Encounter based Routing in Opportunistic Networks

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ABSTRACT: *Opportunistic networks are wireless networks which may be used in areas where large delays are presented between data transmission also long distances may be handled by nodes. In these networks nodes may communicate with others through intermediate nodes. Data transmission takes place via various routing protocols. An opportunistic network provides standard routing protocols that are epidemic routing, prophet routing, spray and wait routing etc. In this paper these protocols are discussed with their own pros and cons. After that a comparative analysis between them is also presented.*

Keywords**:** *Opportunistic networks, epidemic, prophet, spray and wait, store -carry -forward and movement models etc.*

I. INTRODUCTION

TCP/IP neglects to work appropriately or may even quit working totally when there is no path between source and destination. Due to such circumstances, a more up to date system has developed which worked in the environment in which no end to end path is present between nodes. This system is called as opportunistic Network (OPPNET). OPPNET is a discontinuously associated Network where the end-to-end ways may not exist and correspondence routes might just be accessible through time and versatility. Because of absence of reliable availability, OPPNET uses store carry and forward mechanism i.e., in the wake of accepting a few bundles, a node carried them until it contacts another node and afterward advances the messages. Since OPPNET routing depends on portable nodes to forward bundles for one another, the directing execution (e.g., the quantity of messages conveyed to their destinations) relies on upon whether the nodes interact with one another or not [1].

1.1 Characteristics in Opportunistic networks: There are various characteristics of OPPNET. Some of them are as follows:

Intermittent connectivity	• No end to end path
High Latency	• Any two nodes may never meet each other.
Low Data Rate	• Due to the long latency of data delivery.
Disconnection	• It is hard to find an end-to-end path.
Long Queuing Delay	• Because of the disconnection.
Dynamic Network Topology	• Different types of user behavior will result in dramatically different network conditions.

Fig. 1: Characteristics of OPPNET

1.2 Routing protocols in Opportunistic networks: OPPNET provides following routing protocols that uses store carry forward mechanism to forward the packets these are:

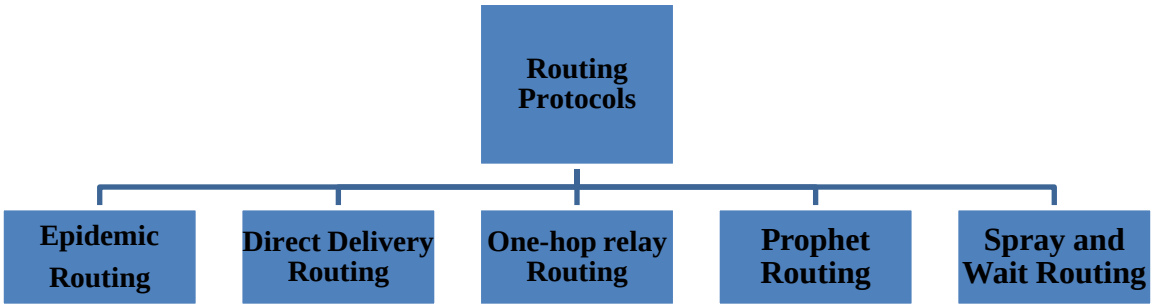

Fig. 2: Classifications of Various Routing Protocols in OPPNET

i. Epidemic routing: In epidemic routing whenever two nodes come across with one another then they replace all the messages currently they carried. When contact duration is over they hold the same set of messages. When this process repeated multiple times then packets are flooded in network so drawback of this scheme is that flooding creates overhead during transmission [2].

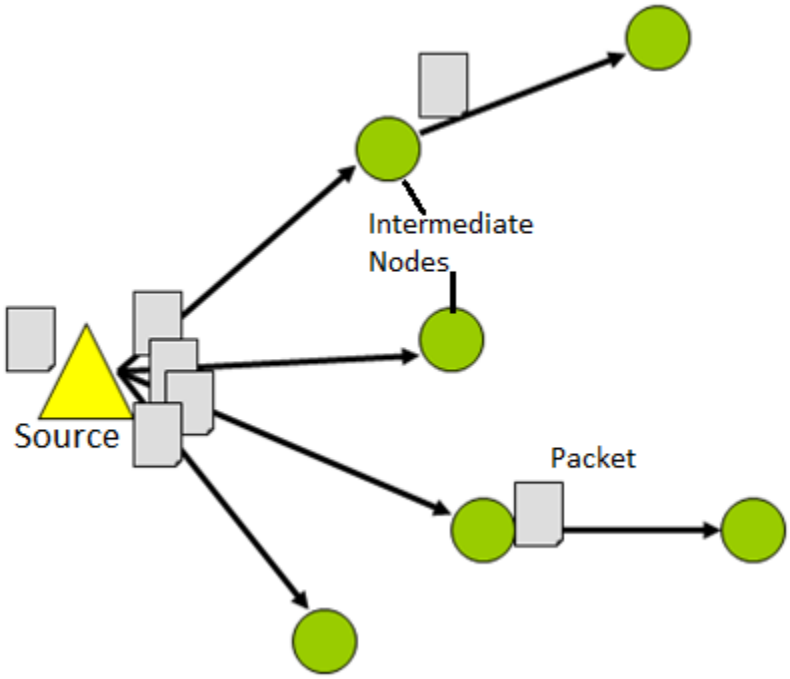

Fig. 3: Epidemic routing

ii. Direct delivery routing: This data delivery scheme is one of the simplest possible where a source delivers a packet to a destination when it comes in direct-contact [3].

iii. One-hop relay scheme: In this scheme, the source delivers a packet to an intermediate node, which in turn delivers the same to the destination. In one hop relay scheme one extra copy of messages are transmitted in network as compare to direct delivery routing [3].

iv. Prophet routing: Past contacts and Transitivity are used in prophet routing protocols to find the next forwarding node [3].

v. Spray and wait scheme: In this routing there are two phases:
Spray phase (only once): L message duplicates are at first spread to L unique nodes.

Wait phase: If the destination is not come to in the spray stage, the L nodes conveying a message duplicate perform direct transmission [6].

II. RELATED WORK

In [8] concentrated on the basic weakness of social-aware directing and sending plans in OPPNET. So as to survey framework delicacy from group structure perspective, we have proposed the CVA issue, broke down the minimization of NMI measure also, gave key bits of knowledge into the choice of hubs that are significant to the group structure.

In [9] studied opportunistic network architecture and investigated the social measurements from encounter, social elements and social properties, individually. They demonstrated that experience data is essential embodiment of social measurements in opportunistic networks. Social measurements, for example, social components and social properties, including social diagram properties what's more, group structure. We then expand the directing techniques from alternate points of view in like manner: experience based steering procedures, directing plans as per social includes and steering techniques in light of social properties.

In [10] proposed an routing mechanism where the transmission heading and the quantity of the duplicates are progressively controlled by data of the entire circulation rate of the nodes.

In [11] proposed content based message forwarding routing that uses predicates for nodes to promote their interests. Predicate parameter was used to indicate the delivery rate of messages. When nodes receive predicate parameter then they updates their predicate value after successful.

In [12] presented location based routing that abuses the normality implanted in human moving example. As human developments regularly display a high level of redundancy including consistent visits to specific spots furthermore, normal contacts amid day by day exercises, they predict a mobility of nodes for future by tracing movement of nodes.

In [13] authors performed comparative analysis on classical routing protocols of OPPNET. To analyze routing protocols authors uses performance measure parameters like delivery ratio, average number of hop count and overhead ratio to find out energy efficient routing protocol.

In [21] authors proposed SONR routing based on social aware routing that uses markov chain model to calculate delivery probability of each node and find optimal node with maximum delivery probability. Proposed protocols were compared by epidemic routing and spray and wait routing.

In [14] proposed routing protocols that uses the concept of cooperation called GAR. GAR incorporates a helpful message exchange plan and a cushion administration methodology. In the helpful message exchange plot, the constrained transmission capacity is considered and the message exchange needs are intended to boost the enhanced conveyance likelihood. In the cradle administration technique, by considering the imperative of support space, they proposed an agreeable message reserving plan and the dropping request of the messages is intended to minimize the diminished conveyance likelihood.

In [15] proposed a routing principle that uses mathematical model to find out optimal routing. Proposed scheme was based on social grouping in which data transmission take place when social interaction between nodes are high to forward the packets. Proposed scheme was energy efficient with low overhead ratio.

III. PROBLEM FORMULATION

The present research work focus on an algorithm to measure contacts between nodes and measure frequent nodes. EBR is the routing in which encounters between nodes are measured with the help of calculating contact between nodes occurs when two node come in range of each other and perform message transmission, calculating most frequent nodes, which are actively participating in message transmission process. Most frequent nodes have highest message transmission rate. By discovering contacts and frequent nodes we can easily improve delivery ratio and reduce replication of packets.

IV. EVALUATION OF SOCIAL AWARE ROUTING PROTOCOLS

In this section evaluation of existing routing strategies are presented with different parameters and their features based on social environment.

TABLE I ROUTING PROTOCOLS EVALUATION WITH NETWORK PERFORMANCE PARAMETERS

Sr. No.	Routing protocols	Centrality	Similarity	Energy
1	CAR	Present	Absent	Efficient
2	BUBBLE	Present	Absent	Not efficient
3	GAR	Present	Absent	Efficient
4	SONR	Present	Absent	Efficient
5	Prohet	Absent	Present	Not efficient
6	MaxProphet	Absent	Present	Not efficient
7	Simbet	Present	Present	Not efficient

In Table I evaluation of various existing routing protocols are presented. This evaluation was done using performance parameters like centrality, similarity and energy efficiency. Routing schemes such as CAR, SONR and GAR was energy efficient routing protocols.

In Table II routing protocols are classified based on their social features.

TABLE II ROUTING PROTOCOLS BASED ON SOCIAL FEATURES

Sr. No.	Routing protocols	Metric	Features
1	Social-aware routing	Awareness likeness	Uses user enthusiasm to improve the utilization of substance replication.
2	Social greedy	community space	Makes the information comparing so as to send choices the social separation, which is figured by the comparability of qualities.
3	Homophily-based routing	Homophily	Spreads most comparable information things among companions and most distinctive information things to outsiders.
4	Social feature-based routing	community attributes	Conducts hypercube and ascertain highlight separation to quantify the closeness as steering utility.

IV CONCLUSION

OPPNET provides various routing protocols like epidemic, prophet, spray and wait, direct delivery and first contact to forward data through intermediate nodes. In this paper these protocols are discussed. After that literature review of encounter based routing has been presented. In EBR various encounters occurred during data transmission are measure. On the basis of these encoders next forwarding nodes are selected. EBR improves delivery ratio while message delay increases because of measurement of encounters.

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