© 2016 IJEDR | Volume 4, Issue 3 | ISSN: 2321-9939

# Epidemic Routing For Mobile Adhoc Network Using Dijkstra's Algorithm

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***Abstract* - Wireless mobile ad hoc networks are self-configuring, dynamic networks in which nodes are free to move. Wireless networks lack the complexities of infrastructure setup and administration, enabling devices to create and join networks "on the fly" - anywhere, anytime. Mobile ad hoc routing protocols allow nodes with wireless adaptors to communicate with one another without any pre-existing network infrastructure. Existing ad hoc routing protocols, while robust to rapidly changing network topology, assume the presence of a connected path from source to destination. Given power limitations, the advent of short-range wireless networks, and the wide physical conditions over which ad hoc networks must be deployed, in some scenarios it is likely that this assumption is invalid. In this work, we develop techniques to deliver messages in the case where there is *never* a connected path from source to destination or when a network partition exists at the time a message is originated. To this end, we introduce *Epidemic Routing*, where random pair-wise exchanges of messages among mobile hosts ensure eventual message delivery. The goals of Epidemic Routing are to: i) maximize message delivery rate, ii) minimize message latency, and iii) minimize the total resources consumed in message delivery iv) using Dijkstra's algorithm for finding shortest range from source to destination. Through an implementation in the MATLAB simulator, we show that Epidemic Routing achieves eventual delivery of 100% of messages with reasonable aggregate resource consumption in a number of interesting scenarios.***

***Key words* - wireless network, mobile adhoc, epidemic routing, message delivery, Dijkstra's algorithm.**

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## I. INTRODUCTION

A wireless ad hoc network (WANET) is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, so the determination of which nodes forward data is made dynamically on the basis of network connectivity. In addition to the classic routing, ad hoc networks can use flooding for forwarding data. Epidemic routing is flooding-based in nature, as nodes continuously replicate and transmit messages to newly discovered contacts that do not already possess a copy of the message. In the most simple case, epidemic routing is flooding; however, more sophisticated techniques can be used to limit the number of message transfers. Epidemic routing has its roots in ensuring distributed databases remain synchronized, and many of these techniques, such as rumor mongering, can be directly applied to routing.

Our approach, called Epidemic Routing is to distribute application messages to hosts, called carriers, within connected portions of ad hoc networks. In this way, messages are quickly distributed through connected portions of the network. Epidemic Routing then relies upon carriers coming into contact with another connected portion of the network through node mobility. At this point, the message spreads to an additional island of nodes. Through such transitive transmission of data, messages have a high probability of eventually reaching their destination. Figure 1 depicts Epidemic Routing at a high level, with mobile nodes represented as dark circles and their wireless communication range shown as a dotted circle extending from the source. In Figure 1(a), a source, S, wishes to send a message to a destination, D, but no connected path is available from S to D. S transmits its messages to its two neighbors, $C_1$ and $C_2$, within direct communication range. At some later time, as shown in Figure 1(b), $C_2$ comes into direct communication range with another host, $C_3$, and transmits the message to it. $C_3$ is in direct range of D and finally sends the message to its destination. The overall goal of Epidemic Routing is to maximize message delivery rate and minimize message delivery latency, while also minimizing the aggregate system resources consumed in message delivery

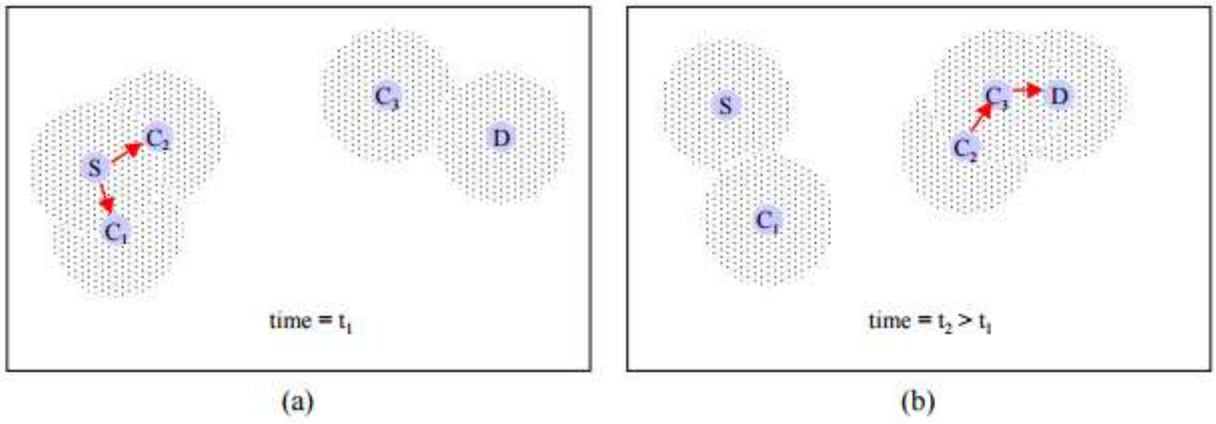



Figure 1: A source, S, wishes to transmit a message to a destination but no connected path is available in part (a). Carriers, $C_1$-$C_3$ are leveraged to transitively deliver the message to its destination at some later point in time as shown in (b).

## II. GOAL AND DESIGN ISSUES

The goals of Epidemic Routing are to: i) efficiently distribute messages through partially connected ad hoc networks in a probabilistic fashion, ii) minimize the amount of resources consumed in delivering any single message, and iii) maximize the percentage of messages that are eventually delivered to their destination.

## III. RESEARCH METHODOLOGY

Routing is the process of selecting best paths in a network. In the past, the term routing also meant forwarding network traffic among networks. However, that latter function is better described as forwarding. Routing is performed for many kinds of networks, including the telephone network (circuit switching), electronic data networks (such as the Internet), and transportation networks. This article is concerned primarily with routing in electronic data networks using packet switching technology.

***Dijkstra's Algorithm***

Dijkstra's algorithm is an algorithm for finding the shortest paths between nodes in a graph, which may represent, for example, road networks. It was conceived by computer scientist Edsger W. Dijkstra in 1956 and published three years later. The algorithm exists in many variants; Dijkstra's original variant found the shortest path between two nodes, but a more common variant fixes a single node as the "source" node and finds shortest paths from the source to all other nodes in the graph, producing a shortest-path tree.

Figure 2 the algorithm finds the shortest path between that node and every other. It can also be used for finding the shortest paths from a single node to a single destination node by stopping the algorithm once the shortest path to the destination node has been determined. For example, if the nodes of the graph represent cities and edge path costs represent driving distances between pairs of cities connected by a direct road, Dijkstra's algorithm can be used to find the shortest route between one city and all other cities. As a result, the shortest path algorithm is widely used in network routing protocols, most notably IS-IS and Open Shortest Path First (OSPF).

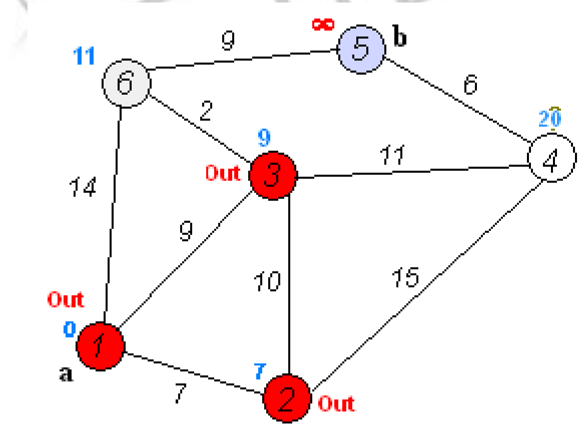



Figure 2: Dijkstra's algorithm to find the shortest path between *a* and *b*. It picks the unvisited vertex with the lowest distance, calculates the distance through it to each unvisited neighbor, and updates the neighbor's distance if smaller. Mark visited (set to red) when done with neighbors.

***Epidemic routing protocol Algorithm***

The epidemic routing algorithm guarantees message delivery, provided that the nodes of the network find opportunities to have a sufficient number of pair wise connectivities and data exchanges. The epidemic routing is a flooding-based protocol and relies upon the distribution of messages through the network for information delivery. In this method messages are distributed through connected parts of the ad hoc network and carried to other portions of the network through mobile nodes. Transitive transmission of messages results in the generated packets to be reached to their destinations with higher probabilities. Each node contains a local buffer maintaining generated messages and received messages on behalf of other hosts. When a message is received, it is placed in the buffer and tagged with a unique identifier. Each node stores the list of all entered messages IDs in a bit vector, called the summary vector. Whenever two nodes come into communication range of each other, exchange the summary vectors and determine the messages that they do not have. Then, each node requests from the faced node copies of the messages that it has not yet received. After this procedure, the nodes will have the same information in their buffers. This interchanging session is called anti-entropy.

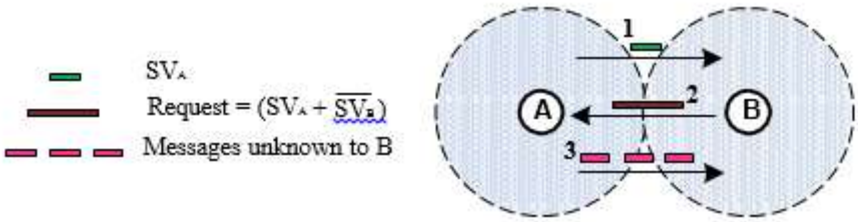
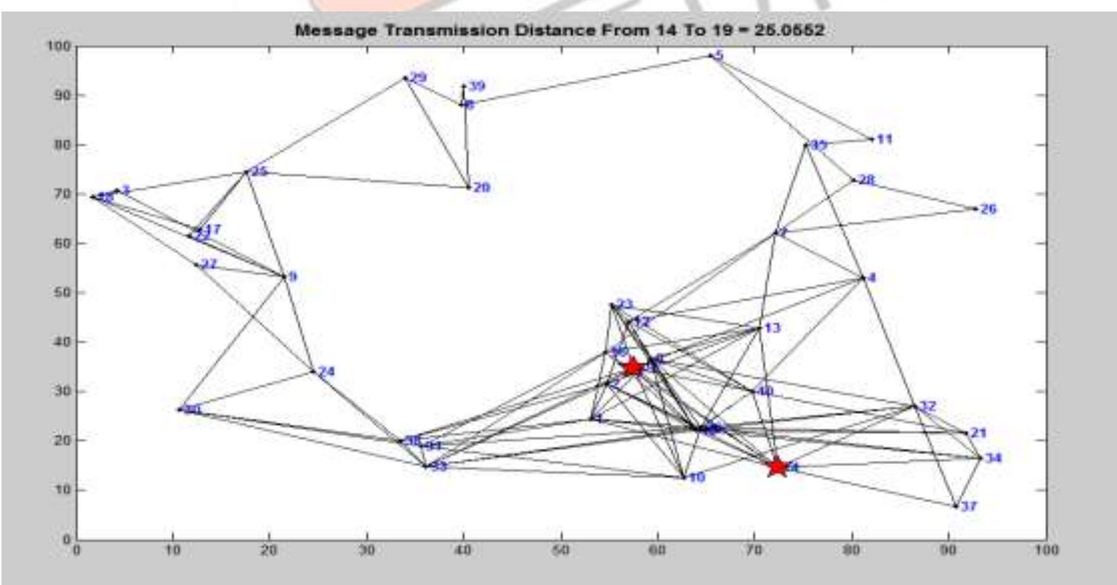



Figure 3: Exchanged messages in the epidemic routing protocol between two hosts, when meet each other.

As it is shown in Figure 3 , after meeting, node *A* informs node *B* about all the messages available at its buffer using $SV_A$. Then, through a logical *AND* operation between the negation version of its summary vector, $-SV_B$ (representing the messages which it needs), and that of *A*, $SV_A$ node *B* determines the messages that it does not have and requests them from node *A*. Then after, node *A* sends the requested messages to node *B*. This process is continued transitively whenever each node comes into communication range of other neighbors. To avoid redundant connections, each node maintains the list of hosts that it has met recently. Each node can independently decide to accept or reject messages sent from other nodes depending on the buffer size, trusted host list or etc. Assuming sufficient buffer space and time, this process guarantees message delivery.

## IV. RESULT AND DISCUSSION

In this thesis, we study information delivery which is a fundamental problem in Epidemic Routing for mobile adhoc network using dijkstra's algorithm. The overall goal of Epidemic Routing is to maximize message delivery rate and minimize message delivery latency, while also minimizing the aggregate system resources consumed in message delivery.
We implemented Epidemic Routing using the MATLAB simulator then the results are in the form of topology. Maximum number of nodes connected short range path from source to destination.




## V. CONCLUSION

In this paper, we develop techniques to allow message delivery in the case where a connected path from source to destination is never available in mobile ad hoc networks. While existing ad hoc routing protocols are robust to rapidly changing network topology, they are unable to deliver packets in the presence of a network partition between source and destination. For a number of compelling application classes, including mobile sensor networks and disaster recovery scenarios, nodes can be spread over wide geographical distances. Such wide dispersion makes it unlikely that a connected path can always be discovered, making it virtually impossible to perform message delivery using current ad hoc routing protocols. Thus, we introduce Epidemic Routing, where random pair-wise exchanges of messages among mobile hosts ensure eventual message delivery and by using Dijkstra's algorithm. The goals of Epidemic Routing are to finding shortest path, maximize message delivery rate and to minimize message latency while also minimizing the total resources (e.g., memory and network bandwidth) consumed in message delivery. Through an implementation in the MATLAB simulator, we show that Epidemic Routing delivers 100% of messages with reasonable aggregate resource consumption for scenarios where existing ad hoc routing protocols are unable to deliver any messages because no end-to-end routes are available. At the end show the all unreachable packets and successful packets.

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