

# A Review of Energy Consumption on DTN Routing Protocols

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## Abstract:

DTN is net of similar nets. TCP/IP protocols and MANET networks are responsible for connecting the devices all over the world. The main assumption which has been considered in TCP/IP or MANET environment is that when sender or source sends the data to destination or end point it should be necessary that sender and receiver are connected, if there is no connection between the sender and receiver then the data will be lost at some point of the network. The DTN is interoperability of other nets by accepting long delays and distraction between the networks. The DTN is independent of end to end connectivity. DTN enables communication in mobile ad-hoc networks and in the challenged environment where the communication is not possible. Energy is very vital factor to deliver the message at the destination. Delivery of message depends upon the amount of energy whether it is low or high. There are various factors that facts the energy. In this paper comparison is made in DTN protocols like Epidemic, Prophet and Spray and Wait on the basis of energy. The factors which are considered for the energy are threshold value, Scan\_energy, Response\_energy, Transmit\_energy, Base\_energy, remaining energy.

**Keywords:** Delay tolerant network, Energy, Threshold, Scan\_energy, Response\_energy, Transmit\_energy, Base\_energy, number of dead nodes, nodes average remaining energy.

## 1. Introduction

In today's world internet has been effective for linking the devices all-overs the world. It becomes possible by using the different type of protocol suites like TCP/IP. Every device uses these protocols for transfer the data from source to endpoint. Connectivity on the internet depends on the wired links or by the wireless connection like Bluetooth, satellite. The devices which are connected by this have end to end connectivity and low-delay routes. They have less fault tariffs and symmetric bidirectional data tariffs. The main assumption which has been considered in TCP/IP or MANET environment is that when sender or source sends the data to destination or end point it should be necessary that sender and receiver are connected. If there is no connection between the sender and receiver then data will be lost at the some point of the net which becomes the reason for development of DTN (delay tolerance network).

The DTN is net of smaller nets. The DTN is interoperability of other nets by accepting long delays and distraction between the networks. The DTN is independent of end to end connectivity between the devices or nodes. Delay tolerance network is a tactic to computer system architecture that purposes to address the technical problems in heterogeneous networks that experience nonexistence of continuous connectivity. DTN networks

word Delay tolerant network has improved the currency in the U.S states due to support from DARPA, which has sponsored many DTN projects. Costs are associated with the energy depletion and info loss [1].

### 1.1 Routing in DTN:

The capability to transmit or route data from source to destination is common facility of all communication net must have. DTN are considered by their lack of connectivity, results in lack of rapid end to end paths. In these challenging surroundings, widespread ad-hoc protocols such as AODV and DSR fails. The reason behind it, because these protocols first start establish network or route when route is established then start send the data to the destination. However, when rapid end to end paths are difficult or impossible to establish routing protocols use store and forward approach, in which data is moved from one hop to next hop and stored for the duration of the networks hops and finally reached at the destination hop. Their consequence spectacles that the routing protocols message replication strategies act in response in a different way to increase the buffer size [2]. Store carry -forward networking has been suggested to allow communication over the space-time routes that happen in Delay tolerant network. [3]

In DTN there are six routing protocols:1) Direct Delivery, 2) First contact, 3)Spray and Wait, 4) Prophet, 5)Max-prop, 6)Epidemic.

- Direct delivery routing [8] is a simple flooding routing protocols which carries message until it delivers it to the destination.
- First contact in this a random walk search is followed it delivers the message to a node which is firstly encounter.

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transfer the data from sender to destination if end to end connectivity between the both does not exist. Lately, the

- Spray and Wait [10] it spreads the n number of message copies to the bygone neighbours and waits until these nodes forward the message to the destination.
- Prophet [11] message delivery in this protocol depends upon the probability.it delivers message to the node depending upon its message encounter history.
- Epidemic [12] it is also a flooding protocol. It replicates the message to all the encounter nodes.
- Max-prop [13] it send message to other hosts in a specific order that takes into account message hop counts and delivery of message.

## 1.2 Concept of Energy:

Energy consumption is major concept in the performance and deployment of modern computational and communication system [9]. Energy is the main factor to deliver the message from source to destination.in DTN, for many of the cases, the hardware devices may be highly oblige.it is vital to take into account the remaining energy of the node [14]. To investigate the energy various factors are considered like threshold value, remaining energy of the node, and number of dead nodes, Scan\_energy, Transmit\_energy, Base\_energy, Response \_energy. On the basis of these factors comparison is made.

- Remaining Energy of the nodes the energy which is left within node after the completion of simulation time.
- Number of dead nodes: when the energy of nodes reaches at the zero.
- Scan\_energy: energy which is used to discover the devices.
- Transmit\_energy: the amount of energy which is used to send the messages.
- Response energy: amount of energy used for scanning response device.

This paper is organised as in section 2 we review the previous work. In section 3 we make the comparison based on these papers.

## 2. Literature survey

Cabacas et al.in [4] investigated that energy is very efficient resource for delivering the message or data from source node to destination node. Message delivery will be depend on the energy either it is low or high. If energy is low then message will not be delivered properly to the destination. In this deal with the energy intake by nodes in delay tolerance network (DTN). Compared various existing

protocols and make the comparison between them on the basis of average remaining energy (it is average energy of nodes left after the completion of simulation) and number of dead nodes(these are the nodes whose energy reaches at the level zero). For implementation setup the ONE simulator.

In this implementation choose two routing Protocols which are from the opportunity based and probability based like Epidemic, Spray and Wait, PRoPHET, MaxProp. For simulation, choose the different parameters like they assumed that nodes are moveable in nature. Also set the energy parameters i.e. intial\_energy, Scan\_energy, Transmit\_ Energy, Scan \_Response\_energy and Base\_energy.

On the basis of nodes Average Remaining energy vs. number of nodes conclude the result as if increase the number of nodes then average remaining energy of the nodes going decreased. Result on basis of this among all the protocols Spray and Wait has Highest Average remaining energy, also observed that if number of nodes increasing as well as number of dead nodes also increasing. Increase in number of nodes depends upon, increase in message size. It means if the size of message expanded then number of nodes also increases.

On the basis of this result is concluded that among all the protocols MaxProp has highest number of unavailable nodes. In this paper this is also shown that an increase in message generation interval increases the value of average remaining energy. For showing this they considered the fact that when message generation time increases the flow of messages between the networks have been decreased. This result less energy gets consumed. Result concluded that rate of increase is lowest in the epidemic and highest in the Spray and Wait, but the amount of unavailable nodes becomes less with increase in the message generation interval time. Maxprop has highest number of unavailable nodes.

With increase in speed of nodes remaining average energy decreasing but the number of dead nodes increases. Result is that more number of scans and more energy gets consumed. PRoPHET and spray and Wait energy gets consumed more. At the end they concluded that average remaining energy decreases with the increase in message size, increase in speed of nodes and energy goes increased with the increase in number of message generation interval time. Second point they concluded that with the increase in number of message generation interval time the number of dead nodes decreases.

**Denis Rodrigues et al.** [5] investigated that how much energy is consumed to send the message or data and to receive the messages. In this also investigated how much energy is consumed for searching the nearest neighbourhood node. Paper also considered that consumption of the energy depends upon the discovery of the nodes. They said if want to increase the network performance then design the protocols whose functionality be influenced by the decrease of the message exchange. In this they considered that ONE Simulator is not appropriate for other protocols. ONE simulator has the rudimentary unit of battery and energy depletion implemented as the modification of epidemic protocol. Because it includes many of the limitations in this there is no option for the battery recharge and one another disadvantage which it includes is that it does not consider the energy spent for the information receives.

For this reason decided to design a new version of The ONE: 1.4.1. Paper introduces the energy module which familiarizes the concept of energy depletion between the nodes. For this work, supposed there are five states for the energy module i.e. is Off, Inactive, Scan, Transmission and reception. According to the states all the operation is performed by the method check energy. By developing this module result is conclude that same platform can be used for the dissimilar routing protocols. By using its internal logic protocol can control the energy consumption. There is also concluded in neighbour discovery operations time interval will be clearly defined, but there are some assumption in it like all the values of energy should be indexed to the interface rather than the nodes.

**Mahzad Kaviani et al.** [6] investigates communication protocols for send sensor data to the base station from animal chasing system. Rather than delay tolerance network, other surviving protocols do not use their available energy when the chasing devices cut their energy. Loss of energy limits the rate of delivery probability. This also reduces the life time of network in the energy reserved applications and routing performance becomes worse. Try to improve the performance of data gain by using different type of strategies. In this try to limit the energy loss on sensing, data considering and send data directly to the destinations. Wireless sensor net is able to intellect the behaviour of all type of animals but there is one problem i.e. for small animals, these sensors have small amount of energy because these are light weight. In this paper consider that energy deliberations are imp in energy reserved placement and can increase data sending rates.

All the algorithms and approaches are designed for the animal sensing applications. In the application consider the

flying foxes application and in energy-aware routing protocol paper consider the threshold algorithm and remaining required energy algorithm.

In threshold algorithm, a user defined threshold value is considered. User defined a threshold value, if the node which sends the data has energy below this threshold value then this node cannot transmit the data to the next node and transmit only to the base station. If threshold value is equal to zero it means there is no energy alertness and if the threshold value equal to the 100% then the direct delivery algorithm is considered.

Remaining required energy algorithm automatically generates threshold energy. The concept of RRE algorithm is to send packets in their buffer to the base station by conserving the energy. For simulation and implementation use the ONE simulator and consider the different parameters for the simulation. Everyday sensor nodes cut the energy up to max battery life. Concluded all protocols improve the D.D protocol and delivery protocol can be extended up to 19% when does not consider the available energy.

Optimum threshold can be improved depending on the conditions like cut of energy, reception of messages. Epidemic does not give the better result. Performance of the epidemic protocol is worst while Spray and Wait protocol And ProPHET protocols gives improved performance both limit the network traffic. Threshold value for all the protocols is different. In this paper DTN routing algorithm for wild tracking. Paper shows as compared to energy-unaware protocols threshold and RRE improves data yields up to 10-19% and gives the better results. As compared to threshold in low and medium energy scenario RRF gives equal or better result from optimum threshold.

**Bhed Bahadur Bista et al.** [7] investigates how the movement models can impact on the energy in delay tolerant network. In DTN nodes are the resource constrained means they have low amount of battery life (less amount of energy), less space for memory in buffer. DTN introduces many protocols to deal with this problem. In this paper considered the performance of different protocols on the basis of energy under different mobility models. In DTN all the protocols are designed without any energy oblige but today's device like mobile phones and tablets are energy constrained and different type of energy constrained DTN protocols are designed.

To analysis of impact of energy in DTN protocols different movement models are considered like Random way point movement model, Random Walk movement model, shortest path First model. When sending the data

energy goes decreasing. Different type of movement model consists of different number of nodes and different number of nodes consists of different type of encounters. This encounter sends the different amount of data thus the energy consumption varies depending on encounter.

Random walk movement model simulate the behaviour of unpredictable movements. In the model mobile nodes takes the random steps for changing its current location and by choosing random steps the move at the new location.

Random way point models works similarly as random walk movement model but there is pause time between the movements.

In the shortest path map based model a map is used where the node calculates the address of its destination and uses the smallest distance to reach at the destination point.

In this paper results are concluded on the basis of average remaining energy and message delivery probability.

Spray and Wait has highest average energy whether epidemic has lowest energy average remaining energy. Average remaining energy of nodes is highest in random way point models for all the protocols and lowest in the shortest path map based movement model. On the basis of delivery probability performance of prophet is better in random walk model but spray and wait and epidemic performs better in shortest path map based model and random way point movement models.

Shortest path map based movement model do not give better performance for any of the protocol. In this paper they identified DTN protocols in different movement models for identifying the impact of energy. They found that there is no one single model which is suitable for all the movement models. Means no one single movement model is suitable for all the DTN's protocols. They made these results by observing the simulation for 12 hours.

### 3. Conclusion

At the end of this paper, concluded that if number of nodes increases then dead nodes goes increasing and average remaining energy goes decreasing. If scanning of nodes many times then it will consume more energy.

From RRF and threshold model, RRF gives equal or better performance than threshold model.

Max-pro has large number of dead nodes. Spray and Wait has highest average remaining energy than the nodes and also better in the case of threshold.

From the movement models Random way Point gives better performance of energy from all the models whether shortest path movement model gives worst performance. But if we considered shortest path model on the basis of average remaining energy then it gives better performance for spray and Wait.

At the end we conclude that spray and wait is better protocol than others.

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