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Energy Efficient Backbone Based Routing [EBR] in an Intermittently Connected Wireless Network

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ABSTRACT

The scope of the paper is to provide seamless communication between partitioned rescue workers in disaster relief operation . Disaster such as tsunami , hurricane , earthquakes etc is unpredictable and when it happens it could cause damage to lives , livestock and property and also destroy the existing communication infrastructure which result in long delay in emergency operation .Establishing communication between victims ,rescue workers who get partitioned due to mobility and other volunteers without using infrastructure is challenging task . since portable devices which have wireless capability and limited resources ,are used to communicate with one another the communication should be reliable and energy efficient . Existing wireless routing can't route the packet when the network gets partitioned, because it fixes the path before starting data transmission .This paper proposes a new opportunistic routing technique called ***backbone base routing*** *[BBR] to route the packet from source to destination even if the route between source to destination is currently not available . this paper ensures that even though node's mobility causes network partition it takes the advantages of the same to provide connectivity among partitioned parts of the network.Simulation results shows that EBR achieves high data delivery rate with reduced energy consumption.*

I. INTRODUCTION

People encounter dangers induced by natural disaster such as earthquakes , floods , hurricanes etc . and man-made disaster such as fire accident , terrorist attack etc.they both causes damages to lives ,property , livestock and other living things. it could also destroy the communication infrastructure partially or entirely .Destruction of communication infrastructure causes delays and errors in emergency response and disaster relief operations resulting in lose of life and damage to property. The advent of great improvement in wireless technology and portable devices such as laptop,PDA, smart phone ect . influences the people to use portable devices to communicate with one another.as An emergency and disaster relief efforts highly depend on wireless networks communication failures affect the rescue operation. Adhoc networks play an important role in disaster relief operations which is an infrastructureless network consisting of collection of wireless devices such as laptop ,PDA smart phone etc.

MANET routing protocols[1,2] assumes that the end to end path between any pair of nodes is available before starting transmission . During transmission if path breaks due to node mobility the packet would not be get transmitted unless an alternative route is available which result in low packet delivery ratio.when path break occurs it does not consider the opportunities provided by other nodes which are able to receive the packet when

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they are within the transmission range of the transmitting nodes and it takes broadcast nature of the transmission as one to one wired path.it assumes that path break happens due to movements of node and it does not consider that node mobility can make connectivity between partitioned networks even though end to end path is not available at the time of transmission which result in low packet delivery ratio.Due to this fact Adhoc Routing protocols are not applicable to scenarios where networks suffer from frequent connectivity disruptions ,which means that there is no gurantee that an end-to-end path exists between a given pair of nodes at a given time .a lot of research work is focusing on how to route the packet in the scenarios where network gets partitioned due to node mobility and end to end path won't be available, which is called intermittently connected network or opportunistic network.

1.1 Opportunistic Network

An opportunistic network is a type of wireless network that does not require end-to-end connectivity and is characterized by highly variable delays and intermittent node connections. Typically , an opportunistic networks are used in situations where long delays or even some lost data do not greatly affect final applications .some examples are the ZEBRANET[3], a sensor network used for tracking wild life , and some experiments involving communications between cars in urban scenarios, where vehicles are used as mobile nodes[4].

An opportunistic network behaves differently than an ad hoc network, since it is not required to establish an end-to-end path for message delivery. It takes the advantage of opportunistic contacts and mobility to provide connectivity to nodes that would otherwise be completely disconnected from the rest of the network [5]. In conventional ad hoc networks, nodes act as routers and would fail to deliver messages without an established path to the destination. On the other hand, a DTN uses a technique called **store-carry-forward**, in which nodes store and carry a message until it can be delivered to its destination

or forwarded to another node that may do it. Therefore, it requires specific routing (or forwarding) protocols for its operation in this type of architecture information is delivered via a store –carry and-forward approach wherein information is temporarily stored at intermediate nodes for eventuall delivery to the destination node. While this approach is expected to incur certain delay in sending information there is a still a need to minimize this delay ,especially in time constrained networks such as a network in the area of a disaster. The literature on intermittently connected mobile networks frequently assumes that contacts provide enough capacity for two nodes to exchange whatever the amount of data they have. This kind of architecture is proposed to support communications among ordinary people, directly involved with disaster , in order to provide relevant information by using text or images. networks in extreme environment such as disaster area are unreliable because of the damaged communication infrastructure .network connectivity between user may not be available or there is none at all.in such cases distruption tolerant ad-hoc networks can be deployed to provide end to end connectivity between users although dtn is expected to incur certain delay in sending information there is a still need to minimize the delay latency ,especially in time constrained networks such as a network in the area of disaster. Since Dtn routing utilize the opportunistic contacts among its users, the presence of users in the affected area is important . thus This kind of architecture is proposed to support communications among ordinary people, directly involved with disaster , in order to provide relevant information by using text or images . In [6], the performance of severalDTN routing protocols was evaluated for an emergency Scenario.many of the research work proposed that node's mobility is the one of the main reason for frequent

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disconnection among nodes which result in packet loss. this paper proposes new routing methodology called energy efficient Backbone based routing[EBR] involves only a set of nodes as next hop relays without involving all the nodes as relays.

II. RELATED WORK

The Epidemic protocol [7] tries to disseminate copies of messages across the network. All nodes carrying a message,when meeting another node, exchange the messages they have in memory. This technique ensures high tolerance to node failures by replicating a significant number of messages among several network nodes, which eventually reduces the time for message delivery. However, network resources can be consumed quite voraciously The Prophet protocol [8] assumes that encounters of DTN nodes are rarely totally random. Thus, it uses a metric called

delivery predictability that indicates the probability of a node to deliver a message to a given destination. Nodes replicate messages only to other nodes that have a better chance to

deliver them. This approach reduces message replications and hence the consumption of network resources, such as buffers and bandwidth. The Maxprop protocol [9] sets a priority order for queued messages. Messages to be discarded and those to be transmitted are then ranked according to each priority. Priority is based on the delivery probability to the destination, which

is inferred according to historical data and other auxiliary mechanisms, such as a list of intermediate nodes and notifications of new messages. Several methods can be used to set this priority, including the rate of success in defining a particular intermediate node for some destination. This protocol generally improves message delivery probability.

III. PROPOSED WORK

In our proposed work as in figure 1a &1b when a node wants to send a packet to another node the source selects a set of node from its immediate neighbors which has capability to receives and cover the maximum number of node in 2-hop, to act as relays it does not select all the nodes with its direct transmission range. this process will be repeated until receive the acknowledgement from the destination or the packet's TTL field get expired .in most previous work even though the packet get reached the destination the nodes involved in the transmission has to keep the packet until packet's TTL get expired which leads to quick depletion of memory space . in order to avoid this acknowledgement control packet is used to not to keep the packet after the packet get transmitted. . even though sending and receiving acknowledgement eat energy , compared to keeping the packet in memory and retransmitting the again when retransmitting opportunity arises even if the packet get reached the destination , acknowledgement takes less energy .

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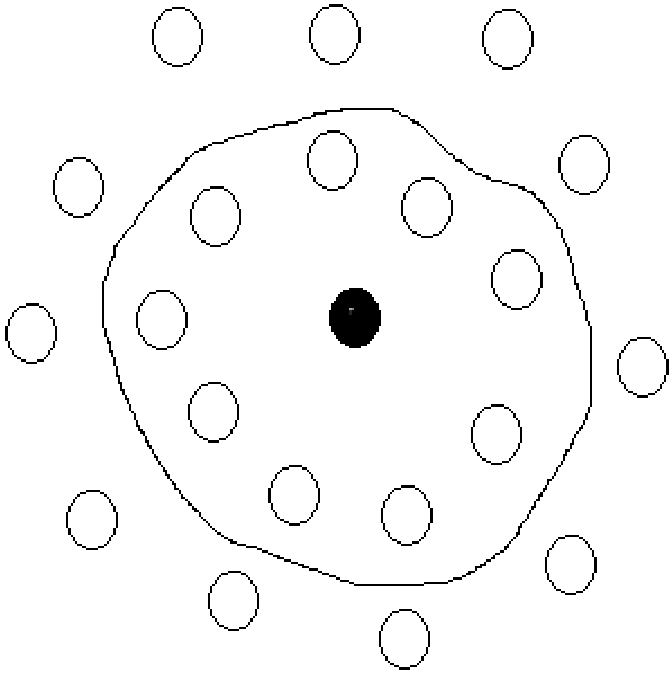

Fig1a. Shows nodes partitioned part of the network and nodes inside the circle are 1-hop neighborsand outside are 2-hop neighbors .

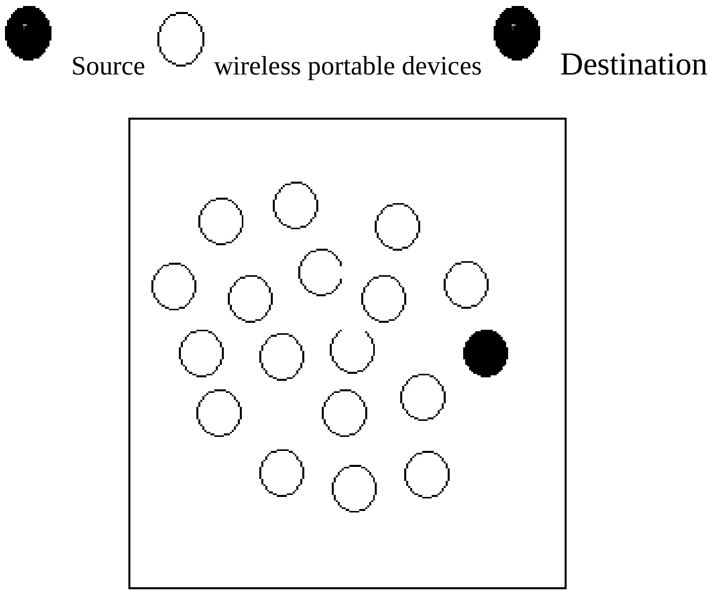

Fig1b Partitioned Part Of The Network Where Destination Is Located

3.1Algorithm

assumption : each node able to detect its immediate neighbors(1-hop) and calculate its total number of 2-hop neighbors through its 1-hop neighbors through beacon messageswhich sent periodically . source 'S' wants to send the packet to destination 'D' . each packet includes source ID, destination ID. forwarding list which

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contains ID of the nodes that selected as relays.our work assumes each node contact many nodes simultaneously.

Step1: if Destination D is not within the direct transmission source S select a set of nodes N from its 1-hop neighbors which has capability to receive the packet without error and cover maximum number of 2-hop neighbors.

step2 : source node 's' includes only selected node id in the packet header to further forward the packet and retransmit the packet.

step 3:each forwarding node take responsibility of source node . goto step 1.

step 4: once node's id is included in the packet header it would not be selected again because each selected node has a copy of the packet.

step 5: once the packet get reached the destination it sends back acknowledgement (ack) . Destination would not select any forwarding list to send the ack. Nodes with in the direct transmission range of destination receive and retransmit the ack . After receiving the ack each node delete the copy of the packet kept in its buffer it won't keep the packet until packet's TTL field get expired.

IV. PERFORMANCE EVALUATION

epidemic routing protocols involve (n-2) nodes to send a packet from one node to another node which leads to high energy consumption . even though it achieves high packet delivery ratio it incurs quick depletion of energy which result in network failure . energy is one of the limited constraints which make the network operational. since network life time mainly depends on the battery level of the node our proposed work involves only a set of nodes to act as relays and achieves the same packet delivery ratio with less energy consumption compared to epidemic routing protocols . our proposed which gives the network more lifetime .

V. CONCLUSION AND FUTURE WORK

As far as wireless portable devices are concerned energy is a precious resource , each device has to avoid wasting energy in order to keep the network operational . our proposed work saves energy by only involving capable and higher degree nodes for next hop relay in order to keep the network functional without affecting the network performances. It proves the tradeoff between network performance and energy consumption . our proposed work only works for high density network i.e dense network . As some application scenarios for instance providing internet facility to rural villages shows sparse network our future work will focus on designing a backbone based routing protocol to route the packet between any pair of devices in sparse network.

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