INTERNATIONAL JOURNAL OF SCIENTIFIC PROGRESS AND RESEARCH (IJSPR) ISSN: 2349-4689
Volume-28, Number - 02, 2016

Impact of Active Route Timeout and Deletion Constant on Scalability in MANET

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Abstract *- Ad-hoc networks routing protocols play an essential role in the performance of wireless network. Route state hold time parameters in routing protocols have a straight effect on the packet delivery ratio. Station . Aim of this research is to identify the effect of the route maintenance matrices Active route timeout (ART) and Delete period constant (DPC) on scalability. By choosing an optimal value of ART we need to keep balance between choosing a short ART which initiate a new route discovery even if a valid route is still there and long value of ART causes a risk to send packets on an invalid route*

Keywords: *MANETs, AODV, DSR, Routing Protocols, ART, DPC.*

I. INTRODUCTION

Wireless network has become most popular during the past decades. There are two kinds of wireless networks- infrastructure and infrastructure less networks. Infrastructure network made up of a network having fixed and wired gateways. A mobile node interacts with a bridge in the network (called base station) within its communication area. The mobile unit can move geographically while it is communicating. When it goes out of the range of one base station, it connects with new one. Infrastructure less, where there is no base station and the nodes can move freely and organise themselves arbitrarily. An example of a non-infrastructure network is a Mobile Ad Hoc Network (MANETs), which has many applications.

A Mobile Ad hoc Networks is an autonomous system of wireless mobile nodes that can self-starting freely and dynamically into arbitrary and temporary network topologies. It allow people and devices to communicate without any pre-existing communication architecture. Each node in the network acts as a router, in which nodes collaborate by forwarding data packets for the other nodes. There is a challenge in the design of adhoc networks , are the development of dynamic routing protocols that can efficiently find routes between two communicating nodes.

Because of the wireless nature of Mobile Ad hoc network, the routing protocol is a very important issue to make it more efficient and reliable. Mobile adhoc networks having various routing protocols like DSDV,AODV,OLSR,DSR etc .Broad classification of MANET protocols are shown in fig1 , which can be divided into Table-Driven and On-Demand Routing protocol where Table Driven protocols are proactive and maintain a routing table and On-Demand are active and do not maintain a routing table.

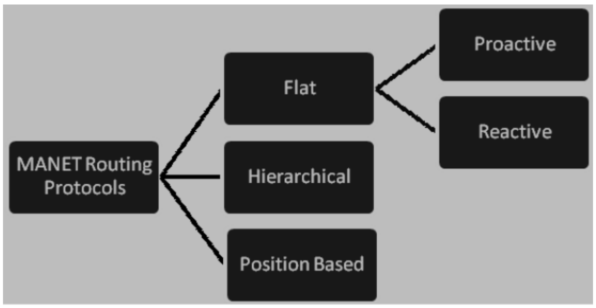


Fig 1.Classification of MANET Protocols

AODV is an on-demand routing protocol which takes important parts of DSDV and DSR. Route is calculated on demand, similar to that in DSR via route discovery process. However, AODV maintains a routing table where it maintains one entry per destination unlike the DSR that maintains multiple route cache entries for each destination. AODV provides loop free routes while repairing link breakages but unlike DSDV, it doesn't require global periodic routing advertisements Routing Protocols are evaluated for performance under quality of service (QoS) metrics, like delay, throughput, packet delivery ratio etc. and route maintenance parameters, such as ART, delete period constant, etc in constant scenario (network load, network size, mobility).

II. BRIEF SUMMARY OF ADHOC ON-DEMAND DISTANCE VECTOR ROUTING

In AODV, the data packets contain the destination address and sequence number and source address. When a source node wants a route to the destination to send a data packets, a route request (RREQ) message is flooded in the network. Usually hello messages are uses by all nodes to notify its presence so next hop in an active route can be monitored. An intermediate node receives a RREQ packet, to examines its local route cache to check for a fresh route is available or not to destination. RREQ packet contains the broadcast ID, source node IP address, the sequence number of the destination and its own current sequence number. Each node should update information about RREQ for the source node and establish backwards pointers to the source node in the route table, a fresh route exists, and then the node send back a route reply (RREP) message immediately to the source. As an optimization, AODV uses an "expanding ring" flooding technique, in which a RREQ is issued by a limited TTL only. If RREP message is not received within a certain time by the source node, then another RREQ is issued with a larger TTL value.TTL value is increased until a certain maximum value is reached. During the process of route discovery, all IP-Packets generated by the application for destination are buffered in the source node itself. When a route is established, then the packets are transmitted. A neighbour that has transferred at least one packet during the past active timeout is considered active for this destination. An active entry in the routing table is an entry that uses an active neighbour. An active path is a path established with active routing table entries. A routing table entry expires if it has not been used recently. AODV uses the distance vector algorithm. It requests a path when necessary and does not require nodes which are not actively used in communication to maintain routes to the destination. AODV protocol consists of main three different message types: Route Request (RREQ) which is broadcast throughout the ad hoc network when route in the routing table after sending last data packet. It is deleted from the routing table when this route entry is not used upto the certain time period. The default value of parameter is 3 sec in AODV. If route breaks, due to link layer failure or mobility before the ART expires. AODV invalidate the route. A route error process initiates, to notify the source with invalid route. Selecting an optimal value of ART we need to keep balance between choosing a short ART that start a new route discovery even if a valid route is still available, and a long ART value causes a risk to send packets on an invalid route. In the first case, the cost is the initiation of a new route discovery that could be avoided, and in the second case it is the loss of one or more packets and the initiation of a RERR process instead of a new route discovery without losing any packet. Delete period constant (DPC) is the time period after which an expired route is deleted. That expired route is deleted after delete period multiplied by the greater of Active Route Timeout (ART) or hello interval.

Delete period = Delete period constant (n) × max (active route timeout or hello interval), where delete period constant default value is n = 5 s. The AODV timer checks whether the lifetime have reached the threshold value. If this is the case, it notifies the protocol about a broken link. After updating the routing table, appropriate REER messages. As number of user continuously increases day by day so it is required that routing protocols characteristics should incorporate the scalability to large network. Scalability in adhoc mobile network is the capability of the network to handle a growing amount of nodes. Network performance is affected by ART and DC value.

III. PROPOSED WORK

AODV routing protocol uses two methods to build and maintains route state. First one is route discovery and other one is route maintenance method. In route discovery establishment of route by the source node is allowed, by flooding the Route Request (RREQ) over a entire network and destination unicasting a Route Reply (RREP) to source, so that all intermediate nodes can store a route state. Life time of the route entry become upgrade. Each node keep this state for a certain time period given by the parameter ART (ACTIVE ROUTE TIMEOUT). Timer goes reset back to ART after using the route. ART which is a static parameter describe how much a route is maintained

This value should be optimized. The ART and DC can also play important role on scalability. If the network is scalable it is required to calculate value of ART and DC. Therefore different scenerios are simulated as discussed. The ART and DC value is optimized by investigating the Application layer parameters like Throughput, PDR, delay and jitter

IV. PERFORMANCE

4.1 PERFORMANCE MATRICES:

Throughput: It is the number of packets passing through the network in a particular unit of time. It is the ratio between the number of data packets sends and the number of data packets received. It is measured in bits per second

Packet Delivery Ratio(PDR): It is the ratio between total packets received at the destination end to the total packet send by the source. Better the packet delivery ratio means good performance of routing protocol.

Average Jitter: It is a measurement of variation over time of the latency of packet across a network. It is deviation of some aspects of the clock pulses from source to reach the destination with different delays.

Average End to End delay: It is a average time period from starting the delivery of packet from source node until it deliver to the destination. It includes all delay resulting from buffering of data packets during route discovery, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times.

4.2 SIMULATION RESULT: Simulations are done using Qualnet 5.2 simulator which is a standard simulator tool for wierd ,wireless Table1. To investigate the performance of AODV on scalable network we have taken 4 different scenarios as mentioned in Table 2

Table1: Simulation Parameter

Simulation Parameter	Value
Simulator	Qualnet 5.2
Mobility model	Random way point
Routing Protocols	AODV
Traffic type	CBR
Packet send rate	4000 packets/s
Data payload	512 bytes/packet
Node speed (min)	1.0 m/s
Node speed (max)	10 m/s
Transmission power	10dbm
Pause time	1 sec
Packet interval	4 sec
Simulation time	900 sec

In scenario1 50 nodes are considered with terrain area 1000*1000, similarly in scenerio2 and scenario3 number of nodes 75 with terrain area1225*1225 and 100 with terrain area 1500*1500 respectively. Based on the simulation results are shown in next section.

V. RESULT ANALYSIS

The performance of AODV has been analyzed by varing the performance metrices ART(.5,1,1.5,,2.5,3,4,6,7,8) and DC(5,7) in the above given scenerios.we measured packet delivery ratio,throughput,average end to end delay and jitter.

Table3: Scenerio 1 at DC=5

	Throughput	PDR	End To End Delay	Average Jitter
0.5	1532.6	0.746	0.165	0.179
1	1533.6	0.747	0.151	0.171
1.5	1518.4	0.74	0.158	0.178
2.5	1533.6	0.747	0.151	0.171
3	**1587.4**	**0.77**	**0.098**	**0.101**
4	1550.1	0.75	0.113	0.122
6	1550.2	0.75	0.116	0.125
8	1561	0.76	0.135	0.138

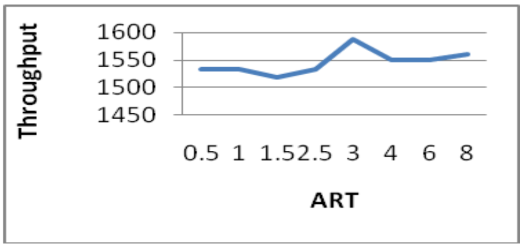
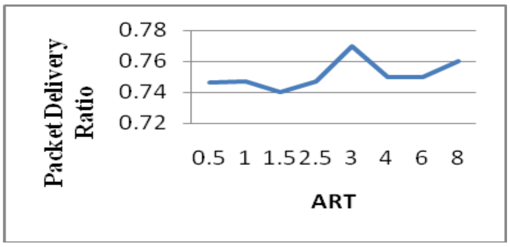
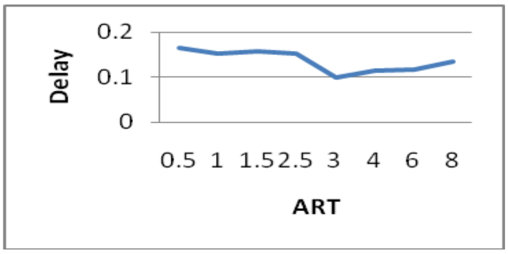


Table2: Scenerio Table

	Area size	Nodes	Links
Scenerio1	1000*1000	50	10
Scenerio2	1225*1225	75	15
Scenerio3	1500*1500	100	20
Scenerio4	1750*1750	125	25





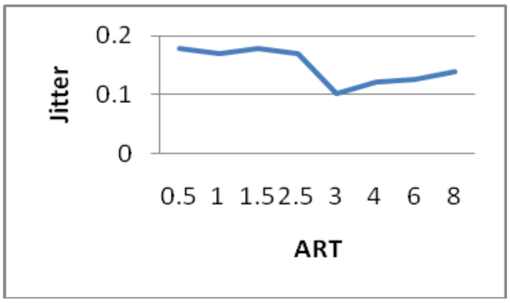
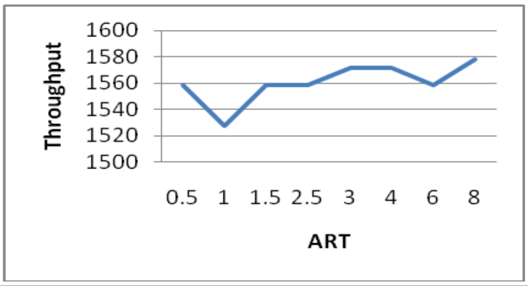
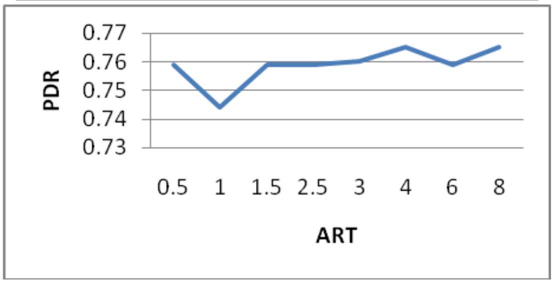
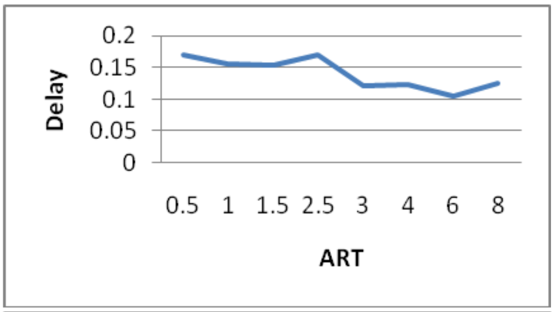


Table 4: Scenerio1 Results at DC=7

	Throughput	PDR	End To End Delay	Average Jitter
0.5	1558.5	0.759	0.169	0.174
1	1527.1	0.744	0.155	0.177
1.5	1558.4	0.759	0.153	0.163
2.5	1558.5	0.759	0.169	0.174
3	**1571.4**	**0.76**	**0.122**	**0.134**
4	**1571.4**	**0.765**	**0.124**	**0.131**
6	1558.4	0.759	0.106	0.12
8	1578.4	0.765	0.125	0.139







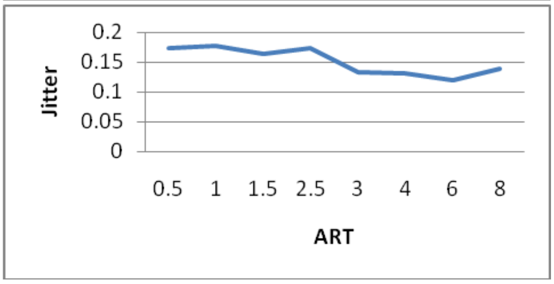
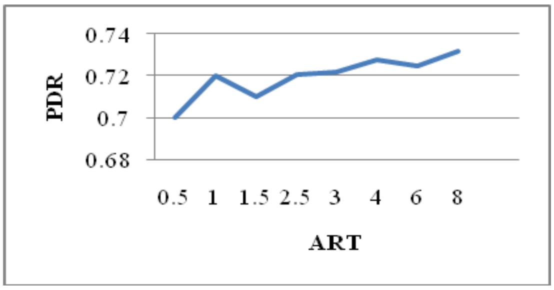
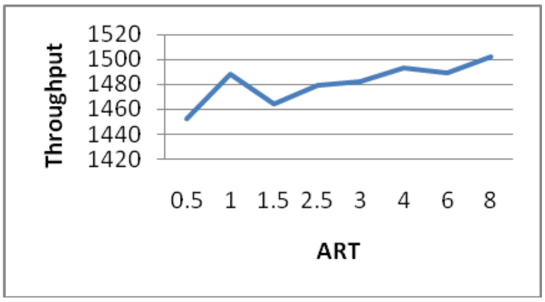
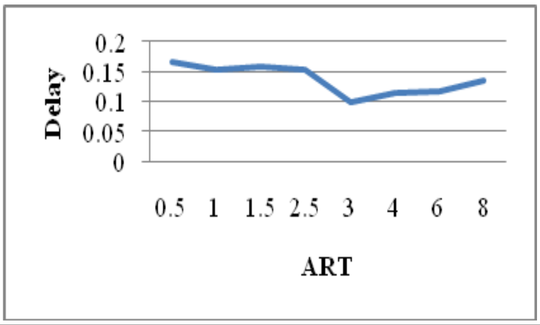


Table 5: Scenario2 Results at DC=5

	Throughput	**PDR**	**End To End Delay**	**Average Jitter**
0.5	1452.1	0.7	0.272	0.261
1	1488.8	0.72	0.25	0.248
1.5	1464.1	0.71	0.23	0.237
2.5	1479.8	0.721	0.172	0.183
3	**1482.7**	**0.722**	**0.196**	**0.196**
4	1493.8	0.728	0.182	0.183
6	1489.7	0.725	0.194	0.208
8	1502.6	0.732	0.154	0.157







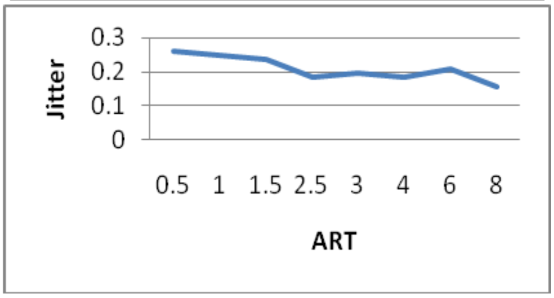
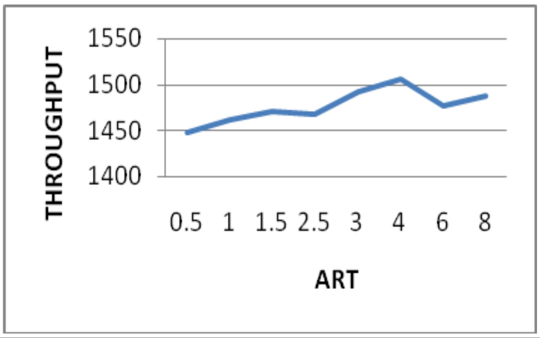
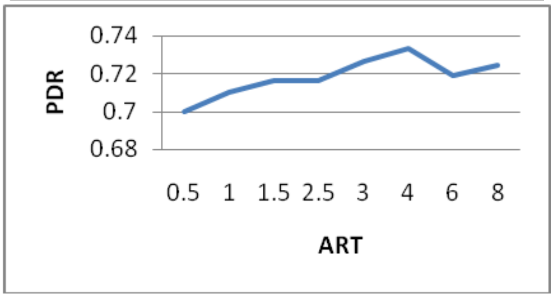
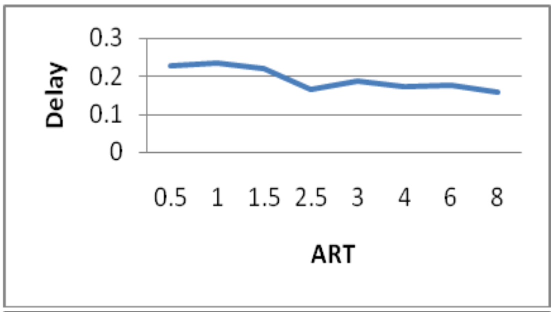


Table 6: Scenario2 Results at DC=7

	Throughput	PDR	End To End Delay	Average Jitter
0.5	1447.2	0.7	0.228	0.218
1	1460.8	0.71	0.234	0.233
1.5	1469.6	0.716	0.218	0.222
2.5	1467.8	0.715	0.166	0.162
3	**1491**	**0.726**	**0.186**	**0.194**
4	1505.4	0.733	0.174	0.183
6	1475.8	0.719	0.177	0.182
8	1486.3	0.724	0.159	0.167







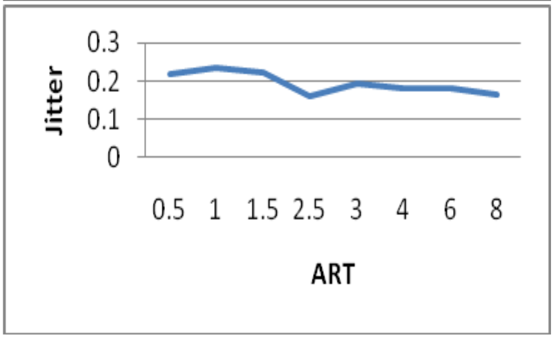
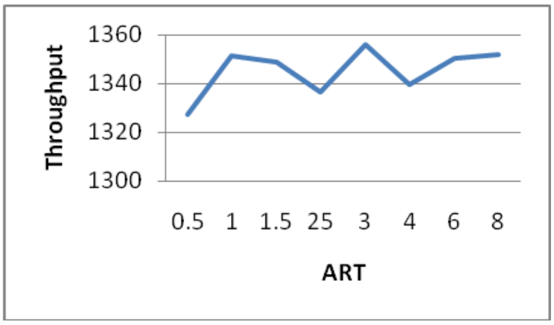
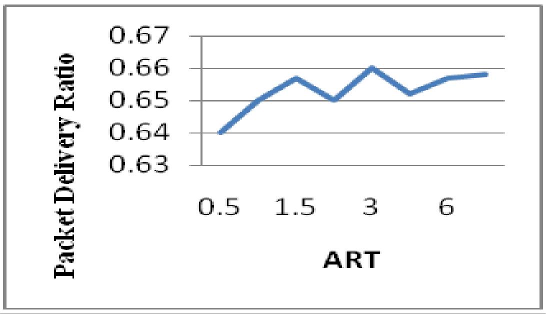
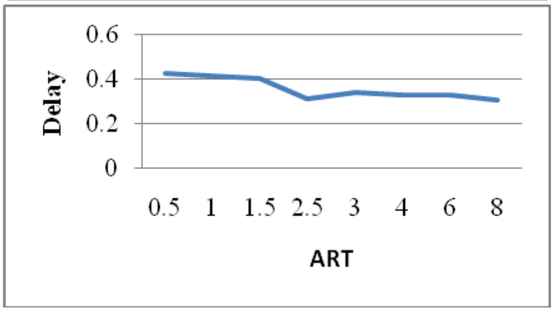


Table7: Scenerio3 Results at DC=5

	Throughput	PDR	End To End Delay	Average Jitter
0.5	1341	0.65	0.302	0.279
1	1340	0.653	0.284	0.276
1.5	1354	0.659	0.252	0.253
2.5	1356	0.66	0.198	0.204
3	**1352.2**	**0.658**	**0.212**	**0.218**
4	1337	0.651	0.208	0.218
6	1332.7	0.649	0.2	0.203
8	1366.6	0.66	0.198	0.196







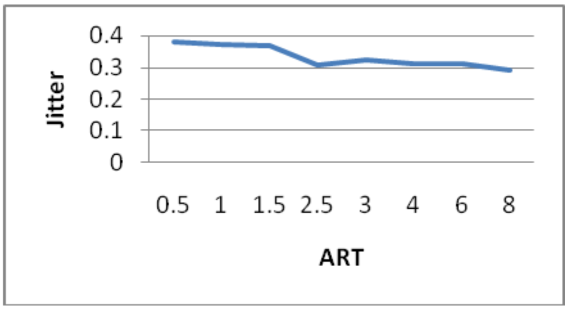
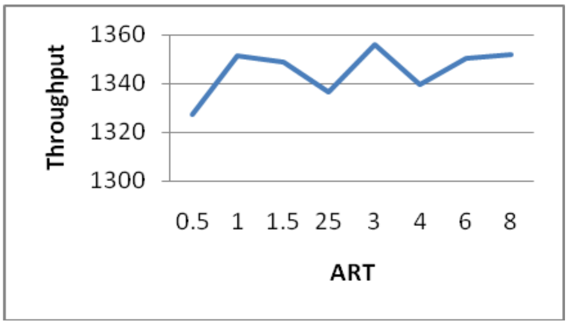
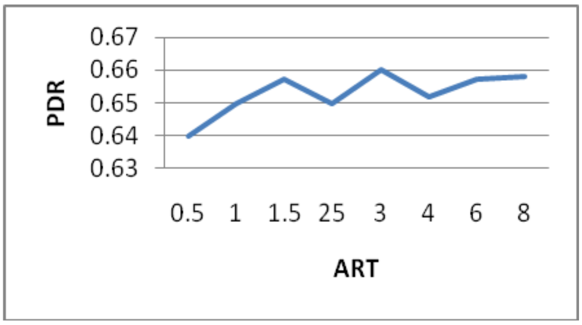
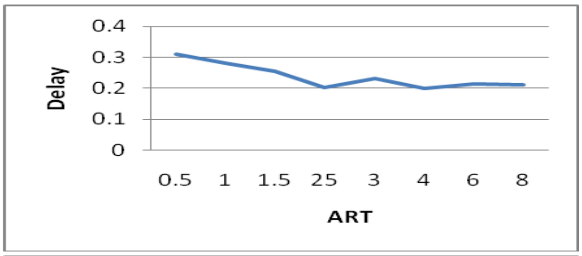


Table8: Scenerio3 Results at DC=7

	Throughput	PDR	End To End Delay	Average Jitter
0.5	1327	0.64	0.311	0.29
1	1351.1	0.65	0.282	0.28
1.5	1348.8	0.657	0.254	0.248
2.5	1336.2	0.65	0.202	0.202
3	**1355.8**	**0.66**	**0.23**	**0.235**
4	**1339.5**	**0.652**	**0.199**	**0.208**
6	1350.1	0.657	0.213	0.206
8	1351.8	0.658	0.211	0.213







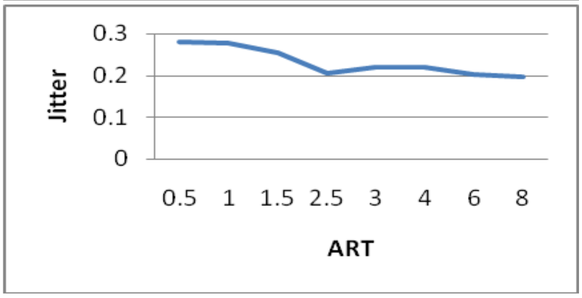
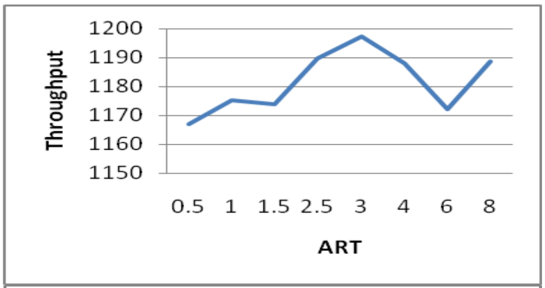
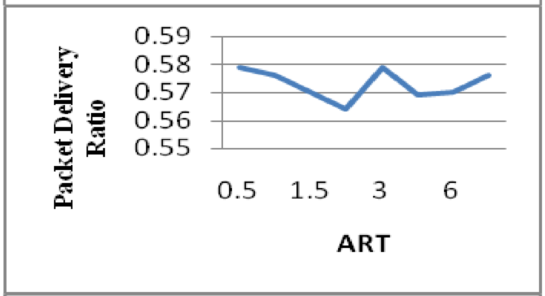
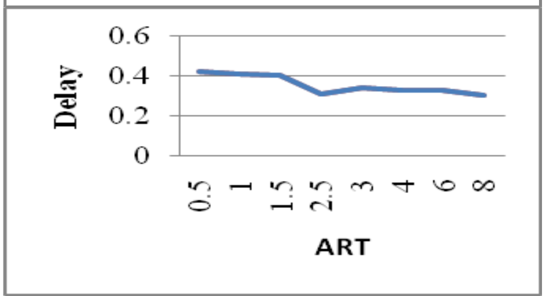


Table 9 :Scenerio4 Results at DC=5

	Throughput	PDR	End To End Delay	Average Jitter
0.5	1167.1	0.56	0.44	0.385
1	1175.4	0.576	0.38	0.345
1.5	1173.8	0.572	0.384	0.353
2.5	1189.7	0.579	0.33	0.325
3	**1197.2**	**0.583**	**0.325**	**0.316**
4	1187.8	0.564	0.318	0.306
6	1172.1	0.571	0.316	0.305
8	1188.7	0.579	0.327	0.304







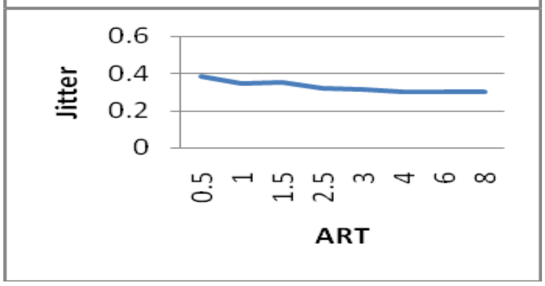
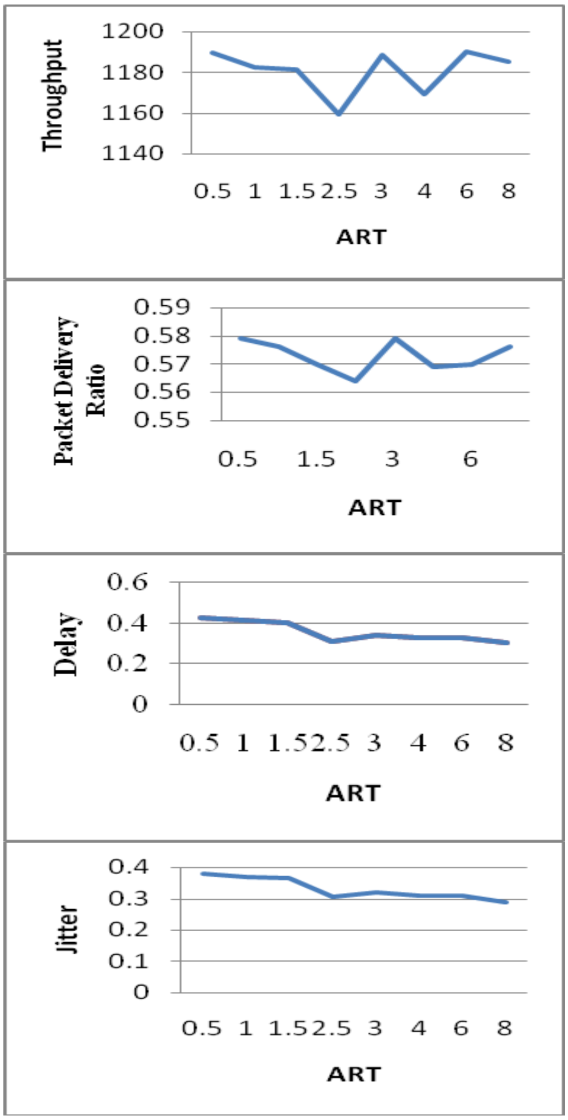


Table10: Scenerio4 Results at DC=7

	Throughput	PDR	End To End Delay	Average Jitter
0.5	1189.7	0.579	0.425	0.379
1	1182.7	0.576	0.412	0.37
1.5	1181.3	0.57	0.403	0.365
2.5	1159.2	0.564	0.311	0.305
3	**1188.6**	**0.579**	**0.342**	**0.321**
4	**1169.3**	**0.569**	**0.329**	**0.31**
6	1190.2	0.57	0.329	0.31
8	1185.4	0.576	0.305	0.289



Best values of throughput and jitter are highlighted in the table3 to table8. By observing these tables best values of throughput and jitter for different values of ART and DC are summarized in Table9 to table11.

Table9: High Throughput and Jitter
ART=3, DC=5

Nodes	Throughput	Jitter
50	1571.4	0.134
75	1491	0.194
100	1355.8	0.235
125	1188.6	0.321

Table10: High Throughput and Jitter
ART=3, DC=7

Nodes	Throughput	Jitter
50	1571.4	0.131
75	1505.4	0.183
100	1339.5	0.208
125	1169.3	0.31

Table11: High Throughput and Jitter
ART=4, DC=7

Nodes	Throughput	Jitter
50	1587.4	0.101
75	1482.7	0.195
100	1352.2	0.218
125	1197.2	0.316

We can conclude that at ART=3 and DC=5 throughput is quite maximum as compare to other values of ART and DC. The parameter average jitter is less at the ART=4,DC=7 in above mentioned scenarios. Take ART =3 and DC=5 if only throughput is desirable otherwise take ART=4,DC=7 if jitter is important parameter. Latency is important parameter with throughput .Above results show that ART and DC value impacts scalability also. If ART and DC are selected properly the results can be improved. This can improve scalability.

CONCLUSION

The analysis of AODV performance on scalable network is investigated in this paper. The ART and DC are important metrics in AODV and also play important role on scalability. By observing the different scenarios optimized value of ART and DC were investigated. The best results are obtained at ART=3 and DC= 5 for throughput and best values of ART and DC for jitter is 4 and 7 respectively.

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