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IMPROVING ROUTING EFFICIENCY IN MANET

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Abstract— **Manet is modern era in networking. A fundamental issue arising in mobile ad-hoc networks (MANETs) is the selection of the optimal path between any two nodes. Major issue arising in mobile ad hoc networks (MANETs) is the selection of the optimal path between any two nodes.A method that has been advocated to improve routing efficiency is to select the most stable path so as to reduce the latency and the overhead due to re-routing instability problem. We study both the availability and the duration probability of a routing path that is subject to link failures caused by node mobility.**

Index Terms— **RD-Mobility Model, stable path, path duration, path availability, MANETS, Reactive routing protocols, Link failures, Node mobility.**

I. INTRODUCTION *(HEADING 1)*

II. MANET is a self-configuring network of mobile nodes connected by wireless links, to form an arbitrary topology. The nodes are free to move randomly. Thus the network's wireless topology may be unpredictable and may change rapidly. Minimal configuration, quick deployment and absence of a central governing authority make ad hoc networks suitable for emergency situations like natural disasters, military conflicts, emergency medical situations etc [1] [2]. Many previous studies have used Random Waypoint as reference model [3] [4]. However, in future MANETs are expected to be used in various applications with diverse topography and node configuration. Widely varying mobility characteristics are expected to have a significant impact on the performance of the routing protocols like DSR and DSDV. The overall performance of any wireless protocol depends on the duration of interconnections between any two nodes transferring data as well on the duration of interconnections between nodes of a data path containing n-nodes. We will call these parameters averaged over entire network as "Average Connected Paths".

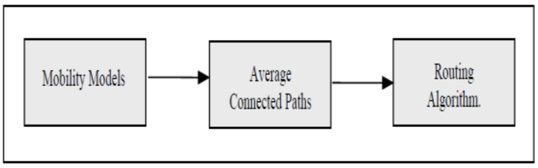

Fig:1 Relationship between protocol performance and mobility model.

The mobility of the nodes affects the number of average connected paths, which in turn affect the performance of the routing algorithm. We have also studied the impact of node density on routing performance. With very sparsely populated network the number of possible connection between any two nodes is very less and hence the performance is

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poor. It is expected that if the node density is increased the throughput of the network shall increase, but beyond a certain level if density is increased the performance degrades in some protocol.

REVIEW OF AOMDV

The main distinguishing feature of AOMDV over AODV is that it provides multiple paths to destination. The paths are loop free and mutually disjoint. AOMDV uses the value of advertised hop-count to maintain multiple paths to destination with the same destination sequence number. In both AODV and AOMDV, RREQ message initiates a node route table entry in preparation for returning RREP. In AODV protocol, the routing table entry contains the following fields:

<destination IP address,
destination sequence number,
next-hop IP address,
hop-count,
entry expiration time>

Where expiration time gives the time after which, if a corresponding RREP message has not been received, the entry is discarded from the table. In AOMDV, the routing table entry is slightly modified to allow for maintenance of multiple entries and multiple paths. The advertised hop-count replaces hop-count and advertised hop-count is the maximum over all paths from the current node to destination, only one value is advertised from that node for a given destination sequence number during broadcast. Next, next-hop IP address is replaced by a list of all next-hop nodes and corresponding hop-counts of the saved paths to destination from that node, as follows:

<destination IP address,
destination sequence number,
advertized hop-count, route list
: {(next hop IP 1, hop-count 1), (next hop IP 2, hop-count 2), . . . },
entry expiration time>.

III. CHANNEL AWARE AOMDV PROTOCOL

Route discovery in AOMDV results in selection of multiple loop-free, link-disjoint paths between ns and destination, with alternative paths only utilized if the active path becomes unserviceable. One of the main drawbacks of AOMDV protocol is that the only characteristic considered when choosing a path is the number of hops. Path steadiness is completely being ignored. Thus, selected paths tend to have a small number of long hops meaning that nodes are already close to the maximum possible communication distance apart, potentially resulting in frequent link disconnections. In CA-AOMDV protocol, the deficiency is addressed in two ways. In the route discovery phase, the ANFD metric, is used for each link as a measure of stability. In the route maintenance phase, the active path to fail are not being viewed, instead it is preempted when a failure occurs, 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. The routing table structures for each path entry in

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AOMDV routing table	CA-AOMDV routing table
destination IP address	destination IP address
destination sequence number	destination sequence number
advertised hop-count	advertised hop-count
	$\mathcal{D}_{min}$
path list {(next hop IP 1,hop-count 1), (next hop IP 2,hop-count 2),$\cdots$}	path list {(next hop 1,hop-count 1,$\mathcal{D}_1$), (next hop 2,hop-count 2,$\mathcal{D}_2$),$\cdots$}
	expiration timeout
expiration timeout	handoff dormant time

Fig 2: Comparison of Routing Table Entry Structures in AOMDV and CA-AOMDV.

A. Route Discovery in CA-AOMDV

Route discovery in CA-AOMDV is an enhanced version of route discovery in AOMDV, incorporating channel properties for choosing more reliable paths. CA-AOMDV uses the ANFD as a measure of link lifetime. The path duration, D, is recorded in the RREQ, updated, as necessary, at each intermediate node. Thus, all the information required for calculating the ANFD metric is available through the RREQ messages, minimizing added complexity. Similarly, to the way the longest hop path is advertised for each node in AOMDV to allow for the worst case at each node, in CA-AOMDV the minimum D over all paths between the given node, and destination, is used as part of the cost function in path selection.

B. Route Maintenance in CA-AOMDV

In mobile networks, it is essential to find the efficient ways of addressing path failure. Using prediction strategy and handoff policy to preempt fading on a link on the active path, disconnections can be minimized, reducing transmission latency and packet loss. Route maintenance in CA-AOMDV takes advantage of a handoff strategy using signal strength prediction, to counter channel fading. When the predicted channel signal strength level falls below a network specific threshold value, the channel aware algorithm swaps to a good-quality link. The fading threshold value is selected so as to provide robustness to prediction errors during selection of links. The presence of multiple users experiencing independent channel fading means that MANETs can take advantage of channel diversity, unlike data rate adaptation mechanisms such as Sample Rate.

All the nodes maintain a routing table of past signal strengths, recording for each received packet, previous hop value, signal power and arrival time. However, this will

depend on the packet receipt times compared with the specified discrete time interval, _t. If packets are received at time intervals greater than _t, sample signal strengths for the missed time intervals can be approximated by the signal strength of the packet closest in time to the one missed. If packets are received at intervals of shorter duration than _t.

C.Handoff

Trigger Route handoff methods are triggered when a link of downstream node predicts a fade in its path and transmits a HREQ message to the uplink node in the network. Let TR be the transmission range of the node, assumed to be the same for all nodes, let Ŕ(t) be predicted signal strength of the link at time t and recall Rth, fade prediction threshold value . If the prediction at t0 + ψ is above Rth while that at t0 + 2ψ is below, the maximum transmitter velocity Vt max ensuring signal strength above Rth at t0 + ψ , is determined . If a fade is predicted at any time, the receiver checks whether the link is at breaking point with respect to distance of the transmission node. The HREQ message registers the following fields: source IP address, destination IP address, source sequence number, fade interval index, long term fading indicator, AFD, and Vt max. *D*

RD-Mobility Model:

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Mobility models play an important role in the simulation of mobile ad-hoc networks (MANET), including protocol performance evaluation, power control, connectivity analysis, and capacity planning, etc. Generally speaking, there are two types of mobility models. The one is called entity mobility model in which mobiles' movements are independent of each other. Actually, as is to be proved, non uniform node distribution and speed decay are also problems of random direction model (RD). This model was proposed by Royer in 2001. Like RWP, RD's mobile moves by a zigzag way. Its speed keeps constant during each segment but varies uniformly on [*V*min, *V*max] at endpoints. The endpoints of RD must be on the boundary, which is to say that nodes cannot stop in the middle of the region (see fig.1). we apply geometric probability to analyze node distribution of RD model. In the case of circular regions, a closed form node distribution is obtained. Furthermore, we analyze the speed distribution of RD by the method of palm calculus and give a general explanation to the hypostasis of speed decay phenomenon. At last, it should be noted that the appellation "random direction model" is also used to emulate Brownian motions.

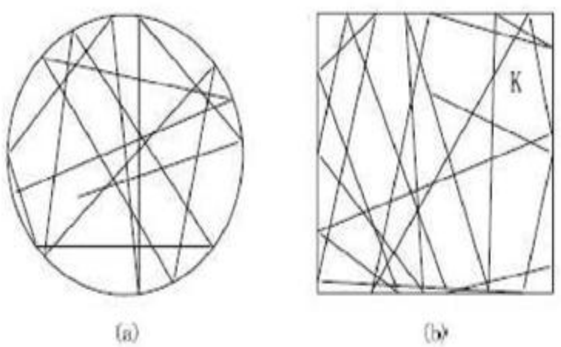

Fig 3: Illustration of RD-Mobility Model in a) Circle Region b) Square Region.

LINK DURATION:

An exact expression for the link duration probability under the RD model appears prohibitive for the following reasons:The relative motion between two nodes moving according to independent RD motions is no longer an RD motion.

ROUTING PROTOCOL FOR MANET:

Routing protocols for MANETs typically fall under two classifications; first one is unicast Routing Protocol, second one is multicast Routing Protocol. Different routing protocols try to solve the problem of routing in mobile ad hoc network in one way or other. routing that means route available immediately. Reactive routing that means discovers the route when needed .The key motivation behind the development of reactive routing protocols like DSR and AODV is the reduction of routing load. There will be impact on performance for low bandwidth wireless link if high routing load is there. There are many simulation study has been done so far for the routing protocols. This paper has been organized as follows: In the

following section we briefly review the three protocols DSDV, DSR and AODV. Then we described the performance metrics on the basis of which we compared the protocols. Next to this a simulation model has been explained on which basis results are obtained and graphs are generated to compare and analyze the results with the help of performance metrics. we have presented the simulation based comparative performance analysis of routing protocols DSR, AODV (Reactive) and DSDV (Proactive) and finally concluded which protocol is better under certain traffic conditions and scenarios

CONNECTIVITY GRAPH METRICS

One of the main challenges for routing in MANETs is to deal with the topology (connectivity graph)

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changes resulting from mobility. The performance of a protocol is greatly determined by its ability to adapt to these changes. Realizing this, researchers have proposed metrics to characterize the effect of mobility on the connectivity graph with an aim to explain the effects of mobility on protocol performance. We define the link duration and path duration metrics in this section. First, we mention some commonly used symbols in this section. Let

1. *N* be the total number of nodes.
2. *Dij* (*t*) be the Euclidean distance between nodes *i* and *j* at time *t*.
3. *R* be the transmission range of the mobile nodes.

The connectivity graph is the graph $G = (V,E)$, such that $|V| = N$. At time t, a link $(i, j) \in E$ iff $Dij(t) \leq R$.

Let $X(i, j, t)$ be an indicator random variable which has a value 1 iff there is a link between nodes *i* and *j* at time *t*. Otherwise, $X(i, j, t) = 0$.

1. **Link Duration:** For two nodes *i* and *j*, at time *t*1, duration of the link (*i*, *j*) is the length of the longest time interval [*t*1,*t*2] during which the two nodes are within the transmission range of each other. Moreover these two nodes are not within the transmission range at time $t1 - \_$ and time $t2 + \_$ for $\_ > 0$. Formally, $LD(i, j, t1) = t2 - t1$ iff $\forall t\ t1 \leq t \leq t2, \_>0 : X(i, j, t) = 1$ and $X(i, j, t1- \_) = 0$ and $X(i, j, t2+\_) = 0$. Otherwise, $LD(i, j, t1) = 0$.

2. **Path Duration:** For a path $P = \{n1, n2,...nk\}$, consisting of *k* nodes , at time *t*1, path duration is the length of the longest time interval [*t*1, *t*2], during which each of the $k-1$ links between the nodes exist. Moreover,
at time $t1-\_$ and time $t2+\_$, $\_ > 0$, at least one of the *k* links does not exist. Thus, path duration is limited by the duration of the links along its path. Specifically, at time *t*1, path duration is the minimum of the 248 durations of the $k-1$ links ($n1$, $n2$), ($n2$, $n3$)...($nk-1$, nk) at time *t*1. Formally, $PD(P, t1) = \min_{1 \leq z \leq k-1}$
$LD(nz, nz+1, t1)$ Thus, both link and path durations are a function of time. Link duration has been studied before across the "test-suite" of mobility models. However, that study was based on average values. Here, we also examine the PDFs of the link and path duration across these mobility models. We believe that this approach might give a deeper understanding of the impact of mobility on the protocol performance. PDFs are estimated using simple statistical analysis of the simulation data.

PATH SELECTION:

We address the problem of finding optimal paths in a MANET in terms of path availability. Having analyzed the probabilities of link availability and duration, we have moved to the study of the same metrics in the case of multihop paths, again under the RD mobility model. We have discussed the validity of the link independence assumption.

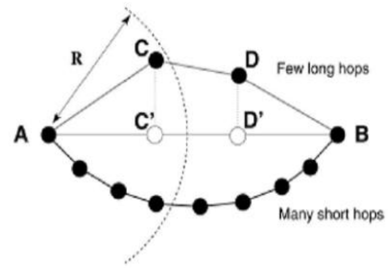

Fig. 4: Path selection between nodes A and B

Conclusion:

In this paper we discuss about the review of AOMDV and Channel Aware AOMDV Protocol for Selection of the optimal path between two nodes. A method that has been advocated to improve routing efficiency is to select the most stable path so as to reduce the latency and the overhead due to re-routing instability problem. And also study both the

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availability and the duration probability of a routing path that is subject to link failures caused by node mobility. We used these results to determine the optimal path in terms of route stability; in particular, we showed some properties of the optimal path and we provided an approximate yet accurate expression for the optimal number of hops. Finally, we discuss about the Link Duration and Routing protocol in Manet.

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