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Encrypted and Consistent Data Transmission in Dynamic MANET's

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Abstract— This paper addresses the challenge of giving data packets regarding highly dynamic mobile random networks inside a reliable as well as timely manner. Most existing random routing methodologies are vulnerable to node mobility, especially regarding large-scale systems. Driven by this problem, we propose a competent Position-based Opportunistic Course-plotting (POR) method which takes benefit from the stateless property of geographic routing plus the broadcast characteristics of instant medium. We recommend a position-based opportunistic direction-finding mechanism that is deployed without having complex customization to protocol as well as achieve many reception without having losing the main benefit of collision avoidance given by 802.11. The very idea of in-the-air back-up significantly increases the robustness of the routing method and reduces the latency as well as duplicate forwarding attributable to local path repair.

Keywords— MANETS, Geographical Routing, Data Delivery

I. INTRODUCTION

Mobile ad hoc networks (MANETs) have gained a great deal of attention because of its significant advantages brought about by multihop, infrastructure-less transmission. However, due to the error prone wireless channel and the dynamic network topology, reliable data delivery in MANETs, especially in challenged environments with high mobility remains an issue. Traditional topology-based MANET routing protocols (e.g., DSDV, AODV, DSR) are quite susceptible to node mobility. One of the main reasons is due to the predetermination of an end-to-end route before data transmission. Owing to the constantly and even fast changing network topology, it is very difficult to maintain a deterministic route. The discovery and recovery procedures are also time and energy consuming. Once the path breaks, data packets will get lost or be delayed for a long time until the reconstruction of the route, causing transmission interruption.

II. PREVIOUS WORK

Ad hoc networking is used to communicate between hosts in the absence of dedicated routing infrastructure, when messages are forwarded by intermediate hosts if the sender and receiver are out of communication range. The quality of such a routing algorithm can be measured by its stretch; that is, the length of the chosen route divided by the length of the optimal route should be as small as possible. In this paper we study ad hoc routing on a network of truly mobile nodes and introduce a routing algorithm with constant stretch. For systems where each node is equipped with a location sensing device, geographic routing has received much attention recently and is considered to be the most efficient and scalable routing paradigm. In the simplest form of georouting, every node greedily forwards messages towards the neighbor closest to the destination node. However, these geographic routing algorithms assume that the sender knows the position of the destination node. This introduces a high storage overhead if each node keeps track of the position of all other nodes. Even more challenging is the situation with mobile nodes: In a mobile ad hoc network (MANET), nodes might be moving continuously and their location can change even while messages are being routed towards them. Clearly, a node cannot continuously broadcast its position to all other nodes while moving. This would cause an excessive message overhead. In the home-based approach, each node is assigned a globally known home where it stores its current position. A sender first queries the home of the destination node to obtain the current position and then sends the message. This can be implemented using distributed or geographic hashing, and is a building block of many previous ad hoc routing algorithms, including. Despite of its broad usage, the home-based approach is not desirable, as it does not guarantee low stretch: The destination might be arbitrarily close to the sender, but the sender first needs to learn this by querying the destination's home, which might be far away. Similarly, a large overhead is introduced by moving hosts, which need to periodically update their homes, which might be far away. Even more important is the observation that the destination node might have moved to a different location by the time the message arrives. Thus, simultaneous routing and node movement require special consideration. Routing on ad hoc networks has been in the focus of research for the last decade. The proposed protocols can be classified as proactive, reactive, or hybrid. Proactive protocols distribute routing information ahead of time to enable immediate forwarding of messages, whereas the reactive routing protocols discover the necessary information on demand. In between are hybrid routing protocols that combine the two techniques. Much work has been conducted in the field of geographic routing where the sender knows the position of the destination. Face routing is the most prominent approach for this problem. AFR was the first algorithm that guarantees delivery in $O(n^2)$ in the worst case, and was improved to an average case efficient but still asymptotically worst case optimal routing in GOAFR+. Similar techniques were chosen for the Terminode routing, Geo-LANMAR routing. All of them combine

greedy routing with ingenious techniques to surround routing voids. Georouting is not only used to deliver a message to a single receiver, but also for geocasting, where a message is sent to all receivers in a given area. All these georouting protocols have in common that the sender needs to know the position of the receiver.

If we consider a MANET, a sender node needs some means to learn the current position of the destination node. A proactive location dissemination approach was proposed in DREAM [3], where each node maintains a routing table containing the position of all other nodes in the network. Each node periodically broadcasts its position, where nearby nodes are updated more frequently than distant nodes. In addition to the huge storage and dissemination overhead, DREAM does not guarantee delivery and relies on a recovery algorithm, e.g. flooding. An alternative to the fully proactive DREAM is the hybrid home-based lookup approach, as utilized. However, this approach does not allow for low stretch routing, as outlined in the introduction. In the presence of lakes, $v_{node\ max}$ is reduced by a factor equal to the largest routing stretch caused by the lakes. Awerbuch and Peleg proposed to use regional matching have to build a hierarchical directory server, which resembles our approach. However, to handle concurrent lookup and mobility, a Clean Move Requirement was introduced, which hinders nodes to move too far while messages are routed towards them. With other words, a lookup request can (temporarily) stop its destination node from moving.

Furthermore, the lookup cost is polylogarithmic in the size of the network, which restrains scalability. A novel position dissemination strategy was proposed by Li et al.: For each node n , GLS stores pointers towards n in regions of exponentially increasing size around n . In each of these regions, one node is designated to store n 's position based on its ID. The lookup path taken by GLS is bounded by the smallest square that surrounds the sender and destination node. As outlined, GLS cannot lower bound the lookup stretch and lacks support for efficient position publishing due to node movement. Xie et al. presented an enhanced GLS protocol called DLM, and Yu et al. proposed HIGH-GRADE. In contrast to GLS, in DLM and HIGH-GRADE most location pointers do not store the exact position of the corresponding nodes, which reduces the publish cost. Nevertheless, neither of them can lower bound the publish cost and they do not tackle the concurrency issue described above.

Recently, Abraham et al. proposed LLS, a locality aware lookup system with worst case lookup cost of $O(d^2)$, where d is the length of the shortest route between the sender and receiver. Similar to GLS, LLS publishes position information on a hierarchy of regions (squares) around each node. A lookup requests circles around the sender node with increasing radius until it meets one of the position pointers of the destination node, and then follows this pointer. MLS borrows some ideas from LLS and HIGH-GRADE, adding support for concurrent mobility and routing, improving the lookup to have linear stretch and bounding publish overhead. [1]

Mobile ad hoc networking is rapidly gaining popularity due to the proliferation of miniature yet powerful mobile computing devices. Mobile ad hoc networks do not require any form of fixed infrastructure for hosts to be able to communicate with one another. A source node that needs to communicate with a destination node uses either a direct link or a multihop route to reach the latter. This requires that all nodes must have some basic routing capability to ensure that packets are delivered to their respective destinations. Since nodes may move anytime, then the topology of the network may also change anytime. A major challenge in mobile ad hoc networking is how to maximize data packet delivery in the face of rapidly changing network topology without incurring a large routing overhead. Over the last few years, many routing protocols for mobile ad hoc networks have been proposed. A number of performance comparison studies have revealed that on-demand routing protocols perform better in terms of packet delivery and routing overhead than proactive routing schemes especially in the presence of node mobility. Proactive and hybrid schemes do not perform well in dynamic topologies because of two major factors: Slow detection of broken links and periodic exchange of route updates even when routes are not needed. Slow detection of broken links causes data packets to be forwarded to stale or invalid paths thereby decreasing the packet delivery ratio. Proactive routing protocols rely on periodic updates to determine if a link to a neighbor is still up. The absence of several consecutive updates from a neighbor implies that the link to this neighbor is down. This causes a large delay before a broken link is declared as "down." Thus, during packet relay, packets are still forwarded to invalid routes. Of course, these packets never reach the destination. In a highly dynamic network topology where link changes are frequent, many such packets are dropped. One solution to make proactive routing protocols quickly detect broken links is to decrease the update interval but this would entail excessive routing overhead. In on-demand routing, quick detection of broken links is facilitated by hop-by-hop acknowledgment of data packets or the use link layer feedback, if this is available. Aside from enabling rapid detection of broken links, this method also reduces routing overhead because there is no need to send periodic update messages to ascertain if a link is still "up." This approach may however require additional overhead because of data packet acknowledgment. But, if the MAC protocol already provides this functionality such as the IEEE 802.11, this is not a major issue. Another downside of using data packet acknowledgment to determine link status is that link failure is only determined after failing to forward a packet. Hence, this packet and possibly more may become undeliverable. Under normal circumstances, if these undeliverable packets are not originating from the node that encounters the link failure, they are simply discarded. To avoid dropping these undeliverable packets, AODV incorporates an optimization known as "local route repair." DSR also provides a feature for the same purpose known as "packet salvaging." However, as will be shown in this paper, these optimizations only worsen the performance of these protocols at high network load and high mobility rates because of their limited effectiveness and undesirable side effects.[2] Our work is driven by two observations: one a growing need and another an opportunity. Many users want cheap and high-quality Internet access from moving vehicles to stay connected while traveling. Cellular networks can provide such connectivity today, but they tend to be expensive. At the same time, there is an increasingly ubiquitous deployment of inexpensive WiFi (802.11) networks, and in many cases, entire cities are being covered. The ubiquity of WiFi provokes an intriguing question: can WiFi deployments support

common applications such as Web browsing, instant messaging, and voice over IP (VoIP), from moving vehicles? We are, of course, not the first to suggest allowing WiFi access from moving vehicles. Several recent works study connectivity from vehicles to open-access base stations. They propose techniques to improve connectivity to an individual base station. Some also propose application-specific techniques or new applications that work well in such environments. The question we pose, however, pushes the envelope beyond this type of special case usage to supporting common applications. Our primary contribution is the design of ViFi, a protocol that minimizes disruptions in WiFi connectivity in order to support interactive applications from moving vehicles. ViFi's design is motivated by a rigorous measurement study of two vehicular testbeds in different cities. The goals of our study are to understand the fundamental challenges in supporting interactive applications and to explore opportunities that can be leveraged in this environment. We find that with current WiFi handoff methods clients experience frequent disruptions in connectivity even when they may be close to WiFi base stations. Handoffs in WiFi today are *hard*, i.e., at any given time, clients communicate with only one base station that is expected to offer the best connectivity. Hard handoffs are limited by gray periods in which connectivity drops sharply and unpredictably, the difficulty of estimating the continuously changing channel quality to near-by base stations, and the short-term burstiness of losses. Interestingly, we find that even though the impact on the performance of delay or disruption-tolerant applications is small, the user-perceived quality for interactive applications that need consistent connectivity deteriorates significantly.

We also find that *macrodiversity*, i.e., using multiple base stations simultaneously, can help reduce disruptions for vehicular clients. Its use has been successful in cellular networks. In our context, it overcomes the limitations of hard handoff because of independence of packet losses across base stations and even outperforms an ideal hard handoff strategy with future knowledge of loss rates. ViFi exploits macro diversity and opportunistic receptions by nearby base stations to minimize disruptions for mobile clients. The challenge in designing ViFi is in coordinating among base stations that opportunistically receive packets. This coordination must be nimble enough to allow per-packet processing and must use the communication channel efficiently. ViFi addresses this challenge using a simple yet effective probabilistic algorithm. Base stations that opportunistically overhear a packet but not its acknowledgment probabilistically relay the packet to the intended next hop, such that wasted transmissions are minimized. Unlike opportunistic routing protocols for wireless mesh networks, the per-packet overhead of ViFi is low enough to not require batching. Batching tends to delay packets and is thus unsuitable for many interactive applications. And unlike diversity-based handoff protocols for enterprise WLANs, ViFi places little additional demand on the inter-base station communication plane that is bandwidth limited in our setting. [3]

III. PROPOSED SYSTEM

A. Node Initialization and Node Discovery

In this module the nodes are assumed to be aware of their own location and the positions of their direct neighbors. Neighborhood location information can be exchanged using one-hop beacon in the data packet's header. The location of the destination could be transmitted by low bit rate but long range radios, which can be implemented as periodic beacon, as well as by replies when requested by the source. When a source node wants to transmit a packet, it gets the location of the destination first and then attaches it to the packet header. At each hop, the node that forwards the packet will check its neighbor list to see whether the destination is within its transmission range. The packet is transmitted as unicast in IP layer and multiple receptions is achieved using MAC interception. The use of DATA/ACK significantly reduces the collision and all the nodes within the transmission range of the sender can eavesdrop on the packet successfully with higher probability due to medium reservation. As the data packets are transmitted in a multicast-like form, each of them is identified with a unique tuple (src_ip, seq_no) where src_ip is the IP address of the source node and seq_no is the corresponding sequence number. Every node maintains a monotonically increasing sequence number, and an ID_Cache to record the ID (src_ip, seq_no) of the packets that have been recently received. If a packet with the same ID is received again, it will be discarded. Otherwise, it will be forwarded at once if the receiver is the next hop, or cached in a Packet List if it is received by a forwarding candidate, or dropped if the receiver is not specified.

B. Forwarding Candidate Selection

In this module one of the key problems is the selection and prioritization of forwarding candidates. Only the nodes located in the forwarding area would get the chance to be backup nodes. The forwarding area is determined by the sender and the next hop node. A node located in the forwarding area satisfies the following two conditions, it makes positive progress toward the destination; and its distance to the next hop node should not exceed half of the transmission range of a wireless node so that ideally all the forwarding candidates can hear from one another. The priority of a forwarding candidate is decided by its distance to the destination. The nearer it is to the destination, the higher priority it will get. When a node sends or forwards a packet, it selects the next hop forwarder as well as the forwarding candidates among its neighbors. The next hop and the candidate list comprise the forwarder list. The candidate list will be attached to the packet header and updated hop by hop. Only the nodes specified in the candidate list will act as forwarding candidates. Every node maintains a forwarding table for the packets of each flow identified as source-destination pair that it has sent or forwarded. The forwarding table is constructed during data packet transmissions and its maintenance is much easier than a routing table.

C. Reliable Call Back

In this module we leverage on the broadcast nature of 802.11 MAC: all nodes within the coverage of the sender would receive the signal. It simply sends out data for all broadcast packets. Therefore, packet loss due to collisions would

dominate the performance of multicast-like routing protocols. We just send the packet via unicast, to the best node which is elected by greedy forwarding as the next hop. In this way, we make full utilization of the collision avoidance. When the MAC layer fails to forward a packet, the function `mac_callback` will be executed. The item in the forwarding table corresponding to that destination will be deleted and the next hop node in the neighbor list will also be removed. As the location information of the neighbors is updated periodically, some items might become obsolete very quickly especially for nodes with high mobility.

D. Path Acknowledgement

In this module if a node finds that there are forwarding candidates in both directions, the data flow will be split into two where the two directions will be tried simultaneously for a possible route around the communication. If a forwarding candidate receives a packet that is being delivered or has been delivered it will record a reverse entry. Once the packet reaches the destination, a path acknowledgment will be sent along the reverse path to inform the node. Then, the node will give up trying the other direction. For the same flow, the path acknowledgment will be periodically sent. If there is another node upstream, the path acknowledgment will be further delivered to that node, and so on.

E. Path Security and Trust Management

We also compute the mobility of all the nodes and store the mobility in each respective node. this mobility is used for efficiently computing the stable links, the mobility computed will be with respect to change in the number of neighbor nodes at different instant of time. this mobility is stored in terms of percentage. the accumulated path will also be able to handle the mobility and decide the best and stable path. In this module when the nodes are computed for determining the forwarding nodes, these will generate unique keys and exchange the computation for the actual keys which will be done by the nodes itself, the forwarding nodes will check for computed keys and if it matches the forwarding node will be appended in the path, else node is not selected to be in the path. therefore the communication over this path will be secure.

IV. RESULTS

The concept of this paper is implemented and different results are shown below, The proposed paper is implemented in Java technology on a Pentium-IV PC with minimum 20 GB hard-disk and 1GB RAM. The propose paper’s concepts shows efficient results and has been efficiently tested on different Datasets.

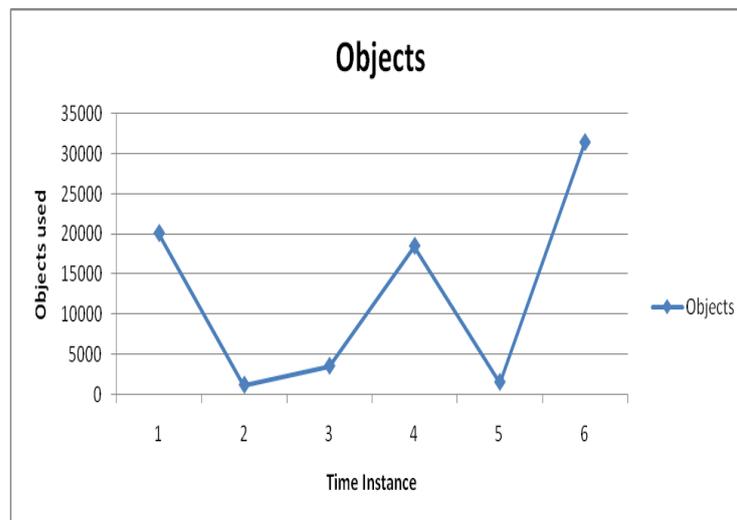


Fig. 1 Time taken by Node to initialize with objects

Time Instance	Objects
1	20121
2	1200
3	3562
4	18524
5	1549
6	31452

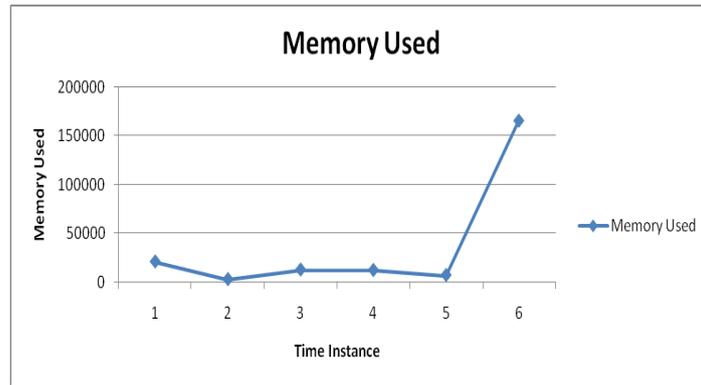


Fig. 1 Time taken by Nodes to initialize with Memory Used

Time Instance	Memory Used
1	20950.08
2	2888.666667
3	12707.2
4	12242
5	7077.2
6	165216



Fig. 3 Memory utilization by Node

Time Instance	Memory Free
1	60515
2	77326
3	197008
4	195024
5	195560
6	194255

V. CONCLUSIONS

In this paper, we address the problem of reliable data delivery in highly dynamic mobile ad hoc networks. Constantly changing network topology makes conventional ad hoc routing protocols incapable of providing satisfactory performance. In the face of frequent link break due to node mobility, substantial data packets would either get lost, or experience long latency before restoration of connectivity. Inspired by opportunistic routing, we propose a novel MANET routing protocol POR which takes advantage of the stateless property of geographic routing and broadcast nature of wireless medium. Besides selecting the next hop, several forwarding candidates are also explicitly specified in case of link break. Leveraging on such natural backup in the air, broken route can be recovered in a timely manner. The efficacy of the

involvement of forwarding candidates against node mobility, as well as the overhead due to opportunistic forwarding is analyzed. Through simulation, we further confirm the effectiveness and efficiency of POR: high packet delivery ratio is achieved while the delay and duplication are the lowest.

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