Design and Implementation of Improved Routing Algorithm for Energy Consumption in Delay Tolerant Network

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Abstract

DTN is a mobile ad-hoc network. It is a network of similar networks in which nodes are not connected with each other all the time by using wireless connections. Traditional networks TCP/IP and MANET are responsible for sending the data by connecting the devices all around the world, but the main assumption of traditional networks is that it fails to transmit the data when end to end path does not exist. DTN provides the communication in the challenging environments where end to end path does not exist. Energy is a vital factor to deliver the message from the source to destination. Existing routing protocols in DTN are using so much energy for transferring messages from source to destination. Therefore to reduce energy consumption a new improved algorithm named as Prophet new routing algorithm has been proposed in this work. It is a hybrid approach of epidemic and prophet routing protocol. It makes a priority list to deliver the message and deliver the message according to this priority list. Experimental results are shown by using ONE simulator for the various routing algorithms in DTN by considering the parameters Energy, Overhead Ratio, Average Hop count, packet delivered and packet delivered probability .In this work, the comparison of this new routing algorithm is shown with the Epidemic and Prophet routing algorithm on the basis of energy parameters and Overhead Ratio, Average Hop count, packet delivered and packet delivered probability Experimental result shows that prophet new routing algorithm gives better result than the Epidemic and Prophet routing protocols in the both cases delivery of message and energy consumption.

Keywords: Energy, Initial Energy, Scan Energy, Transmit Energy, Scan Response Energy

I. INTRODUCTION

In Today's world internet is very effective way of communication. It uses many protocols to transmit the data like TCP/IP and MANET. These traditional networks are used to transmit the data from one node to another node. But the assumption of these networks is that they transmit the data if end to end path from source to destination exist. So these networks are failed to transmit the data in case of where the lack of connectivity. Many researchers' develop the new protocols and try to overcome this problem but there are also some assumptions which consequences in the concept of DTN. The DTN is a communication network which transmits the message in the network if there is no end to end path exists. DTN is robust to long delays, station disruption and intermittent connectivity. DTN is a network which stores the packets temporary until the next node becomes available [1] or end to end connection re-establish. This network is an approach to computer system architecture that purposes to discourse the technical problems in dissimilar networks that experience nonexistence of continuous connectivity. Factors like movement of nodes, connection failure, and discharged batteries may negotiation the connectivity [2]. Lately, the word Delay tolerant network has improved the currency in the U.S states due to support from DARPA, which has subsidized many DTN projects. Costs are associated with the energy depletion and info loss [3].

DTN uses the concept of persistent storage. In which it stores the messages until the connection is established between the nodes. A node stores the message until the next node becomes available to get the message. DTN is used in many challenging environments like deep space networking, cell phone applications and underwater or aquatic applications.

There many routing algorithms are designed for routing in the DTN. These routing algorithms like Epidemic, prophet and spray and wait are not energy constrained algorithms, but due to smart cell phones and tablets many energy constrained algorithms are designed because these are energy consistent devices [5]. There are many energy constrained protocols for which different movement models are described. These movement models include the random way movement model, random walk and shortest path map based movement model etc. Different movement model has different encounters for transmission of the data and for the different encounters it has different amount of the energy consumption in every movement model.

Energy is very significant factor for delivery of the message from the source to destination. So in the proposal of DTN routing algorithms energy consumption must be as a vital valuation measure. In Delay tolerance network to amount the impact of energy on the performance of networks different routing algorithms are designed. A mechanism that accounts for energy depletion was intended and implemented for the one Simulator [4]. Energy module obtains the amount of energy pay out in search for the other nodes, transmission and reception of the messages. Energy module in ONE simulator is used to handle the power use for the

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scanning the devices, response from the device and transmission of messages. If scanning is done for than 1/s then constant scanning is assumed.

In this paper, analyses the impact of energy on the DTN routing protocols. For analysis the impact of energy three routing protocols are considered like Epidemic, Prophet and Prophet new routing algorithm. Prophet new routing algorithm is hybrid approach of Epidemic and Prophet routing algorithm.

This paper is organized as in section second we review the previous work. Section 3rd defines the new routing protocol and section 4th defines the simulation setup and results. Last section gives the conclusion and future scope.

II. LITERATURE REVIEW

Cabacas et al.in[3] investigated about the energy, which is very vital factor to delivery of messages from source node to destination node. Delivery of message depends upon the energy whether it is low or high. In paper, comparison of routing algorithms is made on the basis of the average remaining energy, number of dead nodes. Average remaining energy may be defined as energy left after the simulation process and number of dead nodes may be defined as the nodes whose energy is reaches at the end point means reaches at the zero. Epidemic, Prophet, Spray and Wait and Maxprop is chosen for the comparison. Different simulation parameters and Energy parameters are set for performing the simulation.

They concluded the result that Spray and Wait routing protocol has highest average remaining energy and maxprop routing algorithm has highest number of dead nodes (nodes that reaches at the point of zero energy).if the speed of nodes increases then number of dead nodes increases and amount of remaining available energy decreases. In this paper it is also concluded that the average remaining energy decreases with the increase of message size whether when number of dead nodes decreases with the increase in message interval time.

Bhed Bahadur Bista et al.in [6] investigated that effect of movement models on the consumption of energy in Delay tolerance network. Nodes in the DTN are resource constrained. This paper considered the impact of energy on the different routing protocols by considering different movement models. The different movement models i.e. considered is Random way point, Random Walk, Shortest Path First movement model. They considered the results on the basis of delivery probability and average remaining energy. Random way point has highest remaining energy for all the routing algorithms. Shortest Path movement model is lowest average remaining energy. On the basis of delivery probability prophet routing model is better in random way point model. They concluded that not a single movement model is best for the routing algorithms all have different impact on the routing protocols.

Mahzad Kavini et al.in [7] investigated on the communication protocol for the sensor data to the base station from animal pursuing data. Surviving protocols does not use there available energy when the pursuing devices amended their energy.in energy restrained application it reduces the life time of network and performance of routing becomes the worse. In this they try to limit the amount of energy loss on the sensing and try to send the data to the destination directly. There are various devices to sense the behavior of animals but when they are used for the small animals they does not work because they have less amount of energy. Energy allocations are vital in energy aloof places. By this increase the data sending rates. For this they consider the two algorithms i.e. threshold energy and remaining required energy algorithm. They concluded that performance of epidemic is not good whether prophet and Spray and Wait give the better results. But by using the threshold and RRF protocol improves the data yield up to 10-19%.

III. ROUTING PROTOCOLS

DTN routing is divide into Replication based routing, forward algorithms routing and probabilistic routing.

Epidemic routing Protocol [8] is based on the replication routing. It is a flooding type routing algorithm. Epidemic routing protocol transmits the message to all the encounter nodes. All the nodes have same message. Node does not receive the message if it is already in its buffer but there is wastage of resources, energy and memory.

Prophet routing Protocol is based on the probabilistic routing. Lindgren et al [9] proposed this routing algorithm to reduce the utilization of resources and the energy. Prophet router saves the resources because it does not send the message to all the encounter nodes. It sends the message to only the node which has higher delivery probability. It transfer the message based on the previous history.

Spray and Wait Routing Protocol [10] is a protocol which controls the spreading of messages in the network. This routing protocol does not have any knowledge about the encounters like the Prophet routing protocol. It spreads L message in the network. Spray and Wait has two phases 1) Spray Phase 2) Wait phase. In Spray Phase a node spreads limited number of copies in the network. In wait phase the node tries to send its own copy to the destination via direct transmission.

Improved prophet new routing algorithm: this routing algorithm is hybrid of Epidemic and Prophet. Prophet routing protocols delivers the message according to the delivery probability if highest probability node already has message then skips the node to transmit the message but in the new improved algorithm it does not skip the message it sends the message according to the priority list. In this it sends one more copy of message in the network. By doing this the chance of message loss decreases. It also checks whether the message delivered to all the nodes or not. If message is not delivered then it checks the available connection and these connections try to sends the message at the available nodes by using the epidemic routing protocol approach.

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A. Working Steps of Prophet New Algorithm

- Step 1: A priority list is created according to the Delivery Probability. D.P is calculated as:

$$P(a,b) = P(a,b)_old + (1 - P(a,b)_old) * P_init$$

- Step 2: Messages are distributed to the nodes according to this priority list.
- Step 3: it does not skip any node to deliver the message sends message according to list.
- Step 4: It uses Try all function to check the delivery of message to all the nodes, whether messages are delivered to all the nodes are not. For checking the delivery of message it does not consume the energy.
- Step 5: If any node left to get the message then it retransmits the message to that node

B. Flow Chart

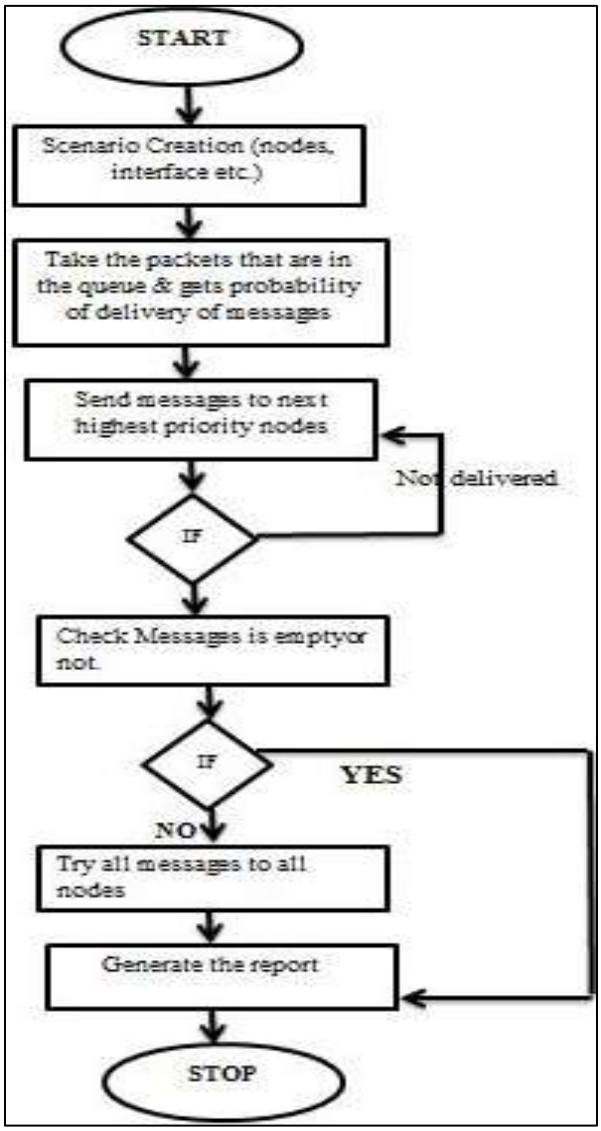

Fig. 1: Flowchart

IV. SIMULATION SETUP

For Simulation ONE (Opportunistic Network Environment) is used. ONE simulator has written in java language. This simulator combines the concept of movement modeling, routing simulation, visualization and reporting in one program.

A. Simulation Parameters

In simulation all the nodes are mobile in nature. Common settings have done for all the routing algorithms. A simple scenario of nodes is created which has settings different from the default settings. 50 nodes are moved under the scenario which is mobile in nature.

Simulation parameters are as following:

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Table – 1
Simulation parameters

Parameters	*Values*
Simulation area	*1000x1000 m*
Simulation Time	*43200 sec=12h*
Interface	*Bluetooth*
Interface Type	*Simple broadcast*
Transmit speed	*250 KBPS*
Transmit Range	*10 m*
Routing Protocol	*Epidemic, prophet, prophet new routing*
Time to live	*300 minutes= 5hr*

Table – 2
Energy Parameters

Parameters	*Value (units)*
Initial Energy	*4800*
Scan Energy	*0.0099*
Scan Response Energy	*0.0015*
Transmit Energy	*0.0009*
Response Energy	*0.0009*

In this simulation process all the nodes have same initiated energy. Scan energy is the energy used to discover the devices. Scan response energy is the energy used for response from other device. Transmit Energy may be defined as energy used to send the data from source node to destination node. Simulation was performed for 12 hr.

B. Results

We check the energy consumed by the nodes according to the simulation time. Result shows that how much energy has consumed according to the time and effect of energy has shown on different routing protocols. In this comparison of the routing algorithms is shown by energy consumption, message delivery, average hop count, message delivery probability and overhead ratio.

1) Energy: Higher energy of the node is better because it performs well with this energy, if the energy of the node reaches to Zero then it becomes the dead node and does not perform any activity.
2) Packet Delivered: It may be defined as how many packets are successfully delivered at the destination.
3) Packet Delivered probability: it may be defined as number of message delivered upon the total number of message created.
4) Overhead Ratio: it may be defined as resources used during transfer of data.
5) Hop count: it may be defined as number of routers or nodes present from source to the destination. Or number of routers or nodes through which data is passed to reach at the destination**.**

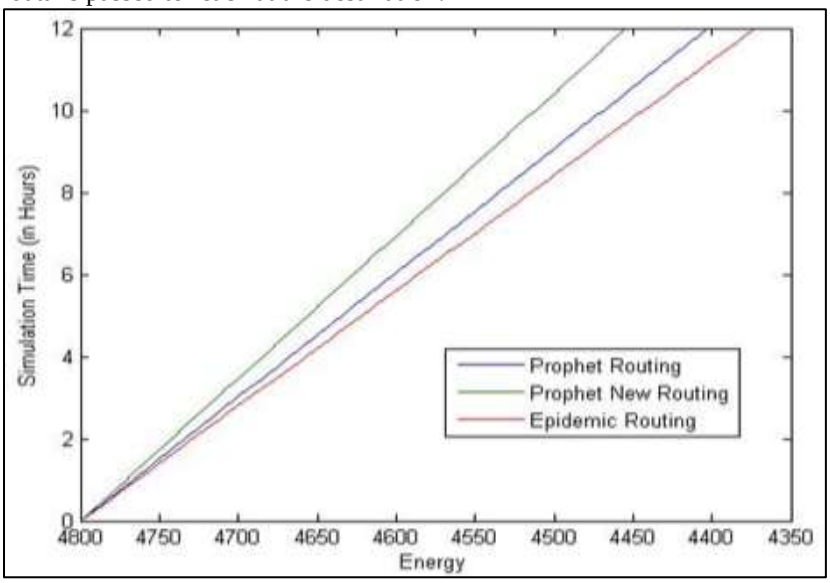

Fig. 1: Energy consumption comparison of routing protocols

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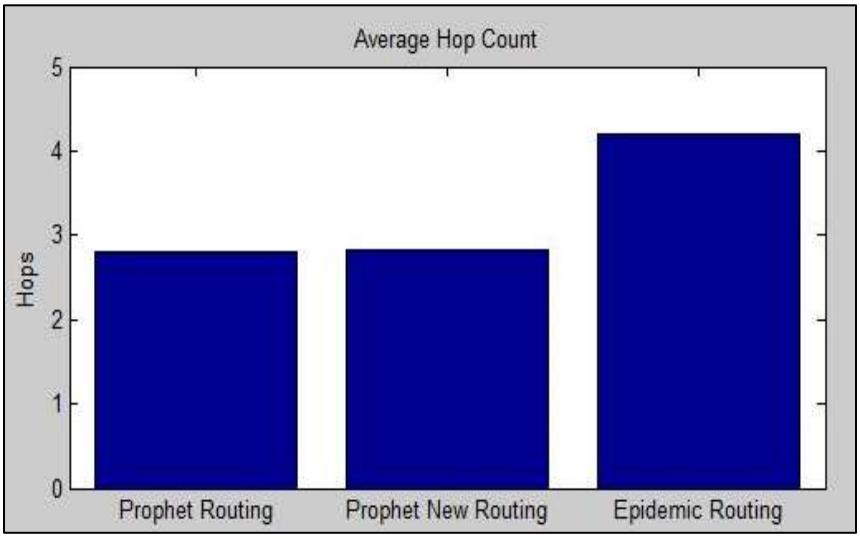

Fig. 2: Comparison on the basis of average hop count

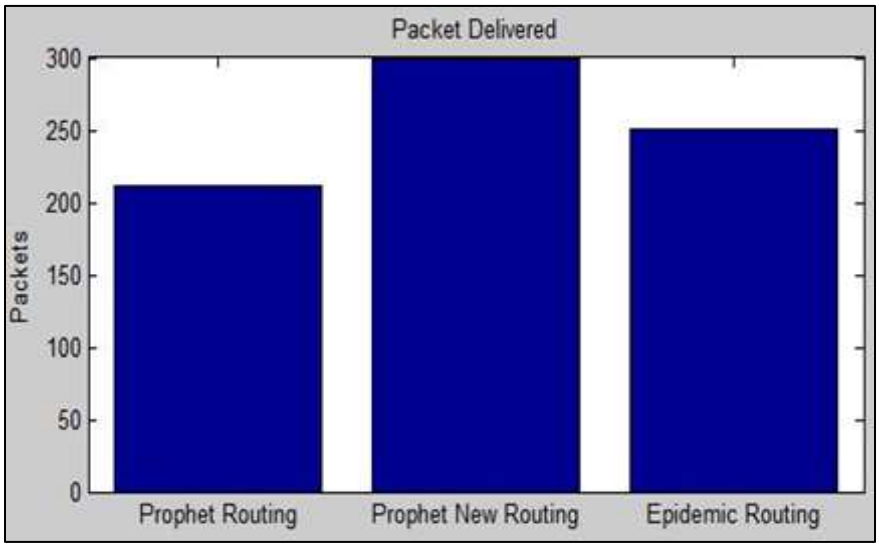

Fig. 3: Comparison on the basis of Packet delivered

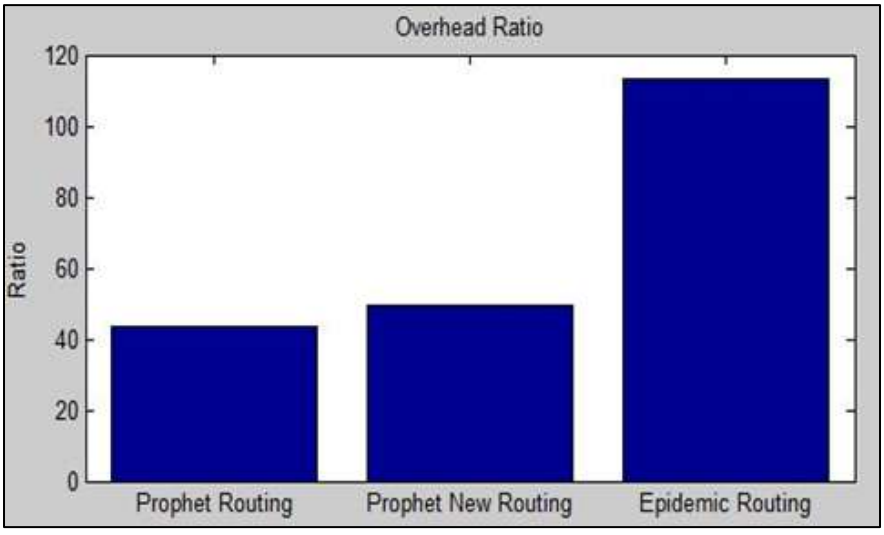

Fig. 4: Comparison on the basis of overhead ratio

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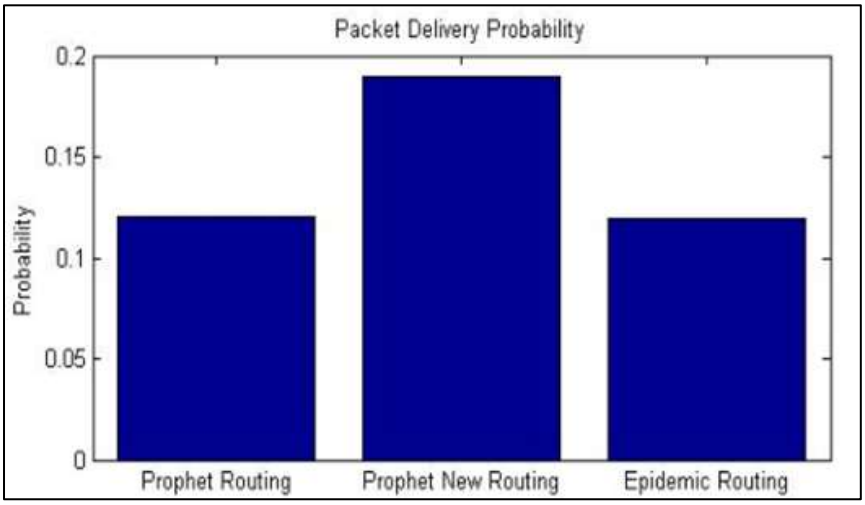

Fig. 5: Comparison on the basis of packet delivery probability

V. CONCLUSION AND FUTURE SCOPE

In this paper, we analyzed that the new routing protocol gives the better performance than the other two routing protocols because it consumes less amount of energy to transmit the data. The average remaining energy of this routing protocol is greater than the Epidemic and Prophet routing protocol. Prophet routing protocol is better from the Epidemic in energy consumption. The hybrid protocol (prophet new routing) gives better result for packet delivery and packet delivery probability than the epidemic and prophet routing protocol. If we considered the overhead ratio this hybrid approach is better than epidemic routing protocol and equal to the prophet routing protocol. We concluded that this new hybrid approach named as prophet new routing algorithm is better than the epidemic and prophet routing protocol. In this approach message is never lost until the whole network has failed. The delivery Probability always remains one in this protocol. The comparison between these protocols shows that Epidemic does not gives the better performance. Prophet protocol is better than the Epidemic, but the Hybrid approach is better from both the Epidemic and Prophet.

In future we can improve the more energy consumption in prophet new routing protocol and also make it better in overhead ratio. This scenario is performed at the small scale by performing it on large scale application we can improve the results more. Furthermore, we need to find how movement models effect the energy consumption on this routing protocol and we can also check the energy consumption by hybrid it with Spray and Wait. We leave it on future work.

REFERENCES

[1] "Delay tolerant networking research group." [Online]. Available: http://www.dtnrg.org.
[2] E. P. Jones and P. A. Ward. Routing strategies for delay-tolerant networks, 2006.
[3] Cabacas, Regin A., Hideaki Nakamura, and In-Ho Ra. "Energy Consumption Analysis of Delay Tolerant Network Routing Protocols." International Journal of Software Engineering and Its Applications 8.2 (2014).
[4] N. L. Helsinki University of Technology. The one the opportunistic network environment simulator @ONLINE, July 2011.
[5] Xiaofeng Lu; Pan Hui, "An Energy-Efficient n-Epidemic Routing Protocol for Delay Tolerant Networks," Networking, Architecture and Storage (NAS), 2010 IEEE Fifth International Conference on , pp.341,347, 15-17 July 2010
[6] Bista, Bhed Bahadur, and Dand B. Rawat. "Energy Consumption and Performance of Delay Tolerant Network Routing Protocols under Different Mobility Models."
[7] Kaviani, Mahzad, et al. "Delay Tolerant Routing Protocols for Energy-Neutral Animal Tracking." Proceedings of the 3rd International Workshop on Energy Harvesting & Energy Neutral Sensing Systems. ACM, 2015.
[8] Vahdat, Amin, and David Becker. "Epidemic routing for partially connected ad hoc networks." (2000)..
[9] Lindgren, Anders, Avri Doria, and Olov Schelén. "Probabilistic routing in intermittently connected networks." ACM SIGMOBILE mobile computing and communications review 7.3 (2003): 19-20.
[10] Spyropoulos, Thrasyvoulos, Konstantinos Psounis, and Cauligi S. Raghavendra. "Spray and wait: an efficient routing scheme for intermittently connected mobile networks." Proceedings of the 2005 ACM SIGCOMM workshop on Delay-tolerant networking. ACM, 2005.

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