International Journal of Advanced Research in Science Management and Technology
ISSN(Online)-2454-4159 Volume 4, Issue 6, June 2018

"Implementation of Reliable Routing in Wireless networks"

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Abstract— Opportunistic networks are one of the most increasing evolutions of MANETs. In opportunistic networks the existence of a simultaneous path is not assumed to transmit a message between a source and a destination. In opportunistic networks, path connecting to the mobile nodes never exits, mobile nodes transmit messages with each other when they get opportunity to transmit. Furthermore, nodes are not supposed to possess or acquire any information about the network topology. Routes are built dynamically, while messages are route between the source and the destination, and any possible node can opportunistically be used as next intermediate node, only if it is likely to bring the message nearer to the final destination. These features make opportunistic networks a challenging and promising field of research. In this paper we describe approach for routing in opportunistic networks, rendering old traditional routing protocols unable to deliver messages between hosts. Thus, there is a need for a new technique to route through such networks. We propose composite approach which combines concepts of Epidemic Routing and Probabilistic Routing techniques together with acknowledgement approach for better delivery. Our results show that composite routing protocol is able to provide better message delivery probability and less message delay.

Keywords— Epidemic Routing, Routing Opportunistic networks, Probabilistic Routing.

I. INTRODUCTION

Wireless network infrastructures have been exploring and expanding at a rapid pace throughout the globe. However, wireless networks may still be unavailable in many areas such as poor regions, sensors in underwater, or military operations. In order to provide networking support for situations where there are no directly connectivity paths, opportunistic network can be applied. Opportunistic network is a type of delay tolerant, intermittently connected network using an ad-hoc like structure. The extension of Mobile Ad hoc Network (MANET) is opportunistic network. Wireless networks" properties, such as disconnection of nodes, network partitions, mobility of users and links" instability, are seen as exceptions in traditional network. This makes the design of MANET significantly more complex an difficult [1]. When a node wants to deliver data to another node but there does not exist a direct connection between them, packets can be forwarded to intermediate participating nodes which aid in delivering the packet from the source to the destination. Opportunistic networks [2] are created out of mobile devices carried by people, without relying on any preexisting network topology. Opportunistic networks consider disconnections, mobility, partitions, etc. as norms instead of the exceptions. In opportunistic network mobility is used as a technique to provide communication between disconnected groups of nodes, rather than a drawback to be solved. Unlike a typical ad-hoc structure, however, opportunistic network assumes there is almost never a fully connected path between source to destination and the intermediate nodes may not encounter other nodes frequently or consistently[1],[7],[15]. In some cases, intermediate nodes may have to buffer the packets received for a long time. Due to the uncertainty of packet delivery success in opportunistic networks, numerous routing protocols were proposed to maximize packet delivery rate. One of the most well known routing protocols for opportunistic networks is a protocol called PRoPHET [1],[3]. Since the chance of having a directly connected path from a source node to the destination node is rare or non-existent, identifying potential follow. Intermediate carriers for the packets to be transferred are essential. Forwarding data to intermediate carriers that rarely encounter the destination node will, in the worst case, fail to deliver the data. PRoPHET [1] uses a predictability value, which is calculated using the history of encounters between nodes to evaluate the packet forwarding preference. While PRoPHET has shown decent results [1], there is still room for improvements. Due to the FIFO queuing nature of PRoPHET [1], packets may be dropped consistently when packets are forwarded to a few concentrated nodes. Packets may also be lost due to node failures or incomplete transmissions [3], And another protocol is Epidemic routing [2],[4],[11] in which a node A "infects" every contact B with packets that it has that B doesn't have. A summary vector is typically exchanged to determine the missing packets. Epidemic routing is unbeatable from the point of view of successful delivery as long as the load does not stress the resources (bandwidth, storage).

The design of efficient routing protocols for opportunistic networks is generally a difficult task due to the absence of knowledge about the network topology. Routing performance depends on knowledge about the expected topology of the network. We present a novel composite approach for routing in opportunistic network. We propose the use of probabilistic routing approach [1], and Epidemic Routing approach [2] assuming non-random mobility of nodes to improve the delivery rate of messages while keeping usage of buffer and communication overhead to low level.

It represents the currently working environment and behavior of different users. It helps to identify best suitable forwarders based on context information stored in summary vector about the destination. We can classify the main routing approaches proposed in the literature based on the amount of context information of users stored in summary vector they exploit.

II. RELATED WORK

Vahdat and Becker presente a routing protocol for intermittently connected networks named as Epidemic Routing [2]. This protocol relies on the theory of epidemic algorithms [4] by performing pair-wise information of messages between multiple nodes when they get in contact with each other to finally deliver messages to destination. Messages are buffered by Hosts even if currently there is no path to the destination available. An indexing of these messages known as summary vector is maintained by the nodes, and when two nodes meet they exchange their copy of summary vectors. After this exchange is one, each node can determine about other node that they have some message that were previously unseen to this node. In that case, the node sends request for messages to other node. This means unless buffer space is available, messages will sprayed like an epidemic of some disease within the network and nodes meet to "infect" each other. Each message contains a globally unique message ID to determine its previously seen status. Besides the standard and obvious fields of source and destination addresses, messages also contain a all hop count fields. This field same as TTL field in IP packets and it determines the maximum number of hops to send a message, and can be used to limit the utilization of resource of the protocol. Messages having hop count as one will only be delivered to their final destination eventually.

The usage of resources of this scheme is managed by the hop count placed in the messages, and the buffer space available at the nodes. If these are sufficiently large enough, the message will finally be propagated throughout the entire network if the possibility exists. They , however have shown that by selecting an appropriate maximum hop count, we can keep delivery rates high while the utilization of resource is lower in the scenarios used in their evaluation [2].

A communication model that is similar to Epidemic Routing is presented by Beaufour et al. [5], which focuses on data dissemination among sensor networks. The Pollen network proposed by Glance et al. [6] is also similar to Epidemic Routing.

Chen and Murphy proposed a protocol known as Disconnected Transitive Communication (DTC) [7]. It utilizes an application-tunable utility function for locating the current node in the cluster of currently connected nodes that it is best to forward the message to next node based on the needs of provided application. In each step, a node searches the cluster of currently connected nodes to find a node that is “closer” to the destination, where the closeness is generated by a utility function that can be optimized by the application to provide appropriate results.

Shen et al. proposed Interrogation-Based Relay Routing, a routing protocol for ad hoc space networks with Scientific Earth Observing (SEO) satellites [8], characterized with frequently changing topologies, and intermittent and sparse connectivity. The satellites interrogate with each other to learn more about current network topology and nodal capacity to generate intelligent routing decisions.

Work by Li and Rus [9] deal with a similar communication problem in disconnected networks. They proposed a solution in which nodes actively change their trajectories to create new connected paths to accommodate the data transmission. While this might work in military applications and in some of robotic sensor networks, in many scenarios it is not likely that nodes will move just to communicate with other nodes (if it is even possible to communicate the need for it).

Grossglauser and Tse looks at the utility to use the mobility of nodes to deliver messages to their destination with a slightly different point of view. One of major problem with ad hoc networks is that they scale badly due to interference of concurrent transmissions between nodes. Grossglauser and Tse show results by only doing local communications between neighbors and instead by relying on the movement of nodes to bring a message to its fina destination, this problem can be mitigated [10].

III. PROBABILISTIC ROUTING

Though the random way-point mobility model can be used in evaluations of mobile ad hoc protocols, real users will not likely be moving around randomly, but rather moving in a predictable manner based on repeating their behavioral patterns such that if a node has visited a location several times before, means there is chance of that its visit to that location again. We would like to make use of these kind of observations and this information to improve our routing performance by doing enhanced probabilistic routing using History of Encounters and Transitivity [1].

To accomplish this, we establish a probabilistic metric called delivery predictability, P(b,a) [0,1], at every node b for every known destination a. This indicates chances of this node delivering a message to destination. When two nodes meet each other, they exchange summary vectors which also contains the delivery predictability information stored at the each nodes. This information helps to update the internal delivery predictability vector as described below, and next the information in the summary vector helps to decide which messages should be requested from the other nodes based on the current forwarding strategy implemented.

Delivery predictability calculation [1]

The calculation of the delivery predictabilities divided in three parts. The first one is to update the metric whenever a node is encountered in network, so that nodes that are often encountered will have high delivery predictability. For this calculation refer to “(1)”, where Pinit [0, 1], is an initialization constant.

$$P(a,b) = P(a,b)_{old} + (1 - P(a,b)_{old}) \times P_{init}. \quad (1)$$

If a pair of nodes does not encounter each other in a while, they are considered less likely to be good forwarders of messages to each other, thus the delivery predictability values must age accordingly, after being reduced in the process which is calculated in following aging equation. Refer to “(2)”, where [0,1] is the considered as aging constant, and k is the number of time units that have elapsed since the last time the metric was aged. The time unit used can differ in some ways, and should be defined based on the current application and the expected delays in the targeted network.

$P(a,b) = P(a,b)old \times \gamma k.$ (2)

The delivery predictability also contains transitive property, that is based on the some observations as if node B frequently encounters node A, and node C frequently encounters node B, then node C probably is a good node to forward messages destined for node A. Refer to “(3)”, it shows the result of transitivity affects the delivery predictability, where [0, 1] is a scaling constant that decides how large impact the transitivity should be having on the delivery predictability.

$P(a,c) = P(a,c)old + (1-P(a,c)old) \times P(a,b) \times P(b,c) \times \beta.$ (3)

IV. EPIDEMIC ROUTING

Epidemic Routing [2], [4] provides final delivery of messages to destinations with minimum assumptions regarding the current topology and connectivity of the current working network. In fact, only periodic pair-wise connectivity would be required to ensure final message delivery to destination. Epidemic Routing provides the final message delivery to random destinations with minimum assumptions about the topology and approx. connectivity of the network. Final delivery of messages only depends on periodic pair-wise connectivity between all mobile devices. The Epidemic Routing approach is working on the theory of epidemic algorithms [6]. In this, each host maintains two buffers with itself, one for storing its originated messages and second for buffering of messages on behalf of other hosts. Each mobile device maintains summary vector that contains a very compact representation of currently stored messages in buffer.

The Epidemic Routing protocol works as follows. Epidemic protocol relies majorly upon the transitive distribution of all messages through ad hoc networks, with messages finally reaching their desired destination. Each host manages a buffer consisting of all messages that it has originated and the messages that it is buffering on behalf of other hosts. For better efficiency, a hash table is used to index this list of messages, it is keyed by a unique identifier associated with each message. Each host stores a bit vector known as the summary vector which indicates about the status of the entries in their local hash tables.

When two hosts come within communication range of one another, the host having smaller identifier initiates session with the host containing larger identifier. To avoid redundant connections in network, each host manages a cache of hosts. Anti-entropy is not re-initiated with other remote hosts that have already been contacted within a mentioned configurable time period. During anti-entropy, the two hosts does the exchanging of their summary vectors to identify which messages that are stored remotely have not been viewed by the local host. In return, each host then requests for copies of the messages that it has not yet viewed. In the design for the Epidemic Routing, it associates a unique a hop count, message identifier, and an optional ack request with each and every message. The message identifier is generated unique 32-bit number. This identifier is a combination of the a locally-generated message ID and host’s ID (16 bits each). However, if some hosts in an ad hoc network are assigned the similar subnet mask, then the remaining bits of the IP address is used as the identifier. In this implementation, the hosts in the ad hoc network are assigned ID’s statically. In this the hop count field determines the maximum no. of epidemic exchanges subjected to a particular message. While the hop count is same as the TTL field in IP packets, messages with one hop count will only be delivered to their desired end destination. The larger values for hop count more quickly it will distribute a message through the network. This will eventually reduce average delivery time for message, but will also increase the total resource consumption during message delivery. Thus, high priority messages should be marked with a high hop count, and most messages can be marked with a close value to the expected number of hops for a provided network configuration to reduce consumption of resource [2], [4], [11], [13].

V. PROPHET ROUTING

PROPHET [7], a Probabilistic Routing Protocol using History of Encounters and Transitivity makes use of current observations that real users mostly moving in a predictable fashion. If a user has visited a location several times before, then there is high probability of user to visit the same location again. PROPHET uses this information for improving performance of routing. To accomplish this in effective manner, PROPHET manages delivery predictability metric at each and every node. This metric represents message delivery probability of each host to the desired destination. PROPHET is similar to Epidemic Routing in some ways but it is enhanced with new concept of delivery predictability. Delivery predictably is the probability for a node in encountering certain destination. When two nodes come near, they also exchange their delivery predictability information and summary vectors. This information is used by nodes to update the delivery predictability information of metric.

When a message is received at node, node verifies availability of destination. If destination is unavailable, node stores the message to itself and upon each encounters with another device or nodes, it takes decision to transfer a message or not. Message is transferred to the other node only if the other node is considered with higher message delivery probability to the desired destination [7].

VI. COMPOSITE APPROACH

Composite routing protocol is a novel approach for effective and efficient routing in opportunistic network. In this approach we try to combine both the Probabilistic Routing approach an Epidemic Routing. A node forwards the message to the any two neighbors having maximum delivery predictability.

Delivery predictability, P(a,b)   [0,1], at every node a for each known destination b is ability of a node to deliver message to destination b node.

When two nodes encounters each other, they exchange their summary vectors which contains the delivery predictability information stored at each nodes. This information is used for updating the internal delivery predictability vector at nodes, and then the information in the summary vector is used to take decision about which messages to be requested from the other nodes as described below.

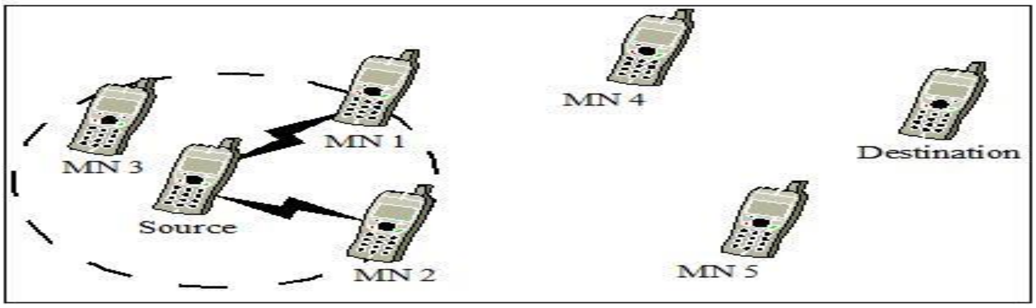
Each host manages a buffer consisting of messages that it has originated and all messages that it has buffered on behalf of other hosts. A hash table indexes this list of messages, it contains a key which is unique identifier associated with each message in table. Each host stores a bit vector called the summary vector which indicates the status of the entries store in their local hash tables. To avoid redundant connections among nodes, each host maintains a cache of previously encountered hosts. When two hosts meet by coming into communication range of one another, they exchange each other's summary vectors to determine the messages that are stored remotely but have not been seen by the local host. In turn, each host will requests for copies of messages that it has not yet seen.

When message reaches to desired destination, acknowledgment is sent in the same manner to the sender node that sent the message.

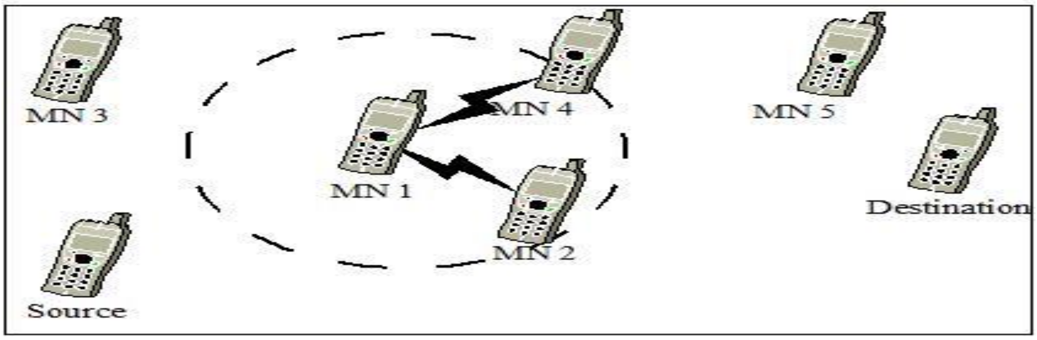
For example, while transmitting the message the source node searches the nodes in its range, thereafter by exchanging delivery predictability information he finds MN1 and MN2 having higher delivery predictability than other nodes in range therefore source node forwards current message to nodes MN1 and MN2 as shown in fig. (a). The nodes who received the message from source node again follow the same process as source node executed but

International Journal of Advanced Research in Science Management and Technology
ISSN(Online)-2454-4159 Volume 4, Issue 6, June 2018

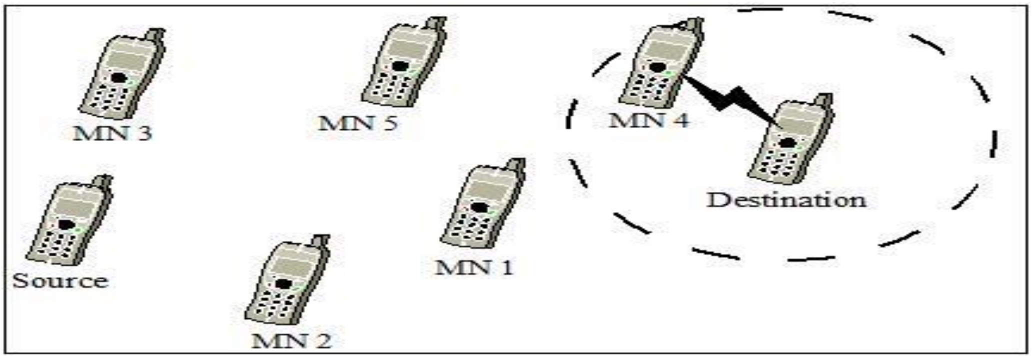
as shown in fig (b) MN2 is receiver of message from source as well as node MN1. MN1 and MN2 only exchanges their summary vectors. And by exchanging they know that they don't have new messages to exchanged so communication is stopped. In fig. (c) The node MN4 follows same procedure and message reaches to the desired destination.



(a)



(b)



(c)

Fig.1 Composite Routing.

VII. IMPLEMENTATION DETAILS

ALGORITHM

Step 1: Deploy 'N' number of nodes to generate wireless network

Step 2: Choose source node 'S' and destination node

Step 3: Create TCP/UDP connection among the nodes

Step 4: Declare default Energy value 'E' for All nodes in the network

Step 5: Declare trust value 'T' for All nodes present in the network

Step 6: Create Routing Table, one- hop neighbor for all nodes deployed in current Wireless network

Step 7: Create Routing path

For Node (i=0, i<=n)

If {

ISSN(Online)-2454-4159 *Volume 4, Issue 6, June 2018*

trust value = 0

assign the node to routing table Rt

if {

energy value <1

assign the node to routing table Rt

}

}

Get Rt

Step 8: Start the packet delivery by using the router derived above

Step 9: Update the counter credit value for Nodes in Rt incrementing value by one

Step 10: Destination receives packet from source.

VIII. PERFORMANCE EVALUATION

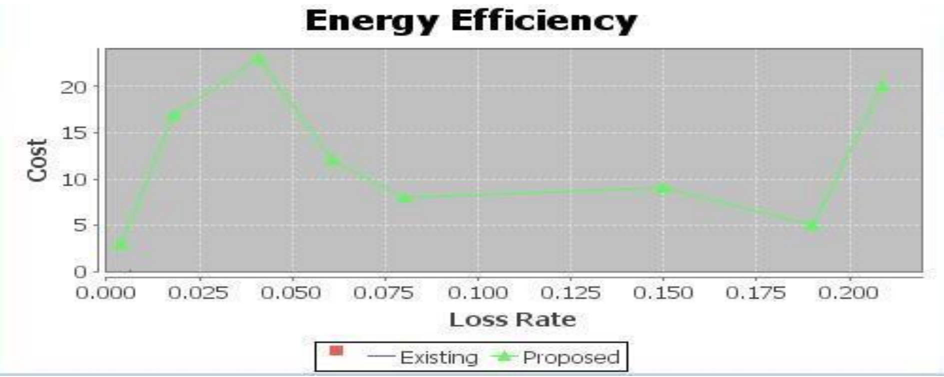
- SIMULATION SETUP

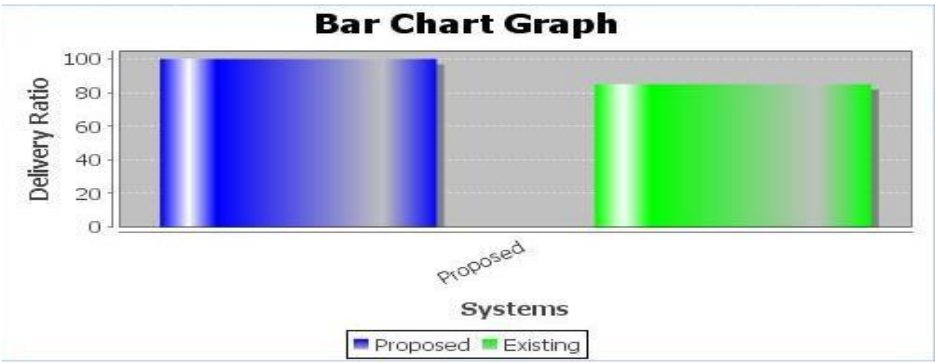
We have performed simulations using the tool ns-2 to evaluate our proposed ideas. The simulation parameters that we have chosen are summarized in table I.

Table 1. Simulation Parameters

Parameters	**Values**
Simulation Time	200ms
Monitoring Area	1500 X 500
Number of Nodes	30
Communication Range	30m
Length of Packets	100bytes

- SIMULATION RESULTS





IX. ADVANTAGES

- Increased message delivery rate than probabilistic or epidemic model.
- Considerable reduction in resource consumption than epidemic model.
- Black hole attack is almost removed since a message is sent to two different nodes having higher delivery predictability.

X. CONCLUSION

Thus we implemented a new composite approach for routing in opportunistic networks, rendering old traditional routing protocols unable to deliver messages between hosts. Our new proposed technique to route through such networks combines concepts of Epidemic Routing and Probabilistic Routing techniques together with acknowledgement approach for better delivery. Our results show that composite routing protocol is able to provide better message delivery probability and less message delay than probability an epidemic approach separately.

XI. FUTURE WORK

In proposed work delivery predictability is calculated by using three metrics as- time span between their meetings, number of encounters between nodes and transitive property of delivery predictability.

It will be interesting to evaluate delivery predictability by using different metrics like detailed context information of nodes.

REFERENCES

[1] Probabilistic routing in intermittently connected networks. SIGMOBILE Mob. Comput. Commun. Rev. 7(3):19–20, 2003.

[2] Amin Vahdat and David Becker. “Epidemic routing for partially connected ad hoc networks”. Technical Report CS-200006, Duke University, April 2000.

[3] Ting-Kai Huang, Chia-Keng Lee, Ling-Jyh Chen “PRoPHET+: An Adaptive PRoPHET-Based Routing Protocol for Opportunistic Network”. IEEE Proceedings,2011.

[4] Werner Vogels, Robbert van Renesse, and Ken Birman. “The power of epidemics: robust communication for large-scale distributed systems”. in proceedings of first workshop on hot topics in networks (HotNets-I),28-29 October 2002, Princeton, New Jersey, USA, oct 2002.

[5] Allan Beaufour, Martin Leopold, and Philippe Bonnet. “Smart-tag based data dissemination”. in First ACM International Workshop on Wireless Sensor Networks and Applications (WSNA02), June 2002.

[6] Natalie Glance, Dave Snowdon, and Jean-Luc Meunier. “Pollen: using people as a communication medium”, Computer Networks, vol. 35, no. 4,pp. 429–442, March 2001.

[7] Xiangchuan Chen and Amy L. Murphy. “Enabling disconnected transitive communication in mobile ad hoc networks”. in Proc. of Workshop on Principles of Mobile Computing, collocated with PODC’01, Newport, RI (USA), aug 2001, pp. 21–27.

[8] Chien-Chung Shen, Girish Borkar, Sundaram Rajagopalan, and C haiporn Jaikaeo. “Interrogation-based relay routing for ad hoc satellite networks”. in Proceedings of IEEE Globecom 2002, Taipei, Taiwan, November 17-21,2002.

[9] Qun Li and Daniela Rus. "Communication in disconnected ad-hoc networks using message relay". Journal of Parallel and Distributed Computing, 2003.

[10] Matthias Grossglauser and David Tse. "Mobility increases the capacity of ad-hoc wireless networks". IEEE/ACM Transactions on Networking, vol. 10, no. 4, Aug 2002.

[11] Ram Ramanathan, Richard Hansen, Prithwish Basu. "Prioritized epidemic routing for opportunistic networks". MobiOpp'07, June 11, 2007, San Juan, Puerto Rico, USA. Copyright 2007 ACM 978-1-59593-688-2/07/0006.

[12] Anders Lindgren, Avri Doria, and Olov Schel´en. "Poster: Probabilistic routing in intermittently connected networks". in Proceedings of The Fourth ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc 2003), June 2003.

[13] Chung-Ming Huang, Kun-chan Lan and Chang-Zhou Tsai. "A Survey of opportunistic networks". 22nd International Conference on Advanced Information Networking and Applications, Workshops, 978-0-7695-3096-3/08 IEEE DOI 10.1109/WAINA.2008.292.

[14] Elizabeth M. Royer and Chai-Keong Toh. "A Review of current routing protocols for ad hoc mobile wireless networks". IEEE Personal Communications Magazine, vol. 6, no. 2, pp. 46–55, Apr. 1999.

[15] Leszek Lilien, Zille Huma Kamal, Vijay Bhuse, and Ajay Gupta. "Opportunistic networks: The concept and research challenges in privacy and security".

[16] P. Marshall. The disruption tolerant networking program, 2005. http://www.darpa.mil /sto/ solicitations/DTN/briefs.htm.

[17] S. Burleigh et al. "Delay-tolerant networking: An approach to interplanetary internet". IEEE , Communications Magazine, June, 2003.

[18] A. Pentland, R. Fletcher, and A. Hasson. "Daknet: Rethinking connectivity in developing nations". IEEE Computer 37(1), 78-83, Jan 2004.

[19] P. Jacquet T. Clausen. "Optimized link state routing protocol (olsr)". October 2003. Internet RFC 3626.

[20] E.W. Dijkstra. "A note on two problems in connection with graphs". Numer. Math. 1:269, 271, 1959.

[21] Douglas B. Terry, Marvin M. Theimer, Karin Petersen, Alan J. Demers, Mike J. Spreitzer, and Carl H. Hauser. "Managing Update Conflicts in Bayou, a Weakly Connected Replicated Storage System". In Proceedings of the fifteenth ACM symposium on Operating systems principles, pages 172–183, December 1995.

[22] J. Burgess, B. Gallagher, D. Jensen, and B. N. Levine. "Maxprop: Routing for vehicle-based disruption-tolerant networks". In Proc. IEEE INFOCOM, pages 1–11, 2006.

[23] J. LeBrun, Chen-Nee Chuah, D. Ghosal, and M. Zhang. "Knowledge based opportunistic forwarding in vehicular wireless ad hoc networks". In Vehicular Technology Conference, 2005. VTC 2005-Spring. 2005 IEEE 61st, volume 4, pages 2289–2293 Vol. 4, May-1 June 2005.

[24] J. Leguay, T. Friedman, and V. Conan. "Evaluating mobility pattern space routing for dtns". In INFOCOM 2006. 25th IEEE International Conference on Computer Communications. Proceedings, pages 1–10,Barcelona, Spain, April 2006.

[25] Daddy Marasigan and Papa Rommel. "Mv routing and capacity building in disruption tolerant networks". In INFOCOM 2005. 24th Annual Joint Conference of the IEEE Computer and Communications Societies.Proceedings IEEE, volume 1, pages 398–408 vol. 1, March 2005.

[26] M. Musolesi, S. Hailes, and C. Mascolo. "Adaptive routing for intermittently connected mobile ad hoc networks". In World of Wireless Mobile and Multimedia Networks, 2005. WoWMoM 2005. Sixth IEEE International Symposium on a, pages 183–189, June 2005.

[27] T. Spyropoulos, K. Psounis, and C. S. Raghavendra. "Single-copy routing in intermittently connected mobile networks". In Sensor and Ad HocCommunications and Networks, 2004. IEEE SECON 2004. 2004 First Annual IEEE Communications Society Conference on, pages 235–244,2004.

[28] Yong Wang, Sushant Jain, Margaret Martonosi, and Kevin Fall. "Erasure coding based routing for opportunistic networks". In WDTN '05:Proceedings of the 2005 ACM SIGCOMM workshop on Delay-tolerant networking, pages 229–236, New York, NY, USA, August 2005. ACM.

[29] J'org Widmer and Jean-Yves Le Boudec. "Network coding for efficient communication in extreme networks". In WDTN '05: Proceedings of the 2005 ACM SIGCOMM workshop on Delay-tolerant networking, pages 284–291, New York, NY, USA, 2005. ACM.

[30] Chien-Shiu Lin, Wei-Shyh Chang, Ling-Jyh Chen, and Cheng-Fu Chou. "Performance study of routing schemes in delay tolerant networks". In AINAW '08: Proceedings of the 22nd International Conference on Advanced Information Networking and Applications - Workshops, pages 1702–1707, Washington, DC, USA, 2008. IEEE Computer Society.