Increased Throughput for Load based Channel Aware Routing in MANETs with Reusable Paths

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ABSTRACT
The widespread applications of Mobile Ad hoc Networks (MANETs) have lead to the development of many protocols in this field. Routing protocols for ad hoc networks have generally ignored channel fading. This paper proposes a routing protocol which calculates the channels non-fading duration for routing which attempts to minimize packet loss due to fading and also reuse the path with some security mechanisms to increase the throughput. Specifically, in the proposed work the faded paths can be reused when they become available again, rather than being discarded, also the loads are balanced on the link. The Channel Aware - Ad hoc On-demand Multipath Distance Vector (CA-AOMDV) used for channel average non-fading duration as the routing metric. The Load Based Channel Aware - Ad hoc On-demand Multipath Distance Vector (LBCA-AOMDV) is used for increasing throughput and packet delivery ratio. The NS-2 is used to perform both the simulation and evaluation of the performance of proposed protocol and to compare it with existing protocols. The simulation result demonstrates improvement in the throughput, packet delivery ratio, security and reduction of packet loss on routing.

General Terms
Load balancing, Performance, CA-AOMDV,LBCA-AOMDV

Keywords
Mobile ad hoc networks, routing protocols, channel adaptive routing.

1. INTRODUCTION
A wireless Mobile Ad hoc Networks (MANETs) is a collection of mobile nodes with no infrastructure, forming a temporary network. The packet transmission in MANETs is done using radio link and infrared [1]. In MANETs, routing is done by using many numbers of protocols [2]. These protocols have the properties to improve the efficiency of routings such as increased reliability, power efficient, security and Quality of Service (QoS) [3].

There are many common routing algorithms used in ad hoc networks but Ad hoc On-demand Multipath Distance Vector (AOMDV) [4], which is most popular On-demand algorithm. In this the routes are identified only at the time of packet transmission and not having any valid path [5]. On-demand multipath routing protocol identified more number of paths to perform routing in MANETs [6]. All the identified paths are stored but only one of them is used for transferring of data. The other stored paths will become useful once the current path is broken [7], [8].

In addition, to the channel behavior the new paths are built using the best links or if any path failed it switched to alternate path [9], [10]. In channel adaptive schemes are implemented in Medium Access Control (MAC) protocol [11], [12]. This paper proposes a protocol named Load Based Channel Aware- AOMDV (LBCA-AOMDV), which is an extension of Channel Aware- AOMDV (CA-AOMDV) routing protocol.

Further, we discuss a detailed analysis of the three protocols (LBCA-AOMDV, CA-AOMDV, AOMDV) based on the performance of increased throughput and packet delivery ratio. The performance of LBCA-AOMDV is better compare with other two protocols, by varying speed of nodes and increased size of the network.

In Section 2, we discuss the Ad hoc On-demand Multipath Distance Vector and Channel Aware – AOMDV in Section 3. We presented the proposed methodology in Section 4. The performance evaluation of protocol features are shown in Section 5 and conclusion Section 6.

2. AD HOC ON-DEMAND MULTIPATH DISTANCE VECTOR (AOMDV)
The AOMDV provides a multipath for MANETs routing. When a transmission is made between the sources to destination. The source starts to send packets to its neighbor in the wireless network [13], [14]. If the neighbor goes beyond the range the path gets disconnected and more loss of packet till the next path for transmission is identified. This process continuous till the packets reaches its destination. In case of no neighbor the process stops at middle and it does not send the packets to the destination [15].

Due to fading in the link, path gets disconnected, so more packets are lost. Cannot reuse the path that is disconnected due to fading in the channel [16], [17]. In Figure 1 there are nine nodes simulated when the one node goes away from the channel there was more packet loss due to path disconnect. It finds the alternate path and transfers the packets through that path. If there is again any path failure and no neighbor is found the entire transmission stops. The drawback of AOMDV has been over comed using the CA-AOMDV protocol. In most of the routing protocol doesn't calculate the fadding and non-fading duration [18], [19].

The key aspect of this work, is not addressed in any other work we use reusable path with the security mechanisms. The most feasible path is reused again rather than discarding it. The channel Aware Non Fading Duration(ANFD) is used as a routing metric and measure of link stability and a path selection[20], [21].

The Average Fading Duration (AFD) is utilized to determine, when to bring a path again into play, allowing for varying nature of path usability instead of discarding at the initial failure [22].The feasible path is brought back into the play when they are available again, rather than simply discarding them at the first sign of a fade. At the time of signal fading before handoff take place the system waits for an acknowledgement of saying that the path is secured, it does not transfer the packet rather than it chooses another route.

3. CHANNEL AWARE-AOMDV (CA-AOMDV)

The result of route discovery in AOMDV finds the selection of multiple loop- free, link-disjoint paths between source and destination node [23],[24]. The alternate paths are used only when the active path become dead. Figure 1. Shows the handoff in CA-AOMDV. In the route maintenance phase, instead of waiting for the active path to fail, we prempt a failure by using channel prediction on path links, allowing a handover to one of the remaining selected paths. This results in saved packets and consequently smaller delays.

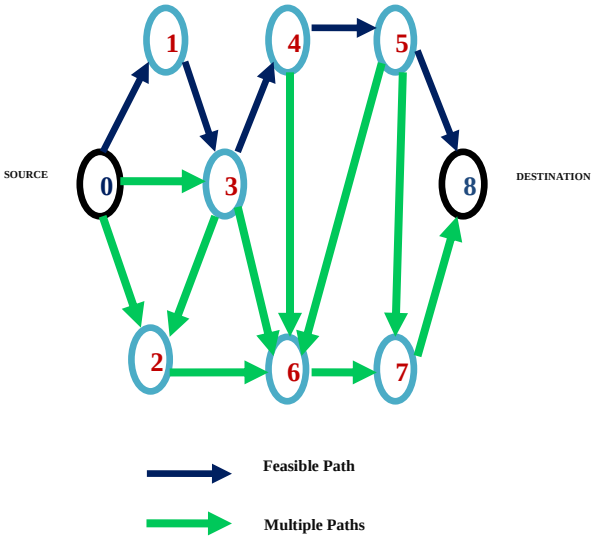

Figure 1: Handoff in CA-AOMDV

In the CA-AOMDV routing protocol, route discovering is the first process, so the source node starts to find its entire neighbor till destination. The neighbour is found in such a way that source node first chooses its next neighbor by sending a "hello" packet. In turn those neighbors will send same "hello" to their next neighbors, this process continuous till destination. After reaching destination the same process is done from destination to source. By that time it finds for the most feasible paths for transmission.

To overcome the drawback in the existing protocol some new criteria's are introduced. In the proposed work the average non fading duration also average fading duration in the channel it calculates the drop in the channel, so that the entire channel is brought mounted. When there is any neighbor goes out of the range it intimates the information to its next neighbor before it goes out. Because of this the packet loss is reduced. It is assured for the source that the packets are transferred to the destination. When the neighbor that goes away from the range comes back that path is taken again by the channel and the packet starts to transmit through the same path. This is done because the first path discover by the channel will be the most feasible path. Path that is most feasible is reused when it comes into the channel [1].

This CA-AOMDV does not provide security when there is a handoff between neighbor nodes, we can't make sure that there are no intruders on hackers else any other damage to the information bring transferred. When a signal fades in the adhoc channel it passes the packets to the next neighbor, before passing it gives a request to that neighbor until it gets an acknowledgment of saying that the path is secured it does not transfer the packet. Rather than it chooses another route. The key aspect of this enhancement which is not addressed in other work is that security.

4. PROPOSED METHODOLOGY

Transmission in AOMDV protocol results in more packet loss. To over this the CA-AOMDV has been proposed. Using this protocol we reduced packet loss but getting throughput is about 35% and it's not sufficient [1], so we proposed another protocol LBCA-AOMDV is an extension of CA-AOMDV. In this Section, we review two protocols that are used in this paper.

4.1 Load Based Channel Aware Aomdv (LBCA- AOMDV)

In MANETs routing, the node failure occurs due to two reasons. One is link failure and other is node overloaded. In this LBCA- AOMDV, we have concentrated on node over loaded by the threshold value. Here we fix the threshold values, if any node exist that particular value consider that node will be overloaded and it comes away from the path and not from the channel. The particular load is replaced by some neighboring node.

4.1.1 Increased Throughput

The load balancing is introduced in this work additionally to improve the throughput. In this, the load of nodes are identified in such a way that it will display the loaded node, after finding the loaded node the channel starts its transmission via another route were it doesn't contains any loaded node. When the over loaded node has reduced its load after transmission then that particular node will enter into the channel.

4.1.2 Packet Delivery Ratio

It is the ratio between the numbers of packets received by the destination nodes to the number of packets sent by the source nodes.

5. PERFORMANCE EVALUATION

NS-2.34 is used to produce the simulated result [25]. A "hello" packet is sent over a wireless network made up of nine nodes. The loss of packet has been reduced, paths have been reused and also security is maintained by getting acknowledgements.

5.1 Theoretical Results

The ratio of multiple path systems packet delivery ratio for Load Based Channel Aware - AOMDV to CA-AOMDV, AOMDV has been calculated and then proved that the value of LBCA-AOMDV is higher than CA-AOMDV and AOMDV.

5.2 Simulation Results

Throughput is the measure of how fast we can actually send through network. The number of packets delivered to the

receiver provides the throughput of the network. In Figure 2: We discuss the throughput comparison of three protocols. The ratio of data packets delivered to the destinations to those generated by the constant bit rate. In Figure 3: we discuss the packet delivery ratio of three protocols.

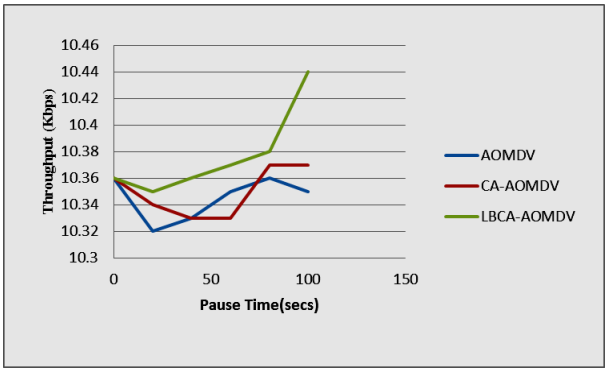

Figure 2: Throughput comparison

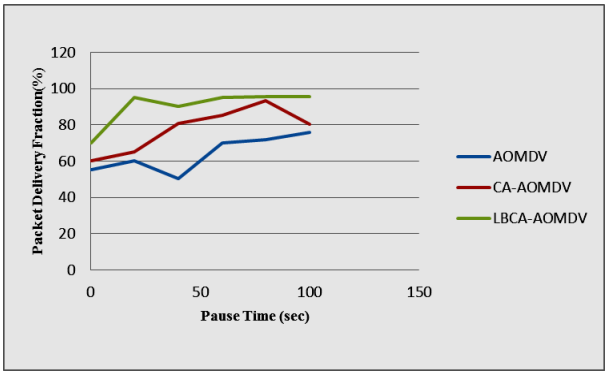

Figure 3: Packet Delivery Ratio comparison

Table 1. Comparison of two features with three protocols

Protocols Features	Throughput Comparison	Packet Delivery Ratio
AOMV	Provides a minimum throughput around 35%.	Provides a minimum Packet Delivery Ratio around 75%.
CA-AOMDV	Provides a throughput around 45%.	Provides a Packet Delivery Ratio around 80%.
LBCA-AOMDV	Provides a maximum throughput above 70%.	Provides a maximum Packet Delivery Ratio around 95%.

6. CONCLUSION

Current research on routing protocols for Mobile Ad hoc Networks (MANETs) has converged to several dominating routing protocols, the recent research efforts have made big progress on ad hoc network routing, both in theory and in practical implementation. This paper proposed a routing protocol which reuses the path also increase the throughput level more than 35% of CA-AOMDV protocol and provides 95% of packet delivery ratio. Theoretical analysis and simulation results show that our LBCA-AOMDV protocol performs better. This yields that the protocol adapts to the changing network parameters and performs well with varying speed of nodes and with increased size of the network.

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