AN INTENSIFY MANET BASED CHANNEL AND QOS CONSCIOUS ROUTING USING AOMDV

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ABSTRACT

A Mobile Ad hoc Network can be utilized for extensive range applications from the past era. In recent days, the technological advancement can be improved in the field of Mobile Ad-hoc Networks. There are plenty of challenges that can be identified and resolved using MANET supported algorithms and protocols were improve the network performance. The Mobile Ad-hoc Network comprises of gathering of mobile nodes without the need of static infrastructure. Such facilities offered by mobile nodes can move anywhere in the network. This can cause mobile node failure, network failure, and channel fading etcetera. To avoid all those drawbacks variant of (Ad-hoc on Demand Multipath Distance Vector) AODMDV protocols can be used and the performance analysis can be carried out to compare the performances of the mobile network. The routing protocol AODMDV (Ad-hoc on Demand Multipath Distance Vector) is taken into the consideration for QoS provisioning. A Channel Aware AOMDV (CA-AODMDV) is experimented with End-to-End Delay and Bandwidth parameters to provide Quality of Service to the application layer. The CA-AODMDV will examine the channel fading by Average Non Fading Duration (ANFD) and Average Fading Duration (AFD). To reduce the control overhead a QoS aware routing is introduced with bandwidth and end to end delay. Simulation parameters can be analyzed on the basis of AODMDV, MAODMDV (Modified–AODMDV constrained with end-to-end Delay and Bandwidth, no speed parameters considered) and CA-AODMDV (Channel Aware-AODMDV) is tabulated and graphical representation used in terms of PDR (Packet Delivery Ratio), Throughput and End-to-End Delay based on Mobility.

Keywords: Mobile Adhoc Networks, AODV, AOMDV, Routing, Delays, Quality of Service

1. INTRODUCTION

A Mobile Ad hoc Networks can be visualized in the form of Graph G= (N, L) Where N is a collection of nodes in the mobile network and L represents a bidirectional link. MANET’s ad hoc nature may lead to enormous applications like military applications, Medical field with secured data, virtual classrooms and video conferencing. Many mobile environment resources like bandwidth, battery and energy of each node can be used for finding and maintaining routes in MANET’s as equivalent to NP complete problems. Now a days there has been a considerable amount of QoS research on the basis of AOMDV routing protocol in MANET’s to sustain with upcoming applications. The rest of the paper is organized as follows. Section II represents a brief overview of Literature Survey of AOMDV routing protocols for MANET. Section III examines AOMDV and its strategy.
to discover the routes for MANET. Section IV proposed CA-AOMDV routing protocol design considerations. Section V represents analysis and comparison of basic AOMDV, MAOMDV (selecting path with End To End Delay and Bandwidth after routes are explored) and proposed CA-AOMDV introduced for stability of route with considering speed of intermediate nodes and adjustment factor for Bandwidth and End to End Delay (EED) metric. The comparative analysis can be carried out for the three protocols through network simulator (NS2) is presented based on PDR, Throughput and EED as QoS parameter to make AOMDV serving reliability. Section VI concludes the paper with the future scope.

II. LITERATURE SURVEY

In past decades there has been a numerous development to improve the Quality of service in through routing protocols in an efficient manner. Now a day it becomes an essential goal to provide reliable service to the end user applications. In May 2016[12] advancement came in AOMDV to overcome some limitations in AODV protocol. The analysis says that 30 nodes were experimented with basis of average end to end delay, energy, throughput, packet delivery ratio and routing overhead and the complexity remains stable by using AODV protocol. The AOMDV incurs more stability even in flooding than the AODV. Since, it is considered as a better routing protocol for forwarding data packets to destination. In April 2016 [11] advancement came that the performance comparison of AOMDV protocol and BWA-AOMDV (Bandwidth Aware – AOMDV) using NS2. This statistical analysis says that, the proposed BWA-AOMDV reduces the delay and bandwidth consumption and it also increases the packet delivery ratio and throughput in the mobile network. From this aspects AOMDV protocol it will be considered as a proposed idea for future things. In August 2016 [15] authors experimented with Stability Enhanced AOMDV routing protocol for MANETs. In this paper Received Signal Strength can be considered as a metric to find the best path for the final destination node. The result says that Stability Enhanced AOMDV has lower routing load compared to AOMDV protocol. This reduces the number of route failure and enhances packet delivery ratio. In April 2015 [9] another advancement came and authors did experiment with OFDM (Orthogonal Frequency Division Multiplexing) based channel Adaptive multipath Routing in Wireless Mobile ad hoc networks. The experimented result showed that improvement in throughput and gave a minimal delay when compared to AODV protocol. In January 2016[10] the major research work started to improve the stability and load balancing using BRSR-AOMDV (Balanced Reliable Shortest Route – AOMDV) routing protocol. The stability of mobile node is achieved by the threshold signal strength metric. In May 2014[5] the research work experimented with QoS based Bandwidth Constrained priority protocol to overcome the shortcomings of AODV protocol. Based on bandwidth availability and priority of mobile nodes the route path has been selected for forwarding data packets to the destination. This make the protocol more reliable for data and voice transmission over 802.11 and significant improvement in packet delivery ratio and packet control overhead for different kinds of mobility speeds.

Mobility and load-aware routing (Yaser K. et al., 2011) is reactive routing protocol. The main goal of MLR is to find the more stable path and balancing the load of various routes in high mobility environment. The author used speed and traffic load of the relay node to detect the best route. It increases network lifetime. Each relay node takes the decision of forwarding packet based on load and speed. These decisions are taken by using MDP tool i.e. Markovian decision process tool. MLR solves broadcast storm problem. MLR has some limitations. Link quality, density, remaining power parameters not take into consideration by MDP tool while taking routing decisions. QoS related multicast routing protocol by using reliable node selection approach (Ajaykumar Y. et al., 2016) used less mobile nodes to find multiple paths in the network. The selected path should be reliable. Only the reliable nodes are selected for routing. It is multipath routing protocol. At the time of routing, the source sends data to multiple receivers by using a multicast route to the destination. The multicast route has all reliable relay nodes. Reliable nodes are found using reliability pair factor. Reliability pair factor is calculated and compared with threshold reliability pair factor. The nodes which have less reliability is dropped from a route. Route request(RQ) and Route reply(RP) packet used to find multicast routes. While choosing multicast route higher reliability value taken into consideration. QMRPRNS maintain tables i.e. multicast route information table and neighbouring information table which consist of the path from source to destinations choosing a route from source to multiple destinations. Limitations of these protocols are: Overhead of table maintenance. Tables have to update periodically.

Mobility and QoS aware anycast routing protocol (P.I. Basarkod and S.S. Manvi , 2015) have been proposed for finding routing which is stable, non-congested. The author focuses on the QoS of a network. The main goal of proposed protocol is to improve QoS of the network. MQAR has three models for calculating the stability of node, to minimize congestion in a network and to improve QoS of the network. These models namely as stability
model, congestion model, link expiration model. The author used anycast routing. Anycast routing saves network bandwidth and time. These models are based on anycast routing. MQAR is reactive protocol. Its performance is better in high mobility and dynamic environment. MQAR protocol selects the stable, noncongested route which has a higher link expiration time. MQAR has certain disadvantages. MQAR protocol is not suitable for high throughput situation. e.g. in multimedia applications by using negotiation parameters in request packets for finding nearest server using non-congested path. This protocol is quite complex due to this additional cost required to handle connection state. Energy consumption is higher due to models.

Multiconstrained and multipath QoS aware routing (Mamatha B. et al., 2014) protocol is reactive multipath routing protocol. It focus on three QoS parameter: delay, route lifetime, energy. It used to calculate multiple paths. The path which satisfies these three parameters is selected as a routing path and stored in the routing table. MMQARP has two packets used for communication purpose i.e. MMRREQ, MRREP packets. All request packet has timestamp related with it. The average timestamp value is calculated and stored in the routing table. Routing table stored total timestamp along with each node. It avoids unnecessary loss of packets. MMQARP has certain limitations. Overhead of maintaining the routing table. Overhead of handle packets.

Link state QoS routing approach(Ali M. et al.,2013) related to link stability of MANET. Mobility factor of nodes is calculated using stability function. It is an extension of optimized link state routing protocol. It selects stable and multipoint relay nodes. It also provide QoS i.e. packet loss, response time. The author used two approaches: Stability of node and fidelity of node (SND and FND). Stability of nodes state stability of MPR nodes. This approach tried to minimize certain limitations of OLSR protocol.SND and FND are used in OLSR to find optimize route. Use of MPR to minimize computation of control messages. The author proposed new protocol i.e. ESTOLSR(standard OLSR) elect MPR nodes to acquire the degree of reachability. It reduces flooding in the network. Limitations are performance degrades if path overload occurs. Fails to calculate remaining energy in the network. As an energy consumption is high.

III. ANALYSIS OF AOMDV PROTOCOL

The AOMDV is multipath, on demand routing protocol, paths are loop free and it discovers more possible paths from source to destination. Each node in the network can uses the separate RREQ and RREP packets. The AOMDV maintains multiple paths to the route with the same destination sequence number. The routing table entries contain a list of next-hops with number hop count value for each and every destination. Both AODV and AOMDV, initiates a RREQ(Route Request) to intermediate nodes and the RREP (Route Reply) received by the source node. If node receives a RREP then it starts sends the packets through that intermediate path to the destination. If RREP is not received by the source then it reinitiates the RREQ packets to the next intermediate path. This is called as entry expiration time. In AOMDV, the routing table entry is modified to maintain all entries and loop free paths. The hop count replaced by advertised hop count and advertised hop count considers all possible paths from current node to destination node. The IP address is replaced by all next hop nodes and hop counts of node to destination.

In AOMDV the routing table entries are as follows:

\[
< \text{Destination IP address} >
\]
\[
< \text{Destination Sequence Number} >
\]
\[
< \text{Advertised hop-count} >
\]
\[
< \text{Rout list: } \{(\text{next hop IP 2 , hop-count1}), (\text{next hop IP 2 , hop-count 2}), ......\}>
\]
\[
< \text{Entry expiration time} >
\]

Node S sends a RREQ to neighboring nodes A, B, E. Then the node A, B, E sends RREQ to its neighboring nodes G,C,E. Then again this will initiate a RREQ to F,D. The first sequence is considered as S-E-D. This is the shortest path and packets will be sent through this path. If any of this path will fails, packets will send through the second path S-B-C-D. If this also fails it selects the remaining possible paths through S-A-G-F-D. The three important things have to be discovered in AOMDV protocol. The Figure 1 explains the above scenario.
3.1 Proposed Route Discovery

The cross layer design approach is used in the proposed route discovery process. For QoS provisioning and other QoS constrained routing can be considered in availability of bandwidth, Route Reply (RREP), Route Request (RREQ) and Route Error (RERR). The changes are done in proposed routing table structure of AOMDV routing protocol. If a node receives the RREQ with QoS guarantee that must be agreed to provide fulfill the service requirements. To find new route discovery process has to be initiated to its neighbor. The additional information about the model, Least Desired Bandwidth and Desired Bandwidth are added in AOMDV RREQ header.

When a RREQ arrives at receiving node, first it checks the model. This model having two kinds of QoS namely, Hard QoS and Soft QoS. In case of Hard QoS, packets transferred to destination only if Residual Bandwidth (ReBW) is higher than Desired Bandwidth (DeBW). The path with minimum hop count and highest bandwidth is considered as best path for forwarding data packets. The node will discard RREQ when the bandwidth is very less. In soft QoS the best path is chosen by considering the higher residual bandwidth and minimum hop count. A node satisfies the above mentioned conditions then that route is selected as a first best route for transmission. The residual bandwidth on that path less than the desired bandwidth, then header will be forwarded. Then this path is considered as second path and so on the remaining paths are selected.

Once RREQ packet received by the destination node receives, it performs the final checking procedure. Through the symmetric link the destination node sends a RREP packet to the source host with changes in bandwidth and AOMDV route reply. If intermediate node receives RREP packet it stores this reply in its route cache and then only transferred to the source. Figure 2 shows the working principle of AOMDV’s procedure.
3.2 Traffic Allocation Phase

The traffic allocation phase will discover the best path for forwarding data packets to the destination. Every node in the network estimates its congestion states based on estimated average queue size from source to destination. Initially it generates a route discovery process to all neighboring node. Each and every node in the network maintains the routing table information and also the congestion status (or) traffic. The best path is selected based on congestion status received from the node. The congestion status is estimated from the average queue size. By sending the packets the length of the queue is increased by one. If the network is highly congested, transmission gets delayed. If the queue size is full, the error message will be received by source node and the source node will select the next possible path for sending packet. If node is non-congested the packets will be sent through that chosen path.

3.3 Proposed Route Maintenance

In normal AOMDV’s route maintenance approach link break is acknowledged by instantaneously monitoring the “Hello” message. If the “Hello” message is not received by the node within the specified neighbor and predefined time interval then the corresponding error message will be send to the upstream node. After the error message is received, the route discovery process will be carried out to select the new route.

The cache memory information is not enough to find the best path. Same as QoS aware bandwidth routing protocol, AOMDV routing protocol will not support when route break occurs. Calculating a new route without knowing exactly how much of bandwidth consumption by host is not possible one. To avoid this problem the proposed modification of AOMDV routing protocol is introduced to maintain the route.

To avoid unnecessary delay and link failure predicting the nearest neighbors information is one of the main criteria. In QoS based Bandwidth estimation technique first neighbors information is retrieved by getting the details of the second neighbours information. The forced updation is possible in QoS and this spread the updated
information to its neighbours immediately. For this concern the “Immediate Hello” used as a special message in order to differentiate with the regular “Hello” message. When an “Immediate Hello” received by host then immediately it sends its regular “Hello” message to the corresponding host. Triggering an updated bandwidth consumption register and spreading the “Immediate Hello” by the “Error message”. If an “Error” message is received by any host that will deduct the available bandwidth. This reflects the consumed broken bandwidth into the changes in bandwidth allocation.

If any of the links is broken between source and destination, it sends an “Error” message to its upstream node. The upstream node will check in the route cache whether there is any alternative best path is available with the desired bandwidth. If desired bandwidth is available in route cache, it transmits the packets through the newly founded route. If the desired bandwidth is not available, then the “Error” message is send to source node and source node generate the new route discovery process for forwarding data packets to the destination.

3.4 Benefits of Multipath Routing Protocol

The benefits of Multipath Routing can be categorized into four.

a) Fault Tolerance
b) Load Balancing
c) Bandwidth Aggregation
d) Minimal Delay

In case of Fault Tolerance the redundant information o be sent to destination through alternative paths and it reduces the data redundancy in the network. Also the probability of communication interruption can be minimized. The second case of load balancing technique will select the path for varying traffic in the network to avoid link congestion. In case of Bandwidth Aggregation the final packet is to be divided into multiple data streams through different paths to the same destination. Hence the effective bandwidth is achieved for data packet. In minimal Delay process, route discovery time is reduced. In single routing protocol, each and every time have to initiate a route discovery process after completion of single route discovery. Then it will consider as a time consuming process. To overcome this drawback multipath routing is introduced.

IV. PROPOSED CHANNEL AWARE (CA) QOS BASED VARIANT AOMDV DESIGN CONSIDERATION

The Channel Aware QoS based routing protocol discovers the route and finding the best link disjoint path to destination. Before forwarding data to the destination the channel information is predicted by CA-AOMDV protocol. The stability is measured in route discovery phase by ANFD (Average Non Fade Duration). The channel state information is determined by OFDM (Orthogonal Frequency Division Multiplexing) technique. The frequency band information is available for each node at receiver side. The average ANFD and AFD is calculated by using OFDM technique for particular channel. In route maintenance phase, the channel prediction technique is used to identify the failure path and handover will be initiated to reduce the delay. This OFDM technique uses Fast Fourier Transforms (FFT). Due to complexity in FFT, the Inverse Fast Fourier Transforms (IFFT) is used in transmitter in the receiver side. The Figure 3 explains the proposed idea.

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4.1 Channel Behavior

The channel behavior of node is determined by ANFD and AFD. The ANFD is calculated by how long the path is active without any disturbance. The AFD is calculated by how frequent the node or link will fail on the specified route. Every node will maintain the routing table information like source, destination, hop count, next-hop, adjacent node (if link fails), ANFD and AFD. The ANFD is affected by some physical phenomenon and environmental conditions. The Figure 4 shows a diagrammatic representation of Fade and Non Fade time with signal amplified and threshold.

![Figure 4: The wireless channel behavior](image)
The Average Non Fading Duration (ANFD) NF can be evaluated as the length of the average time that a signal casing sends above a network-specific threshold $R_{th}$ and it is given by the following formula.

$$NF = c(G_0)^{1/2} / R_{th} d^{\alpha/2} f_0 \left[2\pi (V_t^2 + V_r^2)\right]^{1/2}$$ (1)

The Average Fading Duration (AFD) (F) can be measured as the length of the average time that a signal casing spends below $R_{th}$. For mobile-to-mobile channel the average fading duration is given by the following formula.

$$F = (e^{\rho^2}) / \left[ \rho f (2\pi (1+\mu^2)^{1/2}) \right]$$ (2)

4.2 The Proposed CA Algorithm

Step 1: Transmit RREQ to all the nodes.

Step 2: RREQ from all the nodes with Received Signal Strength (RSS), destination address, Threshold (T) and the Hop Count (H).

Step 3: From the Received Signal Strength analyse the AFD and ANFD.

Step 4: If AFD < Threshold (T) follow the below steps.

i) if, Min H + RSS is high + ANFD is high = Select the path
(Or)

ii) if, Min H + RSS is low + ANFD is high = Reject the path and goto Step5
(Or)

iii) if, Min H+ RSS is high + ANFD is low = Ideally select the path,
if no path available
(Or)

iv) if, Min H + RSS is low + ANFD is low = Reject the path and goto Step5
(Or)

Step 5: Else, Using OFDM, search the other available channel.

Step 6: Upgrade routing table with a newly available channel and telecast this to all nodes.

Step 7: If adjacent channel is available then execute handoff.

Step 8: If the data reached successfully the acknowledgement will be received by the destination.

Step 9: Request Retransmission.

The above scenario will be work based on Min H(Hop count), RSS (Received Signal Strength), ANFD. The Received Signal Strength of a node is calculated by threshold value (T). If a signal strength falls below threshold value, that particular route should be discarded and selects the new route which having highest threshold value.

4.3 Stability of Adjacent Node

Mobility and Link loss path are two parameters considered for neighboring node stability. These factors will be measured by packet flow in the network. Consider two nodes X and Y and the corresponding mobility for X and Y is $M$, $N$. Then this can be calculated by the formula is represented below.

$$\frac{\text{Total Number of packets from M to N}}{\text{Total Number of packets from N to M}} = MN_{mob}$$ (3)

The Signal to Noise Ratio (SNR) is used to identify the faded link. This can be measured using Bit Error rate (BER) and this is related to SNR. Considering the faded link is F in the route path channel and this can be represented by the following formula.
The power factor is considered as a major part for calculating channel fading. This can be calculated by transmitted power ($t_p$) signal and receiver power($r_p$) signal of the source and destination node.

\[ F = \frac{P_{t_p}}{r_p} \]  

From the ratio of transmitted power to noise power the Signal to Noise Ratio (SNR) is calculated.

\[ \text{SNR} = \frac{P_{t_p}}{N_p} \]  

4.4 Stability of route path in the entire network

Consider there are ‘N’ number of mobile nodes in the mobile network. These nodes can move from anywhere to anywhere in network (Around Network or Out of Network). Due to this reason the mobile node link failure and path failure may occur. This cause unstability in the network and the packet will not sent to the end user application. To avoid this situation, need to predict the mobility of mobile nodes and link loss for the particular path is necessary task. This can be measured by the following factors. Considering the hop count for each dat transaction is must here. By using these two parameters the stability of the path for whole network is calculated by the following formula.

\[ S_p = \frac{M_p \cdot LL_p}{H_c} \]  

Where $S_p$ = Stability of Path  
$M_p$ = Mobility of Path  
$LL_p$ = Link Loss Path  
$H_c$ = Number of Hop Count

4.5 Congestion Status Estimation

The congestion status estimation plays an major role in the mobile network. The congestion status estimation is calculated by size of the queue and is represented by $Q_{avg}$. This average size of the queue is calculated by instantaneous queue ($Q_{inst}$) modified by weight parameter. This can be represented by the following formula.

\[ Q_{avg} = (1-W) \cdot Q_{avg} + Q_{inst} \cdot W \]  

Where $W$ is the constant parameter represents weight of the queue. The size of the queue represented by Threshold value (T). The minimum (Tmin) and maximum (Tmax) value of threshold is set for queue size. The minimum value for threshold is set for Tmin = 6 AND Tmax= 16. The higher minimum threshold value have average traffic and packets will send with minimum delay. If the threshold falls below the minimum threshold then that path is considered as bursty traffic and discarded. The queue buffer size is full have to select new route for packet sending.

4.6 QoS Routing

QoS based routing utilizes cross layer design. For provisioning of QoS constrained routing in terms of Channel aware and Available Bandwidth, some modifications are done in the AOMDV protocol routing table structure. The Route Request(RREQ), Route Reply(RREP), Route Error(RERR) messages are added into the proposed
protocol. Any node receives RREQ with QoS guarantee that must satisfy the service requirements of end user applications. The bandwidth is an important factor for mobile network. Any path having a desired bandwidth, the packets will be sent to destination without any delay. If a selected path will not have a desired bandwidth delay will occur or packet will not sent. When a node receives a RREQ message from any node, it first checks the model whether follows Soft QoS or Hard QoS. In both Soft and Hard QoS, the residual bandwidth of a path is greater than the residual bandwidth then that path will be selected a path1, if not this will be discarded. The RERR message will be sent to requested node. Selection procedure for desired bandwidth is illustrated in the below diagram.

4.6.1 Traffic Model
It is used for calculating traffic in the network. Congestion in the network is predicted using RTS and CTS messages.
1) Client send RTS (Request to send) message to next hop by using iterator database.
2) Nodes which are idle send CTS(Clear to Send) message to client.
3) From the response of RTS and CTS message, traffic factor value of the iterator database is modify.
4) Check node availability. If node is idle then the traffic flow ,TF=0 if node is busy then TF=1.

4.6.2 Energy Model
In this model transmission energy of each node is calculated by using equation 9.

\[ T_{x_{\text{node}}} = k \text{dist}^\alpha \] (9)

Where, “k” is the proportionality constant, “dist” is the distance between the two neighbouring nodes, “\( \alpha \)” is a parameter that depends on the physical environment (generally between 2 and 4). \( T_{x_{\text{node}}} \) is a transmission energy of node which measured in joules per meter. Then at the time of packet transmission residual energy of node is calculated by using equation

\[ R_{\text{SEnergy}} = I_{\text{NITenergy}} - T_{x_{\text{node}}} \] (10)

Where, RESenergy is residual battery energy. INITenergy is initial battery energy.

4.6.3 QOS Aware AOMDV Algorithm
QOS_Aware _AOMDV Algorithm ( Source S ,Destination D , EEDmax , BWmin ,P , S, N )
1 : If R is the set of Route/s that are are identified using probability broadcast method then
2 : One of the route R1 from R is taken
if ( bandwidth of R1 >= required bandwidth of application ) then
calculate the EED (end-to-end delay ) over the route selected
if ( EED<=maximum allowable delay )
Route is selected for data relay.
else
quit the route go to 1.
end if.
else
select another route among the subset of routes determined ( after applying Control Overhead strategy ) go to 1.
end if
3 : On receiving a RREQ packet at Node X
// For determining the Route Request frequency for broadcast/rebroadcast isdetermined
if (new RREQ) then
check if node stable
if(speed of node==0) then
get number of neighbors of that node X

let number of neighbors of node X = N
if (N \leq \text{Navg})
then P=P2  // High rebroadcast probability
else P=P1  // Low rebroadcast probability
end if
else
get speed of that specific node X
speed of node X=S
if (0<S \leq S1)
then P=P2  //High rebroadcast probability
else if (S1< S \leq S_{\text{Threshold}})
then P=P1  //Low rebroadcast- probability
else if (S_{\text{Threshold}}< S \leq S_{\text{max}})
then P=0  // Not participate in-route request
end if
else
drop RREQ
end if
//end of algorithm

If Source node S has to establish the route to Destination node D with QoS requirements as BW_{\text{min}} and EED_{\text{max}} then first Go to step 3  // to reduce control overhead of RREQ packets frequency. Notations used in algorithm: P=0 (Node will not participate in Route Request), P=1 (Node will perform blind flooding) [20], P=P1 (Low rebroadcast probability), P=P2 (High rebroadcast probability), \text{Navg}=\text{Average number of neighbors}, for deciding value of P this value will be used as threshold value, S_{\text{max}}=\text{Maximum allowable speed of node}, S1, S_{\text{Threshold}}=\text{Are some predefined values of speed of node, will be used as limiting parameter, for finding probability of rebroadcast. If by performing adjusted probabilistic rebroadcast, utility function F is not able to find route from source to destination then all intermediate nodes will perform Blind flooding with P=1.}

V. ANALYSIS COMPARISON RESULTS AND DISCUSSIONS
The proposed CA-AOMDV is evaluated and analysis has been compared with delivery ratio, Average End to End Delay and Number of hops to destination. The performance results of Channel Aware QoS based AOMDV protocol has been compared with AODV and AOMDV. The simulation results are conducted for various numbers of nodes (25, 50, 75, 100, 125) scattered around the area of 1200 sq m. The transmission range of node is 250 m. Tables 1-3 and Figures 5-7 in this study explains the result in terms of graphical manner for packet delivery ratio, end to end delay and average number of hops to destination.

Table 1: Packet Delivery Ratio

<table>
<thead>
<tr>
<th>Number of Nodes</th>
<th>AODV</th>
<th>AOMDV</th>
<th>CA-AOMDV with QoS</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>0.7305</td>
<td>0.8774</td>
<td>0.9327</td>
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<td>50</td>
<td>0.6845</td>
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<td>75</td>
<td>0.6542</td>
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<td>100</td>
<td>0.6341</td>
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<td>125</td>
<td>0.6016</td>
<td>0.7978</td>
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Table 2: End to End Delay

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<th>Number of Nodes</th>
<th>AODV</th>
<th>AOMDV</th>
<th>CA-AOMDV with QoS</th>
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<tr>
<td>25</td>
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<td>0.001210</td>
<td>0.000923</td>
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<td>0.002232</td>
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<td>75</td>
<td>0.005764</td>
<td>0.001789</td>
<td>0.001335</td>
</tr>
<tr>
<td>100</td>
<td>0.006457</td>
<td>0.001945</td>
<td>0.001487</td>
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<tr>
<td>125</td>
<td>0.007323</td>
<td>0.002200</td>
<td>0.001765</td>
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Table 3: Number of Hops

<table>
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<tr>
<th>Number of Nodes</th>
<th>AODV</th>
<th>AOMDV</th>
<th>CA-AOMDV with QoS</th>
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</thead>
<tbody>
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<td>25</td>
<td>4.73</td>
<td>4.29</td>
<td>3.92</td>
</tr>
<tr>
<td>50</td>
<td>6.12</td>
<td>5.89</td>
<td>4.95</td>
</tr>
<tr>
<td>75</td>
<td>6.64</td>
<td>6.71</td>
<td>5.09</td>
</tr>
<tr>
<td>100</td>
<td>7.06</td>
<td>7.04</td>
<td>5.45</td>
</tr>
<tr>
<td>125</td>
<td>8.04</td>
<td>8.36</td>
<td>5.78</td>
</tr>
</tbody>
</table>

Figure 5: Number of Nodes vs Packet Delivery Ratio

Figure 6: Number of Nodes vs End to End Delay
47

5.1 Packet Delivery Ratio

From the Table 1 no and Figure 5 it is observed that the packet delivery ratio is increased for CA-AOMDV with QoS based routing protocol is compared with AODV, AOMDV, CA-AOMDV with QoS. When compared to AOMDV, CA-AOMDV the packet delivery ratio is increased by 5.53% and compared to AODV, CA-AOMDV is increased by 20.22%. When number of nodes increased to 75, then the packet delivery ratio is increased in CA-AOMDV by 5.98% than AOMDV and 22.75% than the AODV routing protocol.

5.2 End to End Delay

From Table 2 and Figure 6 it is observed that the average end to end delay is decreased for CA-AOMDV with QoS when compared to AODV and AOMDV. When the number of node is 25, the average end to end delay decreased for CA-AOMDV with QoS by 40.2% AOMDV and 30.07% by AODV. When number of nodes is 75, a average end to end delay is decreased for CA-AOMDV with QoS by 44.29% by AODV and 45.44% by AOMDV.

5.3 Number of Hops

From Table 3 and Figure 7, observation clearly shows that the average Number of hops to destination decreases for CA-AOMDV with QoS by 9.01% and 18.73 by AODV. When compare the results of 75 nodes in the table, the hop to destination decreases for CA-AOMDV with QoS by 27.46% than AOMDV and 26.43 by AODV protocol.

VI. CONCLUSION

To enable better service to the end user application, the MANET routing protocols plays a major role for mobile application. The Channel Fading is a very big issue in mobile network and that degrades the performances of the entire mobile networks. The proposed CA-AOMDV with QoS ensures the reliability of the network and channel prediction is done with ANFD metric to avoid delay in communication. The simulation is done with varied number of nodes and the results are compared with AODV, AOMDV and CA-AOMDV with QoS protocols. From the above study and experimental result, this can be concluded that the delays can be reduced and the rate of packet delivery is increased compare with AODV and AOMDV. In future, this can be further tested with different routing protocol and different kinds of simulation times for significance.

REFERENCES


