

# Age Encounter Based Routing Algorithm for Delay Tolerance Network

Chirag Patel<sup>1</sup>, Nimit Modi<sup>2</sup>

<sup>1</sup> Master Student, Computer, Sigma College of Engineering, Gujarat, India

<sup>2</sup> Assistant Professor, Sigma College of Engineering, Gujarat, India

## ABSTRACT

*Abstract: DTN (Delay Tolerant Network) facilitates a communication between heterogeneous networks when there are transmission delay and network disconnection frequently, in order to support a transmission of messages without infrastructure like internet. For improvement of spray and wait routing, which is the representative routing protocol in DTN. This algorithm divides transmission phase into 2 parts and fulfils a data transmission phase in the light of condition of network and end device. For this, we reduce the appropriate number of data transmission and apply the optional number of data transmission respectively based on the network and the device condition. In the first contact routing, giving a message copy to first node encounter and delete the message from queue. In my proposed algorithm, I will build up "AGE ENCOUNTER BASED ALGORITHMS" with above mentions strategies algorithms. In this algorithms, we mention the age, meeting time of destination and the meeting time of source, difference both consider as age.*

**Keyword:** - Delay tolerance networks, spray and wait, first contact routing.

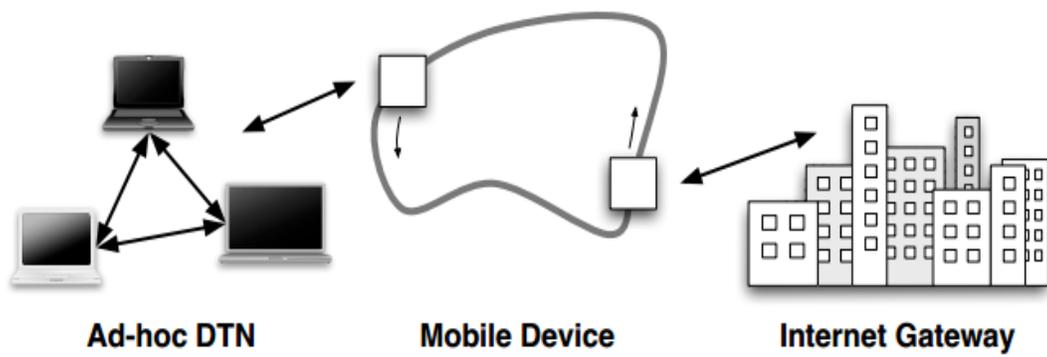
## 1. Introduction

### 1.1 DTN

In wireless network, there are two mainly categories: those with cellular model and ad-hoc networks. An ad hoc network is known as MANET which can be defined as a collection of mobile entities interconnected by wireless network.

The duration of recent years, there are many problems occur in the ad hoc network. The environment of mobile which provides a great flexibility of use mobility creation without any restriction of the communication location. So, mobility shows enormous problems such as: limited energy source, frequent disconnection, low flow of communication, modest resources. Thus, network topology is not working properly or disconnection and message delivery is available delay in the ad hoc network. In the MANET routing protocols which require a network topology, are connected to route with the messages, if there is not finish route from source to destination when message is sending, routing will fail. Only this problem, the ad hoc routing protocol cannot be used in wireless environment with intermittent connectivity.

In order to lack of the connectivity, the delay tolerant network (DTN) is a network of smaller networks. It is an overlay on top of special network including the internet. DTN support interoperability of other networks by accommodating long disruptions and delay between and within those network, and by translating between the communication protocol of those networks. DTNs were originally developed for interplanetary use, where the speed of light can seem slow and delay-tolerance is the greatest need. DTNs may have far more diverse applications on Earth, where disruption-tolerance is the greatest need. The potential Earth applications span a broad range of commercial, scientific, military, and public-service applications. DTNs overcome the problems associated with intermittent connectivity, long or variable delay, asymmetric data rates, and high error rates by using store-and-forward message switching. Whole messages or pieces of such messages are moved from a storage place on one node to a storage place on another node, along a path that ultimately reaches the destination.



**Figure 1:** Laptops communicating with each other and the internet via delay-tolerant network [8]

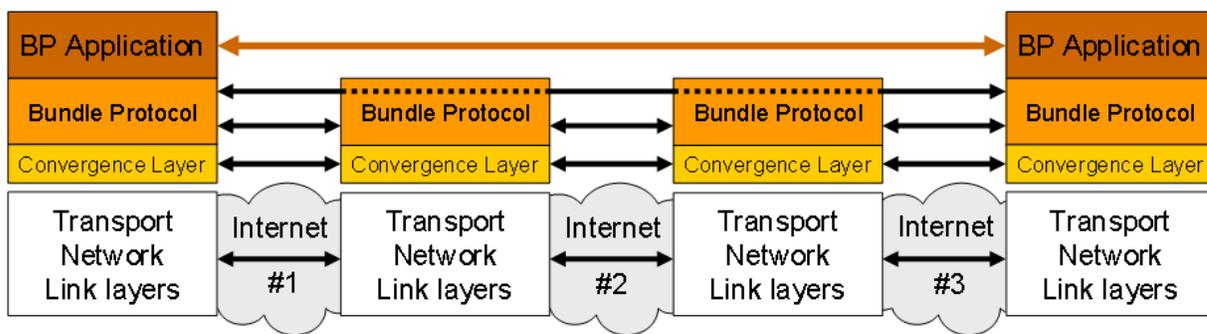
As an example of where these networks are useful, consider a classroom where each student has a laptop, but there is no network infrastructure. One would like the students to collaborate on projects using the wireless network cards in the laptops, and also to communicate with the Internet. Delay-tolerant networking can make this happen, as illustrated in Figure 1. The laptops communicate with each other to exchange data. If the destination laptop is not present, which may occur if the student has gone home, the network stores the messages until they return. To communicate with the Internet, the school could be serviced via a router attached to a bus travelling between the school and an Internet gateway. This device picks up requests from the school and delivers them to the gateway, and then provides the responses on its next trip. First Mile Solutions sells a system called DakNet that is based on this idea [8], while the Wizzy Digital Courier Project uses a simple one-hop delay tolerant network to provide Internet access to rural South African schools [8].

**1.2 DTN routing algorithm**

In This paper, there are mainly two categories in DTN such as Forwarding and flooding protocols. In forwarding protocols, each message only keeps one copy during its transmission in the network like traditional routing protocols. First contact routing is the best example of forwarding protocol in which the message is delivered to the node which is encounter first and to select the best path and messages are forwarded until it reaches to the destination node. In such case, source will generate the message and will encounter first then delete the message from node buffer. Ultimately, one message copy exists in the DTN network [1]. While in flooding protocols, the multiples copy of messages are created to deliver to the destination. Spray and wait protocol is the example of the flooding protocol [5]. In this case, each copies of message are spared in the network. Another example of flooding schema is epidemic protocol.

**2 RELATED WORK**

**2.1 DTN Architecture**



**Fig.2** DTN Architecture [2]

This architecture follows a method for interconnecting heterogeneous networks and to use store-carry forwards paradigm to overcome communication disruptions. DTN has developed architecture for delay-tolerant networking that has emerged from the efforts on interplanetary internet (IPI) [9]. It provides services like electronic mail, but with enhanced naming, routing, and security capabilities. In store-carry-forwards paradigm, is used in the DTN architecture. The DTN architecture implements store-and-forwards message switching by overlaying a new transmission protocol called the bundle protocol. The bundle protocol agent stores and forwards entire bundles between nodes. A single bundle protocol is used a throughout a DTN [3]. By contrast, the bundle protocol is chosen to suit the characteristic of each communication environment. The intermediate node stores the message and carries it. Exchange of bundles hop-by-hop via Bundle protocol agents protocol across different interworks convergence layer provides mapping to lower layer.

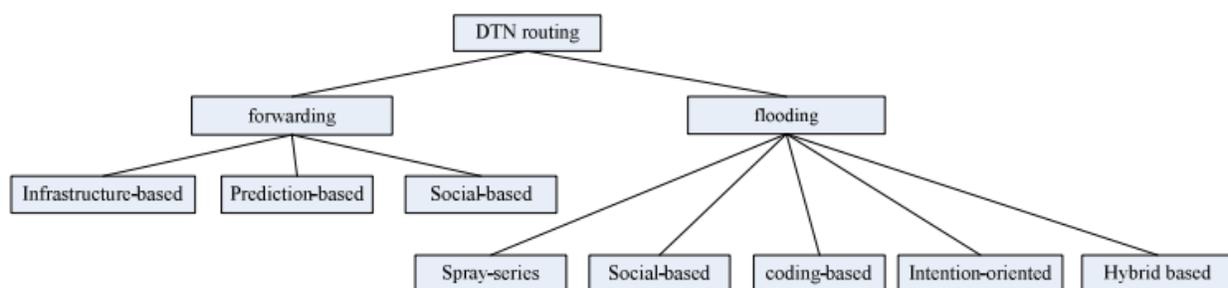
## 2.2 Characteristics

There are some characteristics in DTN environment [9].

- Intermittent connectivity- The absent of an end-to-end path between source to destination is called network partitioning. In such communication, TCP/IP protocols are not working properly.
- Asymmetric data rates- The internet supports moderate asymmetric of bidirectional data rate for users with asymmetric DSL service. If asymmetric are large, they defeat conversational protocols.
- High latency- latency which is defined as there is end to end delay between nodes. Latency is high due to number of disconnection between nodes.
- Low data rate- Its means that numbers of messages delivered under given time period. It is low because of long delays between transmission of nodes.
- High error rates- If error is occurred between links, so they need error corrections. Ultimately, they use more bandwidth then the retransmission of time, it creates more network traffic.
- Long queuing delay- Each node has its own buffer size to store the messages and frequent disconnection might reason of ling queuing delay.
- Limited resources- DTNs need efficient protocol. That's means nodes must consume their limited hardware resources such as battery efficiency, memory and CPU [2].

## 2.3 Classification of routing protocols

DTN routing protocols are classified into two congeries such as forwarding and flooding schemes.



**Fig. 3** classification of DTN routing [5]

In DTN classification, the forwarding schemes are classified into infrastructure-based, prediction-based and social-based strategies, while flooding schemes could be divided as spray-series, social-based, coding based, intentional-oriented and hybrid-based strategies [5].

### 2.3.1 Forwarding Schemes

DTN use network topology information to select best path and the one copy of message is then forwarded from node to node along this path in forwarding protocols. This protocols are divided into three directions as the below.

- **Infrastructure-based strategies**

This routing can mitigate and compensate the rugged environment by deploying fixed infrastructure. In this strategy, mobile agents as message ferries are provided connectivity through the disconnected parts of the network. It is difficult to implement those special nodes in many DTN scenarios.

- **Prediction-based strategies**

For improving routing performance in opportunistic scenarios, prediction-based strategies have been deployed in DTN routings. These strategies calculate and predict knowledge of future network based on history information.

- **Social-based forwarding strategies**

The common relationships and people's daily life communication have been investigated and focused on it. That social mobility characteristics are used to help routing decisions and protocols depend on social models such as SimBet and SSAR.

### 2.3.2 Flooding Schemes

In this scheme, source node generate multiple copies of message and relays store the messages until they contact with the destination in which point the messages are delivered.

- **Spray-wait strategies**

It represents as a few message copies into the network then route each copy independently towards the destination. Spray-wait which consists of two phases. Spray phase: every messages are originated at a source node; L copies of message are spread by the source to L distinct relay nodes. Wait phase: if the destination is not found in the spraying phase, each of the L nodes carrying a message copy performs "Direct transmission".

- **Social-based flooding strategies**

In social-based flooding routings, social network protocol model as the same as the social-based forwarding routings, while it takes advantage of flooding strategy to increase message delivery rate.

- **Intention-oriented strategies**

For improving the performance of DTN routing characteristics, this strategy is very useful. The example of intentional routing is RAPID.

- **Coding-based strategies**

In this strategies, resource consumption is reduced if we used to take the fragmentation and network coding.

- **Hybrid-based strategies**

Some researchers have proposed hybrid routings applying both forwarding and flooding schemes in one protocol. This technology could be viewed as a balance between increasing delivery rate and reducing resource consumption. The representatives of hybrid routings are routings.

### 3 LITERATURE SURVEY

#### Paper 1:

**Title:** The Performance of DTN Routing Protocols[1]  
**Authors:** Ei Arbi Abdellaoui Alaoui, Said agoujil, Moha Hajar, Youssef Qaraai  
**Institute/Organization:** Laboratory E3MI Department of Computer Science Faculty of Sciences and Technology Errachidia, Morocco.  
**Year:** 2015  
**Publication:** W-seas Transactions on Communications  
**Summary:** This paper is to compare two categories based on two-pronged strategy, mainly the replication strategy and the expedition strategy. In addition, our contribution is based on a combination of routing protocol to improve the performance.  
**Limitation:** Spray and wait routing protocol works better only on small network.  
**Idea of Improvement:** Implementing the spray and wait algorithm to increase delivery ratio.

#### Paper 2:

**Title:** From Delay-Tolerant Networks to Vehicular Delay-Tolerant Networks[6]  
**Authors:** Vasco N. G. J. Soares, Joan Triay, Cristina Cervell  
**Institute/Organization:** Superior Technology and Technical University of Lisbon.  
**Year:** 2012  
**Publication:** IEEE  
**Summary:** DTNs introduce a store-carry-forward paradigm that performs better and uses fewer resources than end-to-end protocols, as each hop is optimized individually. The bundle layer hides internal network details and improves message delivery ratios in challenging environments.  
**Idea of Improvement:** Providing hybrid routing algorithm to decrease delivery overhead by using both techniques.

**Paper 3:**

**Title:** Vehicular Delay Tolerant Network (VDTN): Routing Perspectives[4]  
**Authors:** Syed Hassan Ahmed, Hyunwoo Kang and Dongkyun Kim  
**Institute/Organization:** School of Computer Science & Engg.  
**Year:** 2015  
**Publication:** ResearchGate  
**Summary:** Through VDTN relays and store-carry-forwards mechanism, messages in VDTNs can be delivered an end-end connection for delay-tolerant applications.  
**Idea of Improvement:** In VDTN, vehicle use GPS information to perform bundle forwarding decision from source to destination vehicles. Location information is used by the source vehicle to forwards bundles to the encounter vehicle that is near to the destination. Not only GPS information but also map information is used to determine an optimal next forwarder.

**Paper 4:**

**Title:** Evolution of DTN Routing Protocols [3]  
**Authors:** Vrunda Gamit and Hardik Patel  
**Year:** 2014  
**Publication:** IJESRT  
**Summary:** In Delay Tolerant Networking (DTN) data can transfer in challenging environments where a fully connected end to end path may never exist between a source and destination. These networks deal with large transmission delays, frequently disconnected paths, high link & path error and limited resources. Network environment where the nodes are characterized by opportunistic connectivity are referred to as Delay Tolerant Networks (DTN).  
**Idea of Improvement:** Direct delivery routing is no more suitable for real time application because it is very poor to packet delivery probability. It has highest buffer time. First contact is the worst because of single copy in the network.

**Paper 5:**

**Title:** Vehicular Delay-Tolerant Networks- A novel solution for vehicular communications [5]  
**Authors:** Joao N. G. Isento, Joel J.P.C. Rodrigues and Joao A. F. F. Dias  
**Institute/Organization:** Institute of telecommunication  
**Year:** 2013  
**Publication:** IEEE  
**Summary:** VDTN is a breakthrough based DTN-based solution provide vehicular communication under characterized by long delays and sporadic connections. VDTN uses a store-carry-and-forwards paradigm, inspired from DTN, which allows forwards bundles to asynchronously reach the destination hop by hop over travelling vehicles equipped with Wi-Fi deceives.

**Idea of Improvement:** Several routing protocols enable and to improve the bundle delivery ration and delivery delay. Scheduling and dropping polices helps the buffer management of VDTN nodes.

#### Paper 6:

**Title:** A survey of routing protocols and simulations in delay tolerant network [8]  
**Authors:** Mengjuan Liu, Yan Yang and Zhiguang Qin  
**Institute/Organization:** Department of computer science and engg.  
**Year:** 2011  
**Publication:** Springer  
**Summary:** Delay-Tolerant Networks (DTNs) are a type of emerging networks characterized by very long delay paths and frequent network partitions. For the distinct characteristics of DTNs, routing becomes one of the most challenging open problems.  
**Idea of Improvement:** DTN routings and gave a comparison of them with respect to the important performance metrics. We summarized the main mobility models and simulators. From our survey, we have found though DTN routing has been ameliorated largely, there are still some deficiencies and problems. The researchers recently have found DTN application cannot catch up with the development of theory research and only with large scale routing applications.

#### 4 PROPOSED ALGORITHM

In this algorithm, we describe the hybrid approach and this approach we are using two different algorithms likewise spray and wait and first contact. The advantages of two different algorithms can solve the defect in the forward and spray-wait algorithm such as message delivery and overload.

##### Hybrid Algorithm:

1. Each mobile node is in contact with destination node then update age of the message
2. Each mobile node that comes in contact with source node. Mobile node will reply age to source node. And source node delivers the message whose age is high.
3. If age is zero, then source node will send a message to any nodes.
4. For each message check the message time to live  
 If time to live is less than counter, then  
 Check source id is equal to the destination id then deliver the message to the destination and discard the message to our buffer.  
 Else sent the message to another mobile node  
 Else do nothing
5. Drop the message
6. stop

## 5 CONCLUSIONS

DTN is a network where there is no end to end connectivity available from source to destination in which the use of store-carry-forward strategy can increase message delivery ratio.

By using hybrid algorithm which can minimize the overhead and raise message delivery, also connect disconnect rural area and to complete their communication.

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**BIOGRAPHIES**

	<p>He has completed his B.E from Gangamai college of engineering, Maharashtra and He is pursuing master degree in computer engineering in sigma institute of engineering of Vadodara. He is interested in research work mainly related to wireless networking and delay tolerant network.</p>
	<p>He has completed his master from Parul institute of engineering &amp; technology, vadodara.at present he is working as assistant professor in sigma institute of engineering, Vadodara. Networking, cloud and WSS are the areas of his research and interest</p>

