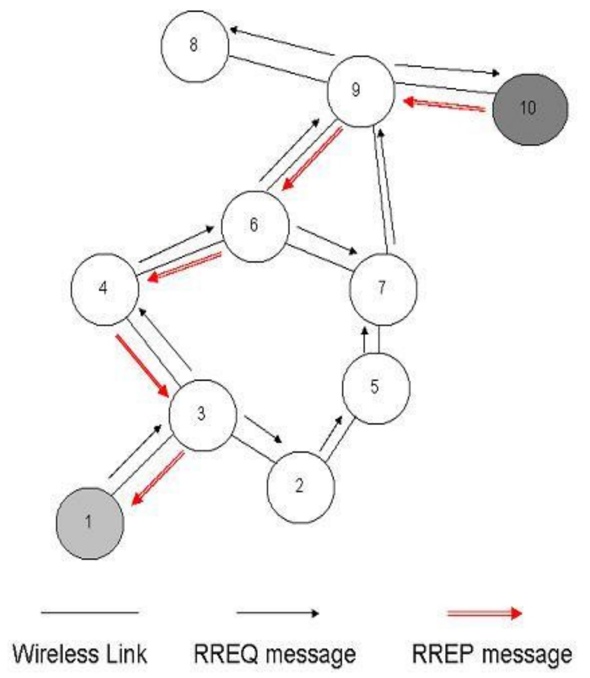

Fig 2.1 The route discovery process from source node 1 to destination node 10. (3)

Route Discovery Process

During a route discovery process, the source node broadcasts a route query packet to its neighbours. If any of the neighbours has a route to the destination, it replies to the query with a route reply packet; otherwise, the neighbours rebroadcast the route query packet. Finally, some query packets reach to the destination.

In this section author should explain in little bit dept about his research or model he/she is working on. Author can be use suitable diagrams and images with the references mentioned [1] in square brackets from particular resource image or diagram author taken.

At that time, a reply packet is produced and transmitted tracing back the route traversed by the query packet.

AODV Route Message Generation

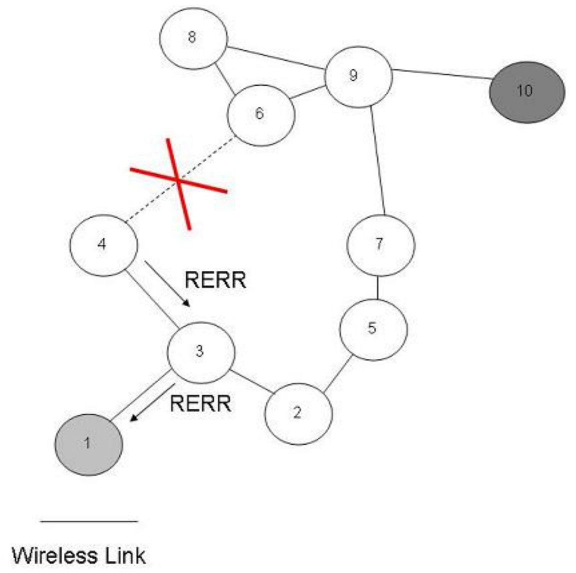

Figure 2.2 AODV Route Error message generation (3)

The route maintenance process in AODV is very simple. When the link in the communication path between node 1 and node 10 breaks the upstream node that is affected by the break, in this case node 4 generates and broadcasts a RERR message. The RERR message eventually ends up in source node 1. After receiving the RERR message, node 1 will generate a new RREQ message.

AODV Route Maintenance Process

Finally, if node 2 already has a route to node 10, it will generate a RREP message, as indicated in Figure 3. Otherwise, it will re-broadcast the RREQ from source node 1 to destination node 10 as shown in Figure.

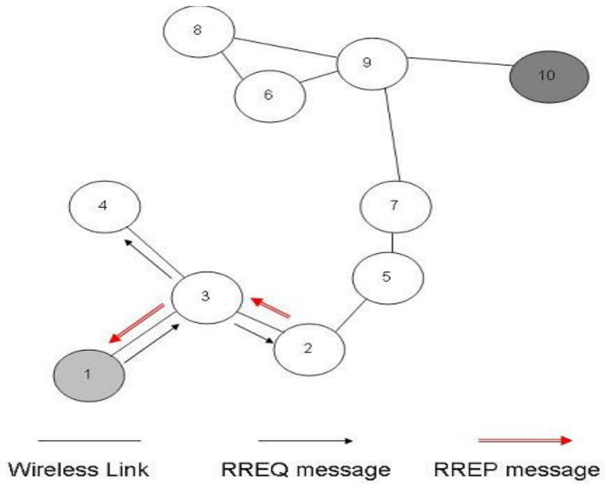

Figure 2.3 AODV Route Maintenance Process (3)

B. DSR Routing Protocol Description

The Dynamic Source Routing (DSR) protocol is a reactive routing protocol based on source routing. In the source routing, a source determines the perfect sequence of nodes with which it propagate a packet towards the destination. The list of intermediate nodes for routing is explicitly stored in the packet's header. In DSR, every mobile node needs to maintain a route cache where it caches source routes. When a source node wants to send a packet to some other intermediate node, it first checks its route cache for a source route to the destination for successful delivery of data packets. In this case if a route is found, the source node uses this route to propagate the data packet otherwise it initiates the route discovery process. Route discovery and route maintenance are the two main features of the DSR protocol.

Route Discovery

For route discovery, the source node starts by broadcasting a route request packet that can be received by all neighbour nodes within its wireless transmission range. The route request contains the address of the destination host, referred to as the target of the route discovery, the source's address, a route record field and a unique identification number. At the end, the source node should receive a route reply packet with a list of network nodes through which it should transmit the data packets that is supposed the route discovery process was successful. During the route discovery process, the route record field is used to contain the sequence of hops which already taken. At start, all senders initiate the route record as a list with a single node containing itself. The next intermediate node attaches itself to the list and so on. Each route request packet also contains a unique identification number called as request_id which is a simple counter increased whenever a new route request packet is being sent by the source node. So each route request packet can be uniquely identified through its initiator's address and request_id. When a node receives a route request packet, it is important to process the request in the following given order. This way we can make sure that no loops will occur during the broadcasting of the packets.

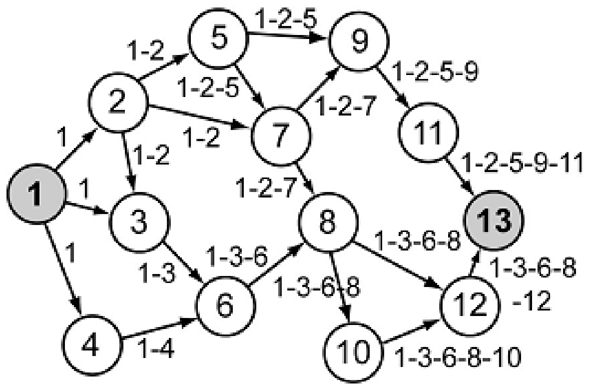

Figure 2.4 Building ofthe record during route discovery in DSR (3)

I. If the pair < source node address, request_id > is found in the list of recent route requests, the packet is discarded.

II. If the host's address is already listed in the request's route record, the packet is also discarded. This indicates removal same request that arrive by using a loop.

III. If the destination address in the route request matches the host's address, the route record field contains the route by which the request reached this host from the source node. A route reply packet is sent back to the source node with a copy of this route.

IV. Otherwise, add this node's address to the route record field and re-broadcast this packet.

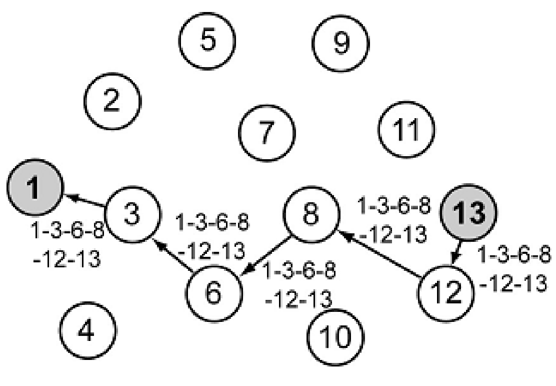

Figure 2.5 Propagation of the route reply in DSR (3)

A route reply is sent back either if the request packet reaches the destination node itself, or if the request reaches an intermediate node which has an active route4 to the destination in its route cache. The route record field in the request packet indicates the sequence of hops which was considered. If the destination node generating the route reply, it just takes the route record field of the route request and puts it into the route reply. If the responding node is an intermediate node, it attaches the cached route to the route record and then generates the route reply.

Sending back route replies can be processed with two different ways: DSR may use symmetric links. In the case of symmetric links, the node generating the route reply just uses the reverse route of the route record. When using asymmetric links, the node needs to initiate its own route discovery process and back the route reply on the new route request.

Route Maintenance

Route maintenance can be accomplished by two different processes:

a. Hop-by-hop acknowledgement at the data link layer
b. End-to-end acknowledgements

Hop-by-hop acknowledgement is the process at the data link layer which allows an early detection and re-transmission of lost packets. If the data link layer determines a fatal transmission error, a route error packet is being sent back to the sender of the packet. The route error packet contains the information about the address of the node detecting the error and the host's address which was trying to transmit the packet. Whenever a node receives a route error packet, the hop is removed from the route cache and all routes containing this hop are truncated at that point. When wireless transmission between two hosts does not process equally well in both directions, end-to-end acknowledgement may be used. As long as a route exists, the two end nodes are able to communicate and route maintenance is possible. In this case, acknowledgements or replies on the transport layer used to indicate the status of the route from one host to the another. However, with end-to-end acknowledgement it is not possible to find out the hop which has been in error.

III. PREVIOUS WORK/LITERATURE SURVEY

I. Srinivas sethi, Ashima rout An Effective and Scalable AODV for Wireless Ad hoc Sensor Networks. In this paper, to reduce time delay for delivery of the data packets, routing overhead and improve the data packet delivery ratio. For this, a third party reply model algorithm was developed and simulated by NS-2 under Linux operating system. The performance of routing protocol was evaluated under various mobility rates and found that the proposed routing protocol is better than AODV. (4)

II. Khushboo Agarwal and Vikash Sejwar Effect on Throughput Due to Changes in Transmission Power of Nodes in MANETs. In this paper effect changes in transmission power of the node has been analysed and its impact on network throughput has been investigated, this shows the various variations have been used for proposing the possible improvement in the network performance. (1)

III. Xuefei Li and Laurie Cuthbert On demand Node Disjoint Multipath Routing in Wireless Ad hoc Networks. An on demand Node Disjoint Multipath Routing protocol is proposed to overcome the draw backs of routing protocols like AODV and DSR. The protocol has novel aspects are, it reduces routing overhead and achieve lower data delay as well as higher packet delivery ratio. (5)

IV. Swarnali Hazra and Sanjit Setua Optimization on Control Overhead in MANET. The transmission overhead is reduced by stopping the unnecessary broadcasting of Route Request packets and unnecessary traversing of Route Reply packets. And proposed the optimized DSR and optimized AODV routing protocols by specific algorithm. (6)

V. Zayed- Us- Salehin and Sumon Kumar Debnath Analysis the Impacts of Transmission Range of AODV & DSDV Ad-Hoc Network Protocols Performance over Mobile WiMAX Networks. This paper investigates the effects of transmission range of BSs for two prominent routing protocols Destination Sequenced Distance Vector (DSDV) and Ad hoc On demand Distance Vector (AODV) respectively over WiMAX networks. (7)

VI. Xian Ming Zhang, En Bo Wang, Jing Jing Xia, and Dan Keun Sung An Estimated Distance-Based Routing Protocol for Mobile Ad hoc Networks. In this paper, an estimated distance (EstD) based routing protocol (EDRP) proposed to steer a route discovery in the general direction of a destination, which can restrict the propagation range of route request (RREQ) and reduce the routing overhead and improve the routing performance in dense or high mobility networks. (8)

VII. Li Xia, Zhaohui Liu, Yue Chang, Peng Sun An Improved AODV Routing Protocol Based on the Congestion Control and Routing Repair Mechanism. Proposed an improved AODV protocol called AODV-I. By adding the congestion processing and the routing repair mechanism to the RREQ message, the new protocol reduces the packet loss rate, end-to-end latency and enhances the utilization rate of the network resources. (9)

VIII. Ambarish R. Bhuyar and V. T. Gaikwad Reducing Routing Overhead in Mobile Ad Hoc Network using Probabilistic Rebroadcast Mechanism. Probabilistic rebroadcast mechanism is used to reduce overhead, In which rebroadcast delay is introduced to determine the neighbor coverage knowledge which will help in finding accurate additional coverage ratio and rebroadcast order. (10)

IX. V. Lalitha and R.S. Rajesh The Impact of Transmission Power on the Performance of MANET Routing Protocols. The multi hop routing protocols deliver acceptably good performance only at a particular levels of transmission powers, and the use of high transmission power will reduce lot of overheads and gives better performance. (11)

X. Nilesh P. Bobade, Nitiket N. Mhala Performance evaluation of AODV and DSR on demand routing protocols with varying MANET size. In this paper an attempt has been made to compare the performance of on demand reactive routing protocols i.e. Ad hoc On Demand Distance Vector (AODV) and Dynamic Source Routing (DSR). As per our findings the differences in the protocol mechanics lead to significant performance differentials for both of these protocols. (3)

IV. PROPOSED METHODOLOGY

In this paper, the overall performance of the DSR and AODV routing protocol (with HELLO message & without HELLO message) has been done with varying Transmission power on the constant node speed i.e.10 m/s.

In MANET transmission range of the network increases with transmission power, when the topology changes in multi hop network, in that condition if transmission power increases, it will able to transmit the message in wide range and it will certainly avoid the link failure, in this condition overhead of the network will reduce and the overall performance of the network improve.

The free space model (12)assumes the ideal propagation condition of clear line of sight path between the transmitter and receiver. The equation for this calculation by Friis (13) is given by –

$$\frac{Pr}{Pt} = GtGr\left(\frac{\lambda}{4\pi r}\right)^2$$

Here,

Pr= received power

Pt= transmitted power

λ = wave length

g= gain

r= transmission range

Here, the transmission power of the network increased for the same node speed and number of nodes, and overhead, throughput, average end to end delay, packet delivery ratio, first packet receive, last packet receive and the total packet receive have been calculated, and find out the best transmission power in which less DSR and AODV routing protocols performs more efficiently.

PDR

The ratio of the number of delivered data packets to the destination. This illustrates the level of delivered data to the destination.

Σ number of packet receive / Σ number of packet send

End-to-end delay

The average time taken by a data packet to arrive in the destination. It also include the delay caused by route discovery process and the queue in data packet transmission. Only the data packets the successfully delivered to destinations that counted.

Σ (arrive time – send time) / Σ number of connections

Throughput

The total number of packets delivered over the total simulation time.

Here, these conditions are observed and a calculation have been done to performance enhancement of DSR and AODV routing protocols.

When the data are send from the source to the destination, a transmission power is needed which transmits the data, which are calculated at different points Under these conditions, AODV was also calculated with HELLO message and without HELLO message.

V. SIMULATION/EXPERIMENTAL RESULTS

In constant node speed, the transmission power are varied for DSR and AODV (with HELLO message and without HELLO message) at physical layer in Qualnet simulator to find out the best transmission power which reduces the overhead. The simulation has been done on the transmission power 12,13,15,16 and 18mbps, for the constant node speed i.e. 10m/s.

Table 1: Simulation Parameters

Simulation parameters	Value
Simulator	Qualnet 5.2
Topology size	1500*1500
Number of nodes	75
Transmission power	12,13,15,16,18mbps

Traffic type	CBR
No. of CBR connection	25
Packet size	512 byte
Pause time	30sec
Node speed	10 mps
Total packet send	1000
Packet size	512byte
Simulation time	900 sec.

RESULT

Here, the calculations have been done over different transmission power for DSR and AODV for taking out the specify range of transmission power, where these protocols works efficiently, result shows very specific and good results for these calculations. When the high transmission power apply to the network, it works more efficiently and works with less End to end delay, good Throughput, less overhead and PDR is also improved of DSR and AODV (with HELLO message & without HELLO message). routing protocol which are listed as number of route request packet initiated, number of route repeat packet initiated, number of route repeat packet initiated as intermediate nodes, number of route repeat initiated as destination. The final calculation is done by adding values of above stated factors for the different routing protocols.

In figure 5.1, throughput of the network shown under the different transmission power for DSR, AODV (With HELLO message) and AODV (without HELLO message) and it shows that the throughput of the network improves with the high transmission power.

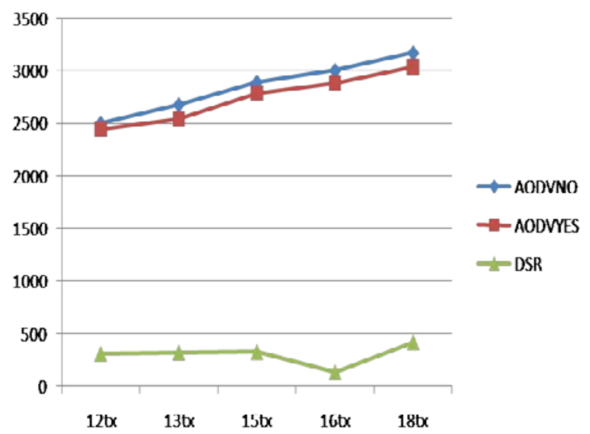

Figure 5.1 throughput of the network

The following figure 5.2 shows the average End to end delay for the specific routing protocols

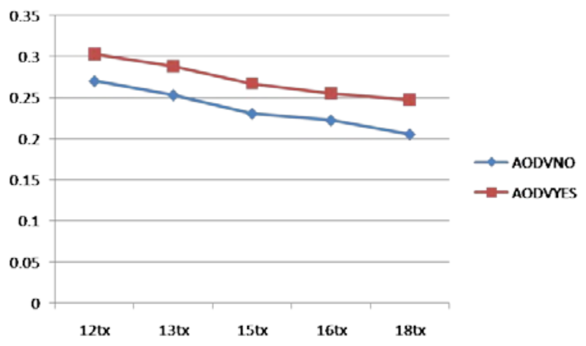

Figure 5.2 (a) average End to end delay for AODV (with HELLO message & without HELLO message)

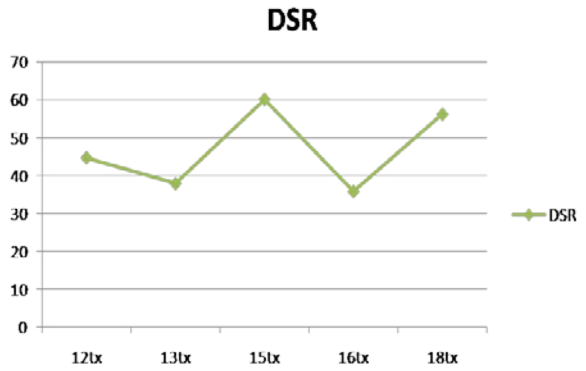

Figure 5.2 (b) average End to end delay for DSR

Figure 5.2 (a) show that, when higher transmission power apply on the network the average end to end delay decreases and AODV without HELLO message gives less end to end delay over AODV with HELLO message, in fig 5.2 (b) shows that the delay of the network in DSR routing protocol varies with the transmission power and it gives the less delay on 16 dBm transmission value.

Following figure 5.3 shows the PDR (packet delivery ratio) in network

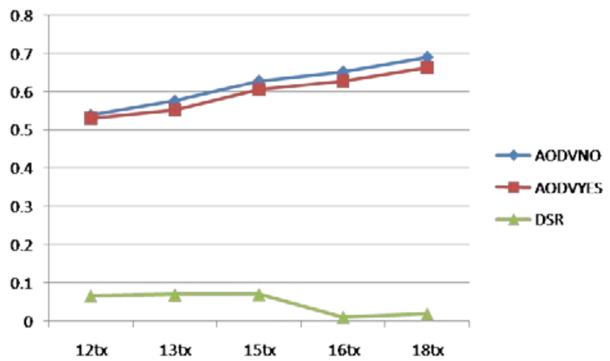

Figure 5.3 PDR (packet delivery ratio)

Figure 5.3 shows that, the PDR increases with the transmission power in AODV routing protocol, but AODV without HELLO message gives the best PDR over the AODV without HELLO message and DSR routing protocols.

In the following figure 5.4, shows the overhead in the network on different transmission powers.

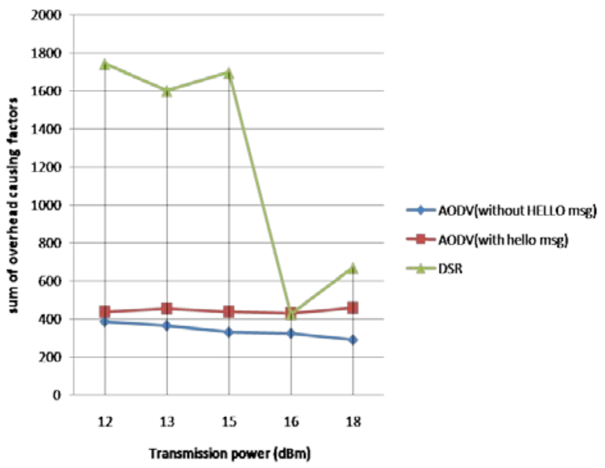

Figure 5.4 overhead in the network

Figure 5.4 shows that the overhead of the network reduces with higher transmission power and at the value of 16 dBm the DSR and AODV with HELLO message works with less overhead.

Following figures shows the packet receive in the network under these simulation conditions, graphs shows the first packet receive, last packet receive and total packet receive in the network.

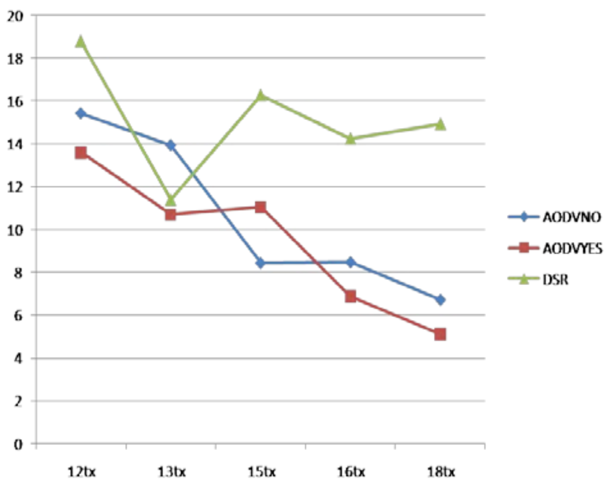

Figure 5.5 first packet receive

Figure 5.5 shows that, at the high transmission power the first packet received by the destination early in AODV routing protocol, and in DSR network receives the first packet in 13 dBm transmission power, but according to the graph on the 16 dBm transmission power DSR and AODV commonly performs well and first packet receive earlier.

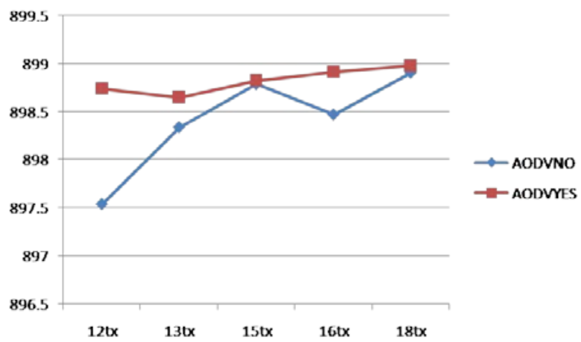

Figure 5.6 (a) last packet receive for AODV (with HELLO message & without HELLO message)

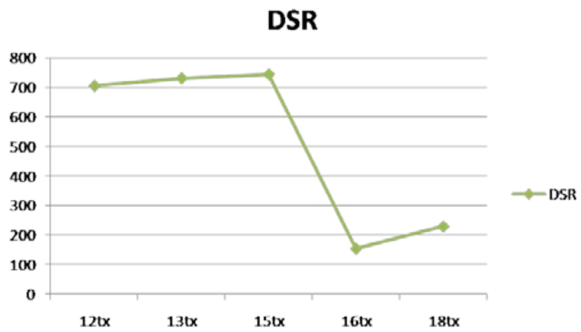

Figure 5.6 (b) last packet receive for DSR

Figure 5.6 (a) and figure 5.6 (b) shows that the last data packet receive by the destination earlier on the 16 dBm transmission power.

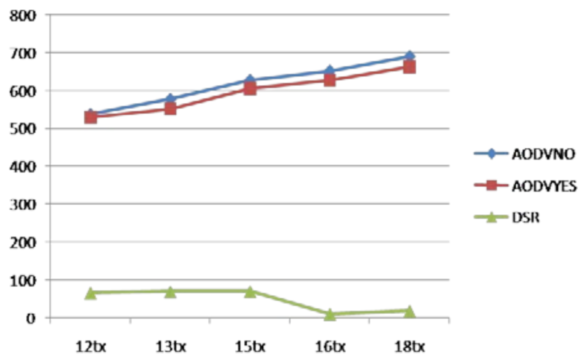

Figure 5.7 Total packet receive

Figure 5.7 shows that, in AODV without HELLO message, it receives more total packets as compare to AODV without HELLO message and DSR.

Based on the above analysis, the simulation results show that performance of the DSR and AODV routing protocols improves with the transmission power, at the high transmission range these routing protocols works efficiently.

VI. CONCLUSION

Here, successfully evaluated the performance of routing protocols i.e. DSR, AODV (with HELLO message) and AODV (without HELLO message) under different levels of transmission power of the nodes. Obviously the change in transmission power has a significant impact on the performance of the routing protocols. The multi hop routing protocols deliver acceptably good performance only at a particular levels of transmission powers. Even though the use of “high” transmission power will reduce lot of overheads, gives better throughput, less end to end delay, better values of packet delivery ratio, first packet and last packet receives earlier and give excellent performance.

If we use the minimum transmission power in the network, it will increase the hops and the message will not be able to transmit in the wide range and convey properly to the destination node and so considerably the network will give the poor performance and message will contain more overhead and other network performance degrading factors cause the improper communication between the source node and destination node.

These results shows that, DSR and AODV (with hello message) protocols works efficiently on or before the specific transmission range which is 16 dBm, so we can consider it the best transmission power for these routing protocols. In a general sense, that “minimum” transmission power has a very lower transmission range, but in that situation if we convey the message in wide area then it will cause more overhead and poor performance of the network. So here, the high transmission power used for the better performance of the network.

VII. FUTURE SCOPES

Here in this paper work, the transmission power of the Nodes were increased in value, because of which the value of the Routing Overhead will tend to be low, the chances of the Route Failure will be less, the time for End to End delay will be less, Throughput and PDR values will also be improved.

In Future, this above stated method can be employed to develop a reliable Multi-hop Ad hoc Network. So, future researches can be carried on this method, to come up with a Multi-hop Ad hoc Network, which will have powerful specifications and effective Network Operations.

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