A Survey: Evaluating Impact Of Varying Buffer Size And Message Lifetimes In A Disconnected Mobile Opportunistic Network Environment

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Abstract: In the present world Smartphone is growing up frequently and the importance of using the mobile opportunistic network may assist users of the mobile to communicate and exchange packets with each other wherever and anytime in a disconnected environment. The opportunistic mobile network is a category of a delay tolerant networks and complement of a mobile ad-hoc network and this network has a special feature which is rare connectivity. End to end connections for communication and transmission of data is missing here and they make use an approach known as a store, carry and forward method to send packets to an appropriate destination node. This paper, provide a general review of the Opportunistic network, architecture, problem, and present-day categorization of algorithms in the mobile opportunistic network that's adopted so far by the scholar. Finally, this survey paper explains human mobility models in opportunistic Network, and we bring to a close this paper with future work.

Index Terms: Opportunistic Network; Zero Information Protocols; Information-Rich Protocol; Human Mobility; ONE Simulator.

1. INTRODUCTION

NOWADAYS the use of mobile devices like Smartphone for communication has become popular growing quickly and become necessary for today's mobile users. The opportunistic network [1] is a family of Delay tolerant networks and human-centric communication where disconnection and delays arise due to problems like sporadic connectivity, high latency, and power failure. Disconnection and reconnection are extremely frequent as the mobile might shift away or turn off their power to save their energy and then links could interrupt at regular intervals and routing protocols of the opportunistic network have to preserve this state and forward messages to a proper destination. Packets will be routed from sender node to receiver through relay nodes and transmission of the message is achievable even if no joining paths are found between the existing nodes. Therefore, the routing and forwarding of a message in this network determined by the contact opportunity among the mobile nodes and routes are dynamically made even no specific path exists and mobiles are communicating and swapping messages with each other through an interface called Bluetooth or Wi-Fi. Because of its organization human-centric network considered as an excellent approach where an internet infrastructure such as access point and routers doesn't exist [1]. The opportunistic network is derived from Mobile ad - hoc network. Both the opportunistic mobile network and Mobile ad-hoc networks contribute certain well known features, such as infrastructure less, node mobility, and resource constraints. On the contrary, they have a several differences as made known in (Fig 1) MANET need a links that connect one end of the nodes to the other end. In MANET Before sending a message the two nodes construct a connection through TCP/IP protocol and exploit a technique called store forward. On the other hand human-centric network use Bundle protocol which supports store-carry and forward means and joining path may or may not exist in this category of networks [1]. Normally each of MANET routing algorithms Ad hoc on Demand Distance vector routing protocol and Dynamic source routing want an active path to disseminate a message to the selected end node. Therefore, the algorithms of MANET are failed to broadcast a message in the periodically and disconnected network. In consideration of its structure at a time of forwarding data through the network, the path results in packet loss.pop-up tool bar to modify the header or footer on subsequent pages.

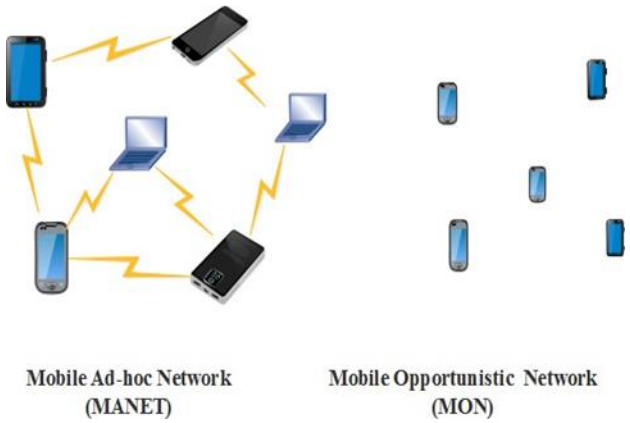

Fig. 1. *Demonstration of both MANET and Mobile Opportunistic Network.*

1.1 Architecture of Opportunistic Network Layer

The Initial architecture of opportunistic networks (Human-Centric) was proposed by (Kevin Fall, 2003). The architecture of opportunistic network does not suppose any compatibility with the concept of the internet and the view of this communication network nodes are separated into various regions and span. Traditional organization and structure of network does not appropriate and works in this area because this type of network creates establishments of a link from sender to receiver nodes before broadcasting information over the network. Opportunistic networks are mainly a wireless communication network which defines a new layer called bundle protocol layer which exists in between of the application layer and transport layer. Bundle layer protocol

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proposed for intermittently and long delay communication network. Bundle protocol is enabled with an approach known as store-carry and forward which pack together packets in their buffer and forwards to a next encountered node. The architecture can be used in the challenging environment where disconnection and disturbance is high, and also essential in developing country when installing a cellular network is requiring an expensive cost (Kevin Fall, 2003).

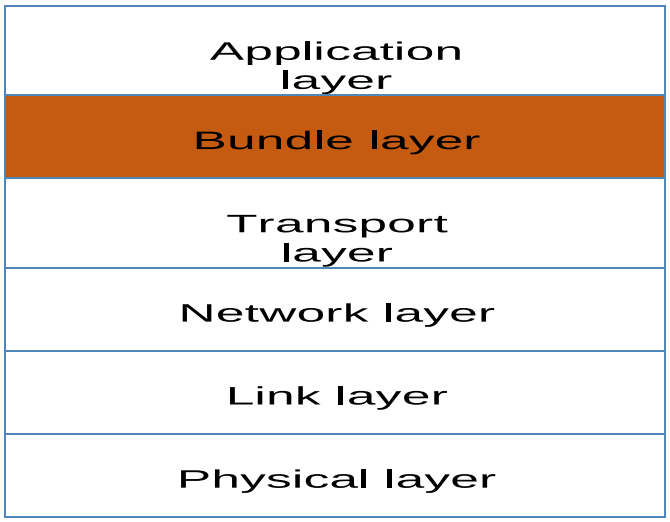

Fig. 2. *Opportunistic Network Protocol Layer [2]*

1.2 Store carry and Forward approach

(Laili Aidi and Jung Changsu, 2011) to guarantee delivery of messages to its proper receiver an opportunistic network use a new technique which is called the store, carry, and forward mechanism. If a sender node has a packet to forward but the path to the next hop is unavailable, it packs together the packets in their memory and waits until a proper upcoming adjacent node is encountered that can transmit the message nearer to the destination. In this case, after a long delay, the message created at source device reaches the receiver device by making use of intermediate node and exploiting mobility of devices to transmit packets. “Fig 3” shows a graphical diagram of store carry and forward technique

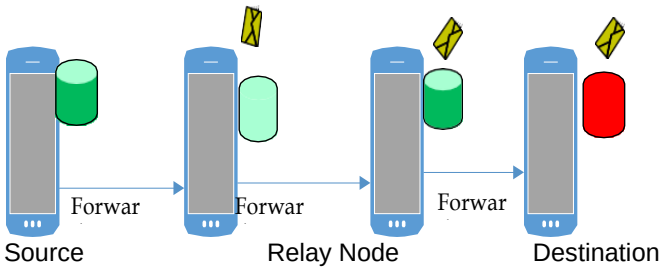

Fig. 3*. . Store carry and forward techniques [3].*

The above figure shows the idea of store-carry and forward techniques. Suppose a mobile device enabled with a store carry and forward mechanism and opportunistic routing protocols then a packet is created at sender node after sometimes the message broadcasted and copied to existing relay node when the two nodes come in the same communication range they begin to exchange uncommon and unfamiliar messages that they have in their buffer. In this manner after some delay, one of the intermediate nodes contact the receiver mobile device and packets are transmitted to a destination by making use of existing human mobility models (Pirozmand et al., 2014).

1.3 Challenges in Opportunistic Netowrk

One of the challenges of the Human-centric network (OppNet) is separation and reconnection of the mobile user and irregular contact time between one node and other mobile nodes due to the mobility of a user (Kevin Fall, 2003). The second challenges of an opportunistic network are security and storage limitation [2] [4] [21]. Since in opportunistic network, there is no administrator, each relay nodes act as the router and dynamically configures themselves when they came within the same coverage area. Therefore, attackers such as Man-in-the-middle interrupt the communication and confidentially data can be accessed by the unauthorized user and generate fake messages. For successfully delivery, a message to the proper receiver the mobile nodes in the opportunistic network require sufficient and adequate storage space for storing messages until they encounter another either intermediate nodes or receiver node. Then through this moment if a storage capacity of a node becomes full messages might be dropped and useful information may get lost. The structure of this paper is arranged as follows: section presents a general idea of recent existing routing protocols; section (III) gives an overview of related work, lastly section (IV) we remark conclusion and future works.

2 EXISTING ROUTING PROTOCOLS IN MON

In this section, we were going to discuss some of the active and popular routing protocols in the mobile opportunistic network that had been so far adopted in literature. As stated by (Yuan et al., 2016) a current classification of the Human-centric routing protocols is proposed. As stated by the above authors, existing algorithms of routing protocols in the opportunistic network is categorized into two sub domains.

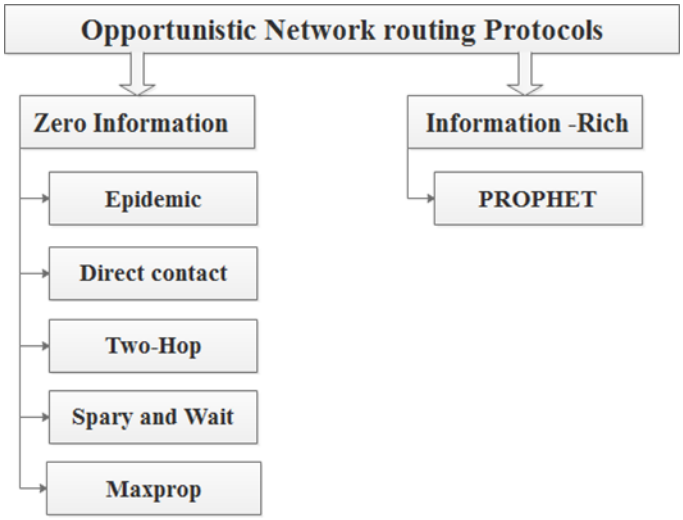

Fig. 4. *A recent classification of routing protocols in mobile opportunistic network [5].*

2.1 Zero Information Routing Protocols [5].

Authors (Yuan et al., 2016) propose a new and latest classification of a routing protocol in the mobile opportunistic network called zero information routing protocols. In zero information routing protocols, there is no recorded past history of the contact nodes and nodes make movement randomly without knowing prior knowledge of the path [5]. For instance, if a message is originated at source sender mobile nodes by the time of finding next hop no need of any contact knowledge about the node and packets are replicated to the neighbors mobile nodes in the uncertain path. Each time message is created it uses a flooding approach which broadcast and disseminates all the packets to every encountered node. A zero information routing protocols can be classified into four different categories and can be demonstrated as follows [5].

2.1.1. Epidemic Routing Protocol [6].

Epidemic routing protocol initial anticipated by (Vahdat and Becker, 2000) for broadcasting packets in the disconnected opportunistic network. It's occasionally called replication based algorithm because of when a message is originated at the source node it diffuses all the packets through the network. A sender node distributes packets, to every encountered node and replaces all the uncommon messages to the encountered nodes. Epidemic routing protocol enables every mobile node to exchange packets they do not have in common by checking summary vector (SV) of each node when they come in the same communication boundary and range [6]. The reasons of Epidemic routing protocol approving a delivery of messages to the receiver with the least average duration of time and, but as multiple packets are replicated in the network this protocol causes in consuming resource and cost [6].

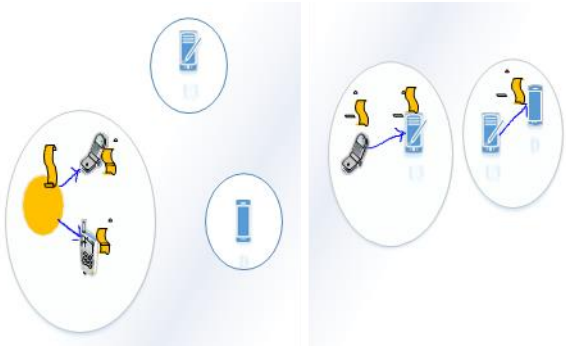

Fig. 5*. Epidemic routing protocol [6].*

Suppose mobile devices are enabled with Epidemic routing protocols and then a source node (S) wants to forward packets to a destination (D), but there's no available path between the two nodes source (S) to the destination (D) as in part (1). Therefore, according to this protocol, the source node(S) distributes a copy of generated packets to its closer nodes to user one (U1) and user two (U2) and all the relayed nodes are forward messages when they get together with other nodes under the same range. After some delay (t2) times, the intermediate node carrying the message comes in contact with another relay node in our case user three (U3) and they begin to exchange uncommon messages in their buffer. After some delay time, a U3 come in contact with the destination (D) and transmit a copy of messages as in part (2).

2.1.2. Direct Contact Routing Protocol [7].

Direct delivery routing protocol sometimes called single hop transmission and forwarding based routing protocol which transmits messages to a destination with direct to direct communication without any previous knowledge of node contacts. This routing protocol doesn't forward messages to an intermediate node or to any relayed nodes. A node that generates messages might forward to the encountered node if it's a destination of messages and source node store the packets in its buffer until it comes in the same communication range with the receiver mobile node [7]. The drawbacks of this protocol are a huge delay but do not consume any network resources, and least and poor delivery probability because only one message copies exist in the network and if the destination is not found, then the packet will get lost [7].

2.1.3. Two Hop Routing Protocol [8].

A two-hop routing protocol is one type of zero information routing protocol and forwarding based protocol. Sometimes a two-hop routing protocol is known as the First contact. The only sender node and the first encountered node are partakers of message forwarding to the proper destination. This routing protocol randomly decides and selects an intermediate node that will forward and carry messages to the receiver node. Whenever two nodes come in the same transmission range they begin to exchange packets and after a message successfully transferred, a first contact routing protocol allows the node to remove the packets from their storage spaces. The disadvantage of this protocol is when the relay node holding a message fails the packet will get lost [8].

2.1.4. Spray and Wait Routing Protocol [9]

This routing protocol is one of the commonly known routing algorithms and suggested by (Spyropoulos et al., 2005). The objective is to improve and reduce the delivery rate and latency of messages respectively by creating a replication limit throughout the network [9]. This protocol is classified under a zero information routing protocol and is an evolving of Epidemic routing protocol, and it does not suppose any prior knowledge about the mobility of the mobile user. The importance of this routing protocol is it reduces network congestion and resource consumption by creating message replication. The only difference between the epidemic and spray wait routing protocol is that spray and wait routing protocol distributes only restricted and limited number of packets in the network. According to the writers, spray and wait algorithm has two categories phases. The first phase called Spray phase where a limited amount of a message copies (L) are replicated through the network by a sender mobile node to every (L) encountered nodes and enters into wait until it gets confirmation from the receiver [9]. The second phase is called Wait Phase: If a message could not be transmitted to the destination in spray phase, every node holding copy of messages will maintain and enter into the direct transmission to the receiver [9]. Like Epidemic algorithm, spray and wait routing protocol uses a summary vector mechanism in order to check and receive the uncommon message during replicating messages and encountering times. Instantly the messages transferred to the destination node it generates an acknowledgment to confirm successful delivery of a packet.

2.1.5. MaxProp [10]

The MaxProp routing algorithm is one of the types of delay tolerant network protocol and was proposed by (Burgess, et al. 2006). Naturally, MaxProp is flooding-based routing protocol and designed to increase delivery ratio and reduce the latency of messages through the network. This protocol maintains the order of the messages and determines that which messages are first forwarded based on higher probability likelihood and which messages are dropped first when the buffer space became overflow based on minimum delivery likelihood [10]. This protocol uses a Dijkstra's algorithm [10] [11] which instruct the nodes to decide and plan a route with a history of the record between nodes and calculate a weight cost for each message to its neighbor. MaxProp also uses a complementary mechanism to send acknowledgments of delivered messages and notify them to eliminate from their buffer [10]. MaxProp routing protocol also prevents and enable the nodes not to accept same packets more than once.

2.2 Information-rich routing protocol [5]

According to (Yuan et al., 2016) information-rich routing protocols record history of past encounter and pre-existing contacts to direct and order a routing of the message to the destination with higher delivery and minimum cost.

2.2.1. PROPHET [12]

The PROPHET is an acronym which stands for Probabilistic Routing Protocol using History of Encounter and Transitivity algorithm in the opportunistic mobile network. It is a predication based routing which is proposed by (Lindgren et al., 2003) and based on replication of messages in the network like the epidemic, spray and wait protocols, but the only difference is each node calculates delivery predictability metrics in this protocol earlier than sending packets and the node with the higher delivery predictability to the destination will be chosen as intermediate nodes [12]. When two nodes come across same transmission range they begin to exchange their delivery predictability metrics. Every node in the network has information of another node and like Epidemic routing protocol whenever one node encounters another node they begin to exchange their summary vector which contains information about the packet such as message ID, destination ID, and message size. Before sending messages to another node initially this protocol enables the nodes to calculate a delivery predictability metrics and send the bundles to the node with greatest delivery predictability to the receiver node. If P (A, B)>P(C, B)), node A are chosen to forward messages to destination B rather than node C [12].

Performance Metrics in opportunistic network:

Commonly known performance metrics used for evaluating and investigating the performance of opportunistic network routing algorithms are a delivery ratio of messages and latency of packets, and overhead ratio [18] [20] [24]. These metrics are explained as follows: Delivery Ratio: Ratio of successfully delivered packets over the number of originally created packets. Defined and calculated by the following formula:

$$DP = \frac{\text{successfully delivered packets}}{\text{Generated packets at source node}}$$

Average Latency: This metrics defines the average latency of a message it takes to reach the receiver from the source node and can be defined by.

$$\text{Average latency} = \frac{MR(t2) - MG(t1)}{\text{Total number of DM}}$$

Where; MR= Message received at the destination with time t2. MG= Message Generated at source node with time t1. DM =Delivered Messages

Overhead Ratio: it's sometimes called communication cost and defined as how many duplicate messages are relayed to carry one message to the destination mobile and can be evaluated by the following method.

$$\text{Overhead ratio} = \frac{RM - DM}{DM}$$

Mobility Model in Mobile Opportunistic Network [13]

In disconnected network communication a mobility of nodes act as a crucial role to deliver packets to an appropriate destination after some delay and it's a rule that enables nodes to walk accordingly (Pirozmand et al., 2014). Some of existing opportunistic network mobility models considered and frequently used in times of performance evaluation is random Waypoint (RWP) where nodes move randomly to a random destination, Map-Based (MP) nodes move in the predefined path and Shortest Based Path Mobility model (SBPM) nodes use Dijkstra's algorithm to find out shortest distance amongst existing paths between the each node. As stated by author's [13] a simulation-based mobility is more essential than dataset based mobility in different aspects: trace based mobility model is recorded within a particular place like campus, conferences, and shopping and they are not manageable and flexible traces and it's impossible change the velocity and speed of nodes [13]. Opportunistic Network Environment simulation tool [14] [15] Opportunistic network Environment simulation tool (Ani Keranen, 2008) is an open source simulator tool which is proposed by Helsinki University. Its java based simulator used for evaluating various DTN routing protocols and consists of six well -known routing protocols and current routing protocols of delay tolerant network are not implemented in this simulation [14]. Investigation of the simulation and the result can be shown through visualization or reports. The Graphical User Interface (GUI) can be used for visualization [15]. A statistics of a report module consist and gather information such as created message, relayed message, successfully delivered message, average latency, and overhead ratio

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3 LITERATURE REVIEW

One of the main problems of the intermittently connected opportunistic network is lack of efficient routing protocol which forward packets with highest delivery rate and lowest average latency. Many researchers have been evaluated performances of several routing protocol algorithms in the opportunistic network under different parameters and scenarios. Authors [16] introduce a social characteristic network routing protocol algorithm (SONR) by making use of community detection and degree of centrality. In this paper, they first used community detection which optimizes the forwarding of packets to every encountered node and they make a use of the degree of centrality to improve the performance of routing protocol in

opportunistic networks and it also helps to direct the messages forwarding by considering community-based mobility model. Finally, in this paper [16] they evaluated the performance of the proposed algorithm with Epidemic, Spray and Wait routing protocol under different values of message lifetime and replication limit. [16] Result of simulation shows that with increasing the message lifetime Epidemic routing protocol have a higher delivery ratio and poorest average delay. Nevertheless, as the number of replication limit grows, the proposed protocol achieves better in terms of overhead ratio metrics. Another author [17] proposed a new routing protocol called space aware spray and transfer routing protocol (SSTR) which consider both temporal and spatial social characteristic like geographical place and speed of the mobile user, encountering interval, and contact time. In this paper they have used space aware delivery predictability calculation, space strategy deliver mean predictability and transfer approach to calculate a delivery predictability value to select the suitable relay node that can create an opportunistic communication from the source node to the destination node in a store carry and forward techniques. [17] By simulation results obtained the proposed algorithm shows better in the three performance metrics compared to the epidemic, spray and wait and PROPHET (Probabilistic Routing Protocol using History of Encounter and Transitivity) under variable values of message lifetime and network size. Authors [18] they have evaluated different famous delay tolerant routing protocols such as Epidemic, SprayWait, PROPHET (Probabilistic Routing Protocol using History of Encounter and Transitivity), and MaxProp by considering a multiple source nodes to a single destination communication scenario under variable values of time to live and changing (increasing and decreasing) the distance between the two end nodes. The outcome of simulation displays raises of time to live from 15 min to 60 min has a slight impact on the performance of each protocol. In the second scenarios as the distance between source nodes and the destination node become grows up, the delivery ratio is declined approximately 10% for all protocols [18]. A different author in [19] assessed performance of diverse routing algorithms in a human-centric network specifically Epidemic, Probabilistic Routing Protocol using History of Encounter and Transitivity, Time to Return and MaxProp protocols with variable values of message size, number of nodes and with different number of messages (message generation rate) in case of emergency scenarios like hurricanes, earthquakes and terrorist attack where infrastructure is broken and unreachable to use it. By the result obtained from the simulation, in all scenarios, MaxProp routing protocol shows greater performance than other routing protocols [19].

Authors [20] evaluated the impact of changing a number of mobile nodes by making a use of some human mobility models namely random walk model, random direction, and shortest path map based on Delay Tolerant Network routing algorithms. Authors, in this research paper, explore and investigate how do intermittently connected network performs under variable nodes and they evaluate a spread based routing protocol specifically Epidemic, Binary Spray and Wait, Spray and Focus, MaxProp, Probabilistic Routing Protocol using History of Encounter and Transitivity, and Resource Allocation Protocol for Intentional DTN. [20] By simulation it shown as a number of nodes increases, all routing protocols perform better delivery ratio in the shortest path map based mobility models because, in shortest path map based mobility, nodes move in the predictable path with the shortest distance and poorest in the random direction mobility model. Average latency of messages is increasing in terms of random walk and random direction mobility model for all routing protocols except Binary Spray and Wait and SprayFocus. Authors [21] proposed classification opportunistic mobile social network routing protocols schema based on encountering based routing where intermediate nodes implement packet forwarding based on record history of contacts. This paper describes social features like users characteristic and interest of user used for creating routing protocols in the mobile social network. People with similar interest are likely to contact with each other and access the same information. The authors of this paper clearly clarify and review social property like community detection to decide and improve the performance of packet forwarding in the opportunistic mobile social network by separating the network into communities or group. [21] In this paper some challenges of packet routing in the mobile social network are discussed such as unlimited resources and opportunistic contact of nodes. The authors in this paper investigate diverse algorithms of opportunistic network protocols namely Probabilistic Routing Protocol using History of Encounter and Transitivity, Epidemic, BubbleRap, SimBet, Friendship Based Routing and SMART with real trace datasets such as MIT Reality, DieselNet, and Cabspotting. By the result obtained from the simulation, Epidemic routing protocol has the highest delivery ratio, lowest average delay and largest average cost comparing to the other resting routing algorithms. Authors [22] proposed social aware routing protocols in delay tolerant network which chooses a relayed node and determines a weight based on local contact history to enhance routing efficiency. Authors of this paper used expanded ago centrality to ensure and improve message delivery efficiency in periodically connected mobile nodes. [22] The author's evaluated the effect of changing a number of mobile nodes on the performance of Epidemic and Friendship routing algorithms by making a use of real trace datasets. The result of simulation shows that under the variable number of nodes Epidemic routing protocol achieves better delivery ratio and worst delivery cost and the proposed algorithm achieve higher delivery efficiency than Epidemic and Friendship routing protocols. According to authors [23], a new routing protocol is designed which improve the performance of message forwarding in intermittently connected nodes which makes a use of controlling a number of message copies and Epidemic controlling which manages and determines the way of message copies. [23] The aim of this paper is to maximize delivery probability, minimize latency and reduce wastage of resources by making use of spraywait with Probabilistic

Routing Protocol using History of Encounter and Transitivity and Epidemic controlling routing protocol. Lastly [23] the authors evaluated the proposed routing protocol with famous routing specifically Epidemic, Spray and Wait, and Probabilistic Routing Protocol using History of Encounter and Transitivity under two different scenarios namely changing transmission ranges from (10-100m) and a number of nodes (10-120). Simulation result shows that the proposed routing algorithm shows better delivery ratio, lower average delay and minimum overhead ratio in both scenarios compared to the remaining routing protocols. Authors in [24] compared the performance of six routing protocols in disconnected mobile opportunistic networks namely First contact, Direct delivery, Epidemic, Probabilistic Routing Protocol using History of Encounter and Transitivity, Spray Wait and MaxProp algorithms under variable number of nodes, speed of nodes and message life times scenarios by giving consideration to two users mobility models random waypoint and shortest path map based mobility model. [24] End result of simulation experiment shows all the routing protocols do better in terms of delivering messages to the destination when the shortest path map based mobility model used and with changing the values of time to live all routing protocols shows approximately the same performances. Authors [25] stated an improved probabilistic routing protocol using history of encounter and transitivity routing protocols which make use of Epidemic routing protocols in forwarding packets to a destination in delay tolerant network. In this paper, the writers evaluated and compared the performance of the proposed routing protocol under varying a threshold forwarding count and threshold hop count with respect to PROPHET (Routing Protocol using History of Encounter and Transitivity) and Epidemic routing protocols. By simulation, it has shown the proposed routing protocol shows better delivery probability compared to the remaining routing protocols. Authors [26] investigated the performance of Epidemic routing protocol under two movement models called individual path based mobility that consider all the nodes within the same community (group) and can share common features and they also used a random waypoint mobility model where nodes move randomly from source to destination node. The writers of the paper have used two scenarios to assess the impact of mobile user movement model under variable a number of nodes and the speed of a mobile user. [26] The outcomes obtained from the simulation shows that Epidemic protocol does better delivery ratio, a minimum average latency of packets for individual path based mobility model than random waypoint and as a number of nodes grow up from 5 to 60 overhead ratio become high. Generally, to sum up, the ideas of different writers in this paper, we have placed the summary in the following table.

	Year	Objective	Methodology	Routing Protocol	Result
Md. Sharif Hossen and Muhammad Sajjadur Rahim	2016	The aim of the paper is to evaluate the performance of replication-based DTN routing protocols by: ✓ Varying numbers of mobile nodes. Under three mobility models namely: ✓ Random walk ✓ Random direction ✓ Shortest path Map based.	Delivery rate Overhead ratio Average Latency ONE simulator	✓ Epidemic ✓ B-SNW ✓ SNF ✓ MaxProp ✓ PROPHET ✓ RAPID	By simulation results all routing protocols, shows better delivery rate in the SPMB movement model than other movement models. ✓ Minimum overhead ratio and average latency for both B-SNW and SNF.
Abraham Mart´n-Campillo, J onCrowcroft and EikoYonek RamonMart	2013	The purpose of this research paper is to investigate the impact of different: ✓ Number of nodes ✓ Message size ✓ Number of message in opportunistic network	Delivery ratio Overhead ratio Delivery cost ONE simulator	✓ Epidemic ✓ TRR ✓ PROPHET ✓ MaxProp	✓ The result of the simulation shows that MaxProp routing protocol has a higher delivery rate.
Chan-Myung Kim, Youn- Hee Han, Joo-Sang Youn, and Young-Sik Jeong	2014	Aim of this paper is to evaluate the performance of social aware routing protocol which is based on local node's contact history. ✓ By varying number of nodes.	Delivery ratio Delivery cos t Delivery efficiency ONE simulation	✓ Epidemic ✓ Friendship	✓ Epidemic shows better delivery ratio ✓ Worst performance in terms of delivery cost. ✓ The proposed routing achieves highest delivery efficiency
Neena V V, and V Mary Anita Rajam	2013	Goal of this paper is to evaluate the performance of the Epidemic routing protocol under two mobility: ✓ Individual path based mobility. ✓ Random waypoint mobility model. By using two scenario: ✓ Varying number of nodes ✓ Varying speed of node.	Delivery rate Average latency Overhead ratio ONE simulator	✓ Epidemic	The result of simulation shows that Epidemic routing protocol performs better delivery for IPBM for both scenarios than random waypoint Model.
Pan da-ru, cao wei, liu xiong, sun jia-jia and shi xiao-jun	2012	Purpose of this paper is to improve the delivery ratio, by proposing a new protocol called SpecRouter and they evaluate with two scenarios: ✓ Transmission range ✓ Number of nodes.	Delivery ratio Average latency Overhead ratio Delivery utility ONE simulator	✓ Epidemic ✓ PROPHET ✓ Spray Wait ✓ SpecRouter	Result of simulation show that the proposed routing algorithm shows better performance in terms of two scenarios.
CHENG Gang, SONG Mei, ZHANG Yong, XING Yi-hai and BAO Xu-yan	2014	The aim of this paper is to evaluate the performance social opportunistic network using community based mobility model by varying: ✓ Time to Live value ✓ Replication limit.	Delivery ratio Delivery latency Overhead ratio ONE simulator	✓ SONR ✓ Epidemic ✓ Spray Wait	Simulation shows that with increasing the TTL Epidemic has higher delivery ratio and least delay. ✓ concerning message replication limit SONR performs better in terms of overhead ratio metrics

TABLE I. *SUMMARY OF LITERATURE REVIEW.*

4 CONCLUSION AND FUTURE WORK

This paper presents the concept of opportunistic networks, its architecture and popular routing protocols and challenges in opportunistic networks such as disconnection and reconnection, storage constraints, long delay, limited resource, and privacy. In this paper, we provide a quick indication of the recent taxonomy of routing protocols and expected to provide state of the art to individuals who are involved in following a research in this field. Finally, there is evidently the need for an efficient routing protocol in the future which defeats all of the opportunistic network challenges like security and privacy. We plan to conduct an experiment to show and evaluate the performance difference between zero information and information-rich routing protocols along with different simulation parameters.

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