

# Assessment of Different Routing Protocols with Movement Models in DTN

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**Abstract:** DTN provides data transmission in challenging environment where no connectivity is present between nodes. The node communicates with each other with the help of intermediate nodes. These nodes can use store carry and forward principle in which nodes can store sender messages and forward these messages to destination node or next intermediate node whenever they come in the range of next nodes. In this paper, an attempt has been made to perform assessment of various routing protocols of DTN by varying buffer space and TTL Time To Live values of nodes during data transmission in DTN. The assessment is performed on ONE Simulator with performance metrics like delivery ratio, average message delay, average hop count and overhead ratio.

**Index Terms-** DTN, Epidemic, Prophet, Random Way point Movement model, Store carry and forward and ONE.

## I. INTRODUCTION

DTN or Delay Tolerance Network is a part of computer architecture which works on pointing out the technical issues in the network that lead to disturbance in continuous network connectivity. This disturbance in networks occurs due to limited wireless radio range, Energy resources, and noise [1].

DTN represent a class of wireless network with no path between source and destination. The main network is divided into several sub-network. DTN supports the class of wireless network that supports the working of the network that experiences frequent or long partitions. Since in DTN path to the destination is not fixed so during routing the main problem occur in finding the intermediate node for packet transfer [2]. In DTN, packets are transfer using store-carry-forward model. Whenever two nodes met each other, the node along path receives the packet from the previous bit and this process continues until the packet reaches towards the destination [3].

### A. CHARACTERISTICS OF DTN

In comparison to the Traditional internet, WLAN, DTN network had following characteristics:

- Intermittent connection

At the node, the energy is limited due to which DTN frequently disconnect and change in its topology take place. To remove this problem the network always keeps the track of intermittent networks so that there is no break in the route

- Limited lifetime of the node

In some special cases of the network, the node may use battery power in harsh condition or hostile environment that in turn decreases the life of the node. Due to this, the node may not guarantee satisfactory working when the power is off. Therefore, it is very possible that battery is off when the message transmits.

- **Poor Security**

DTN networks are vulnerable to many wireless communication network threats like denial of the server, message modification and some other security threats due to poor maintenance in the real world.

- Limited resources

Computing, processing and storage space of nodes weaker than even an ordinary computer. Due to constrain of volume and power this limited storage space result in high loss of data [4] [5].

### B. APPLICATION of DTN

- Deep space exploration

In the upcoming time, NASA is planning to apply a series of projects for space exploration, which include mars, & lunar exploration. In the year 2003, a Cisco router was launched in space until 2008 to monitor the disaster in the UK. Because of this experiment, we came to know that it is possible to use the bundle protocol in space.

- Study of wild zebra

It was among the earliest DTN project started to study the zebra activities. In this project a GPS is injected in the zebra collar to study zebra habits and activity. The collar records the location of GPS after every minute. When these collars come in communication, range the change information. through this experiment, researchers are able to get the present location of zebra along with little information. further modification was done to eliminate issues with energy equipment & Data compression.

- Rural Communication

Many projects are working on our; communication to provide access to the internet in a remote village. Some of these projects focus mainly on reducing the cost of communication. Example of such projects is Wizzy digital courier service, which provides internet access in South Africa for some village schools [6].

## II. RELATED WORK

A few overviews talked about the appropriateness of various network writes for catastrophe interchanges. Subsequent to assessing distinctive past overviews and assessments, the creators in [6] affirmed that DTNs are a fascinating alternative for fiasco situations. They recommend DTNs particularly if the node versatility is high bringing about incessant disturbances, or when the network is scanty. The two perspectives are satisfied for SAR situations. They plainly show that further research to coordinate extra criteria into the routing choices is required, and assess differing situations.

Point by point assessments of DTN protocol execution in a debacle situations were displayed in [7]. The creators assessed distinctive protocols utilizing rather basic portability models and activity. In any case, these models are not relevant to the correspondence of people on call that show distinctive qualities [4]. In this way, the outcomes won't not be pertinent as they are not accomplished under practical calamity situations with an attention on person on call interchanges.

A practical situation is connected in [8]. The creators utilize the hazardous situation model to assess a few protocols. This model produces a thick network speaking to a departure situation with numerous harmed individuals. While the portability is unique, the outcomes give an intriguing understanding on the execution in such situations and can be viewed as a correlative work, if a similar protocol is connected to both thick and meager networks.

## III. PROTOCOL EVALUATION

In this segment we will talk about the pertinence of a few surely understood DTN protocols in regards to debacle situations hypothetically.

### A. DTN Forwarding Mechanisms

Because of the attributes of person on call correspondence, a few viewpoints ought to be considered by sending choices. Development Characteristics Especially in SAR missions, nodes move as indicated by designs (e.g. look developments) in gatherings of a few clients. The examples are rehashed always finished the entire mission. In this way, a sending component that can abuse these examples may take more modern choices.

Activity Characteristics Source and goal of a message speak to parent-youngster connections between singular nodes and their commandants as depicted in Section II-A. On the off chance that such a message must be sent over different levels of order, it will be sent as another message with new goals. All messages are exceptionally corresponded to the fundamental development, since specialists on call will always report their discoveries while looking. Sending systems may have the capacity to misuse this also.

Catching Capabilities Neighboring gatherings will doubtlessly not be the immediate beneficiaries of a message, but rather it is conceivable that messages should achieve all nodes in a specific territory, freely of their area in the legitimate tree. All things considered, a flooding or replication plot, that enables these nodes to get a duplicate, would likewise be fascinating. Hand-off Types Current messages have a strict time limitation. Hence, the sending should attempt to limit the accomplished delay however much as could reasonably be expected in view of the given assets and transfer nodes accessible. It may be helpful to abuse the sort of transfer and its qualities for this situation.

Reliability The correspondence needs to guarantee the conveyance of the messages, in a perfect world without assist associations for the client, for example, dynamic migration to pick up network, or a physically activated retransmission. In any case, regardless of whether messages must be dropped because of restricted cushion assets, a free fractional conveyance of parts (e.g. in the event that a message must be part into a few bundles at the joining layer) will help the general mission achievement. In this manner, the sending methodology should endeavor to amplify the conveyance

proportion and permit fractional conveyance plans. The last alternative is particularly intriguing in conditions with short contacts or mistake inclined connections.

#### IV. ROUTING PROTOCOLS IN DTN

- Epidemic

Epidemic router delivers the message to the final destination using minimum network connectivity and topology. Epidemic router work on the theory of Epidemic algorithm. Each host maintains two buffers and when these hosts come in a range of each other, they exchange their summery vector. Each host also maintains a buffer to keep a list of recently seen hosts to avoid redundant connections. after exchanging the summary vector, the mobile device determines which message is missing. each message has its own hop count. Hop count determines the number of intermediate nodes a message can travel larger the hop count more is the message delivered and reduce average delivery time[8].

- Prophet

The epidemic router will work efficiently only in presence of unlimited network resource but the resources like buffer size and bandwidth are limited. In order to make the efficient use of resources a new router was proposed by Lindgren named Prophet. The focus of this router is on successful delivery of the message. All the nodes corporate in message forwarding[9].

#### V. MOVEMENT MODEL IN DTN

Movement model examines the way in which nodes move during simulation. It explains the various parameter of the node including speed, coordinates, and pause time of the node. The various movement used are:

- Random Waypoint

In this movement, model nodes move randomly between the source to the destination path. There is no particular path for nodes movement. It includes the pause time when there is any change in direction and speed. The nodes start from one location and travel randomly in any direction [10].

- Shortest path Movement

The shortest path the sophisticated version of the movement model .in this mode the node, examine the entire possible path, and after then choose the shortest path for movement from the entire available path. The shortest path chosen is based on the Dijkstra Algorithm[11].

- Map-Based Movement

In this movement model, there is a predefined map and nodes always move with respect to this specific path provided on the map[12].

#### VI. Results

In this paper, ONE simulator is used to perform analysis of different routing protocols of DTN. It is an open source simulator based on java language[13-14].

TABLE 1: Simulation Parameters

Parameter Description	Value
Simulation Area	4500m*3400m
Simulation Time	43200s
Mobility Model	Random way point, Shortest path map based and Map Based Movement Model
Routing protocols	[Prophet; Epidemic;FirstContact ]
Transmission Range	10 meter
TTL(Time To Live)	100s;200s;300s;400s
Buffer Size	5MB;10MB;15MB;20MB
Warm Up Period	1000seconds
Operating system used	Windows 7

No of groups	6
No of Nodes	126
Message size	500 KB to 1 MB

i. Assessment with Random Waypoint Movement Model

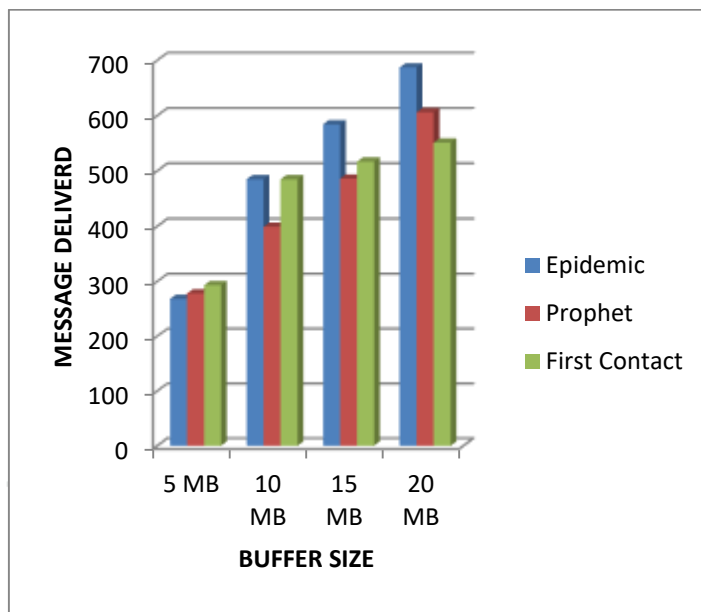


Fig.1 delivery ratio v/s buffer space

This Figure describes the number of messages delivered during the data transfer in DTN. here the buffer size is varied from 5MB-20MB. The result shows that packet delivery rate is high in Epidemic routing with respect to Prophet and First-Contact

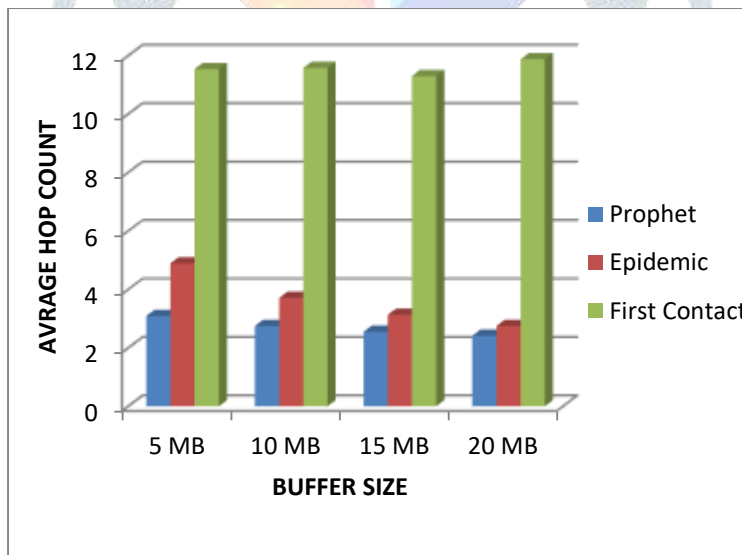


Fig.2Average Hop count v/s buffer space

The Figure shows the Average hopcount during the data transfer in DTN. The buffer size varies from 5MB-20MB. The result shows that Average hop count is higher in case of the First Contact as compare to Epidemic and Prophet.

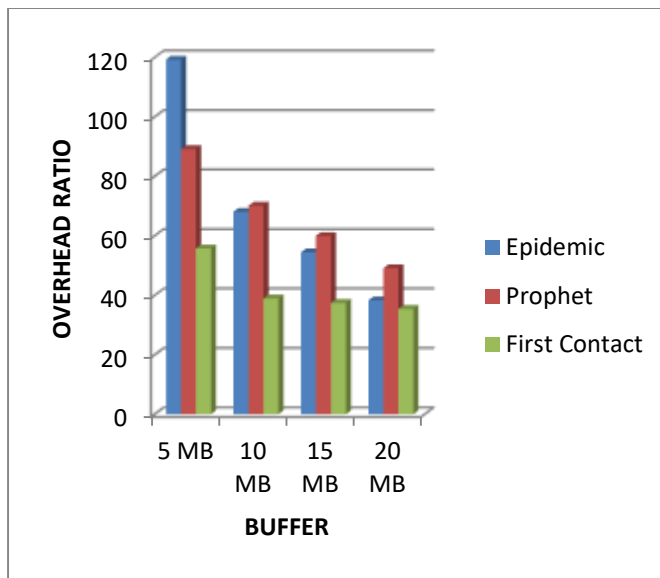


Fig.3Overhead ratio v/s buffer space

The Figure illustrates the Overhead Ratio during the data transfer in DTN. The buffer size varies from 5MB-20MB. The overall result shows that overhead ratio is more in case of the prophet as compare to Epidemic and First Contact.

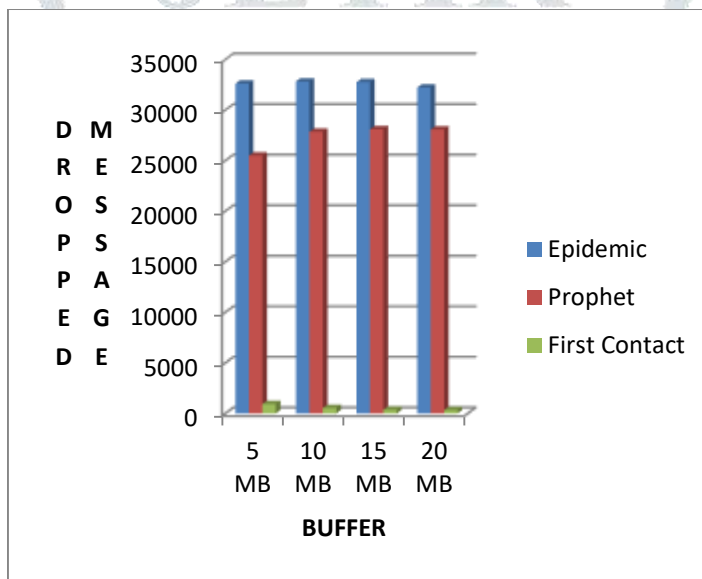


Fig.4dropped packets v/s buffer space

The Figure tells us the message dropped rate during the data transfer in DTN. The Buffer size varies from 5MB-20MB. The overall result shows the message drop rate is more in case of the Epidemic router and lowest in First Contact.

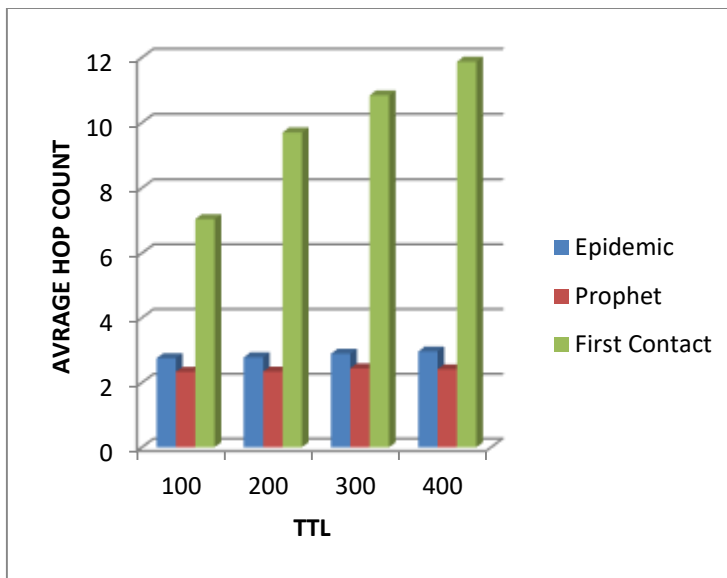


Fig.5 Average Hop count v/s TTL

The graph shows the average hop count during the data transfer session in DTN. Here the TTL size is varied from 100-400. The result shows that Average Hop Count is more in case of First Contact router as compared to Epidemic and Prophet.

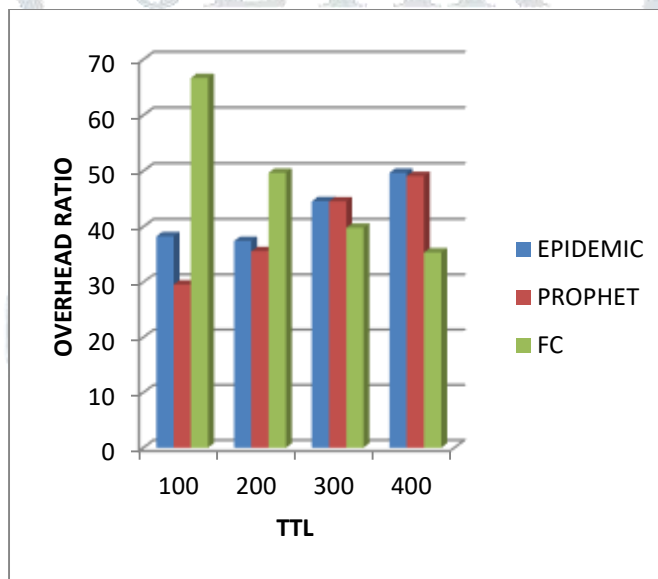


Fig.6 Overhead ratio v/s TTL

The graph shows the Overhead Ratio rate during the data transfer session in DTN. Here the TTL size is varied from 100-400. The result shows that Overhead Ratio is more in case of First Contact router as compared to Epidemic and Prophet for 100-200TTL while for 300-400 TTL Epidemic router takes the lead.

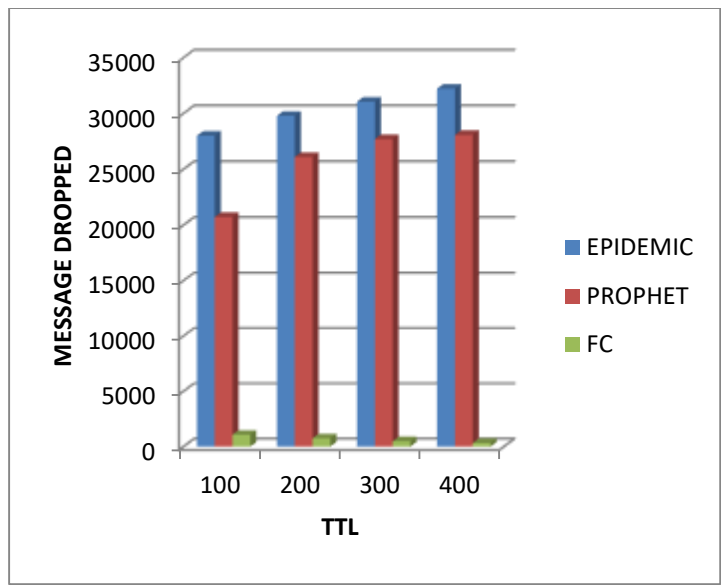


Fig.7dropped packets v/s TTL

The graph shows total Message Dropped during the data transfer session in DTN. Here the TTL size is varied from 100-400. The result shows that Message dropped is more in case of the Epidemic router as compared to First Contact and Prophet.

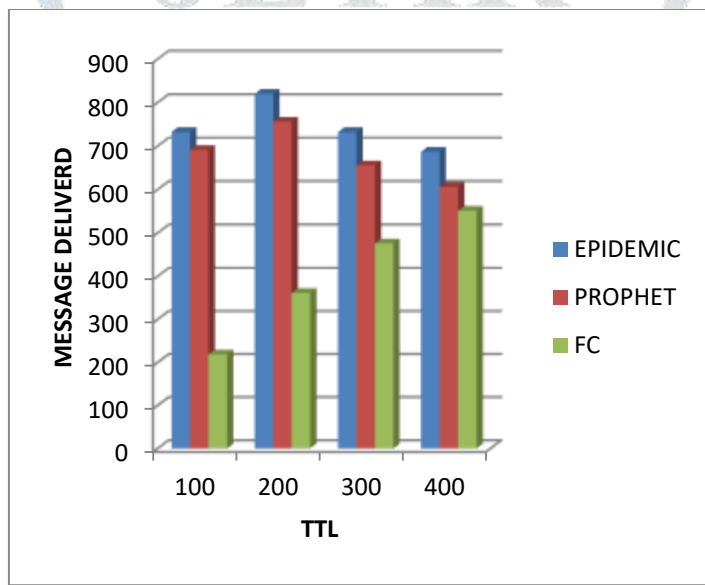


Fig.8Delivery ratio v/s TTL

The graph shows total Message Delivered during the data transfer session in DTN. Here the TTL size is varied from 100-400. The result shows that Message Delivered is more in case of the Epidemic router as compared to First Contact and Prophet.

ii. Assessment of Map-Based Movement Model



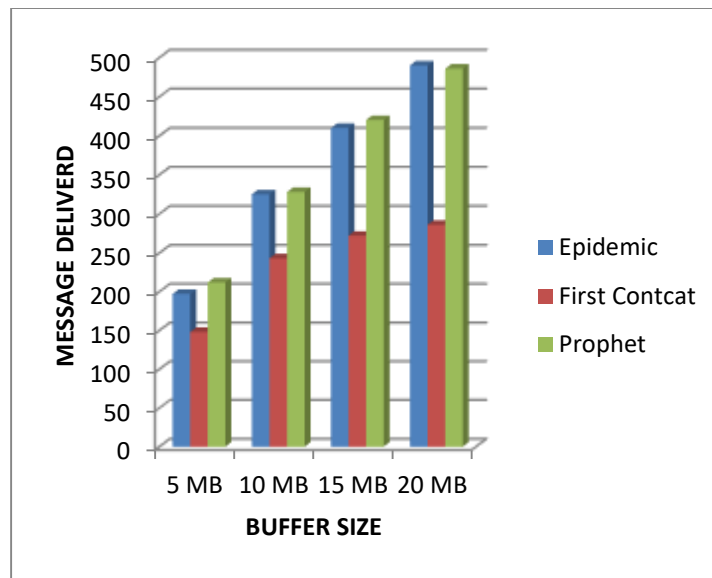


Fig.9 delivery ratio v/s buffer space

The graph shows total Message Delivered during the data transfer session in DTN. Here the Buffer Size size is varied from 5MB-20MB. The result shows that Message Deliver is more in case of Prophet router as compared to Epidemic and Prophet.

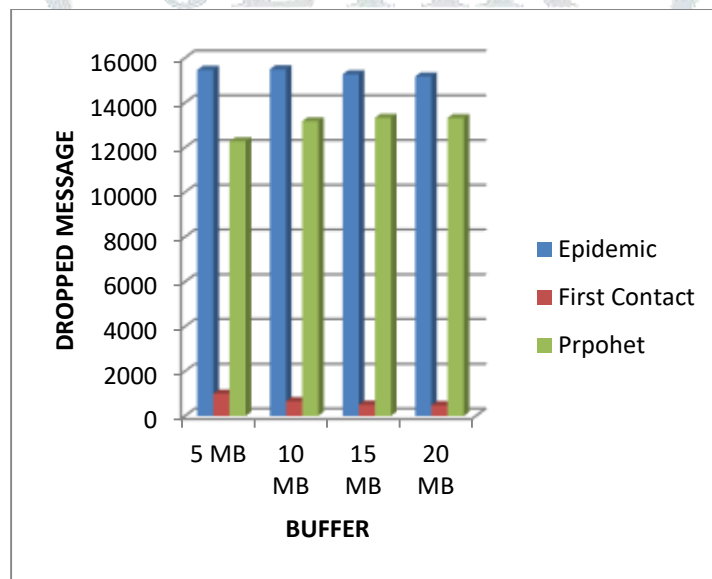


Fig.10 dropped packets v/s buffer space

The graph shows total Message Dropped during the data transfer session in DTN. Here the Buffer Size varied from 5MB-20MB. The result shows that Message Dropped is more in case of Epidemic as compared to First Contact and Prophet.



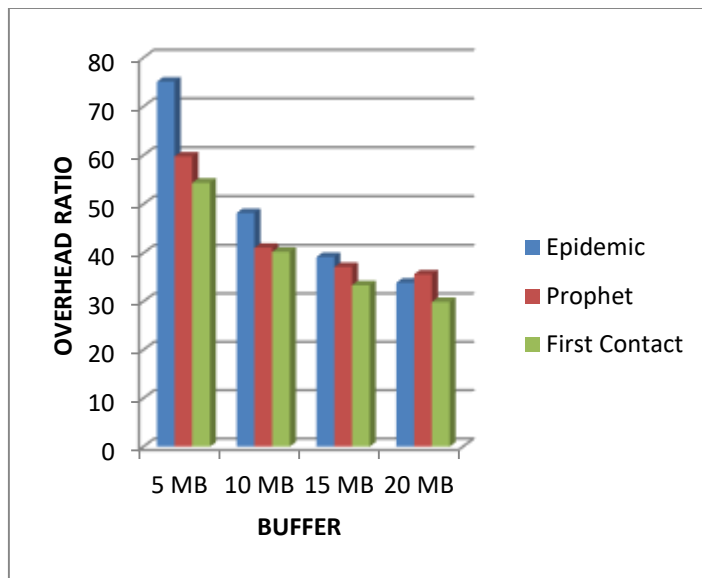


Fig.1 Overhead ratio v/s buffer space

The graph shows Overhead Ratio rate during the data transfer session in DTN. Here the Buffer Size varied from 5MB-20MB. The result shows that Overhead Ratio is more in case of Epidemic as compared to First Contact and Prophet.

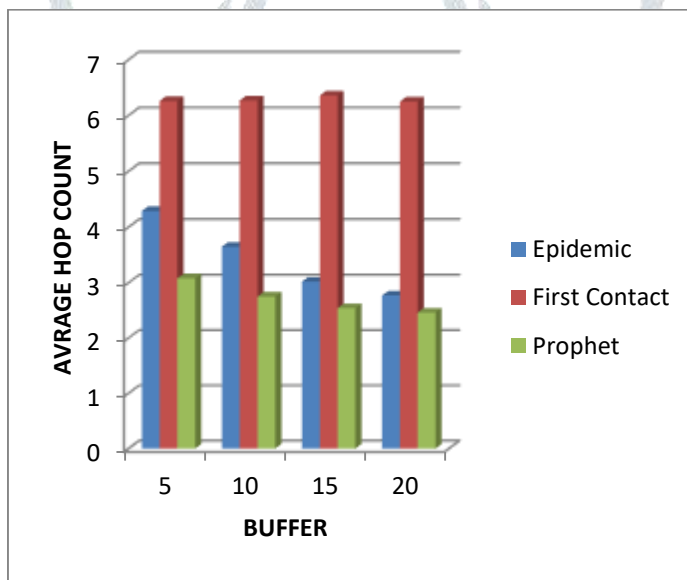


Fig.12 Average Hop count v/s buffer space

The graph shows the Average Hop Count rate during the data transfer session in DTN. Here the Buffer Size varied from 5MB-20MB. The result shows that Average Hop Count is more in case of as Prophet as compared to Epidemic and Prophet.

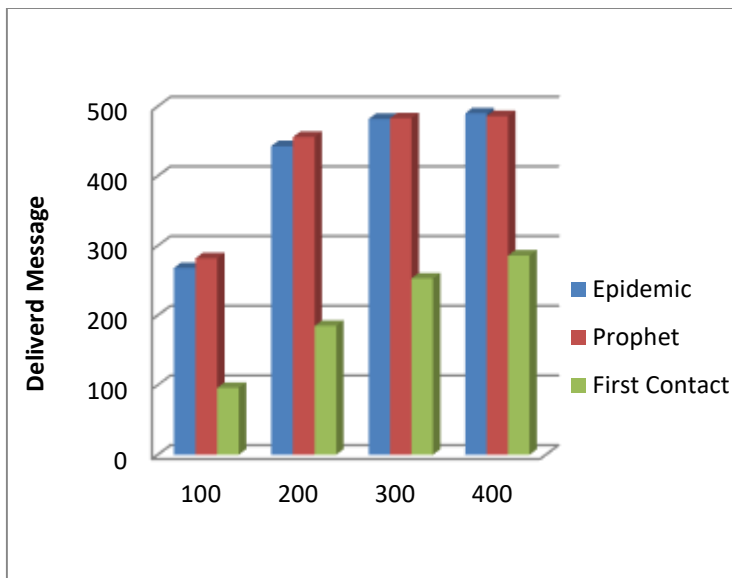


Fig.13 Delivery ratio v/s TTL

The graph shows Total Message Delivered during the data transfer session in DTN. Here the TTL Size varied from 100-400. The result shows that Message Delivered is more in case of as Prophet as compared to Epidemic and Prophet.

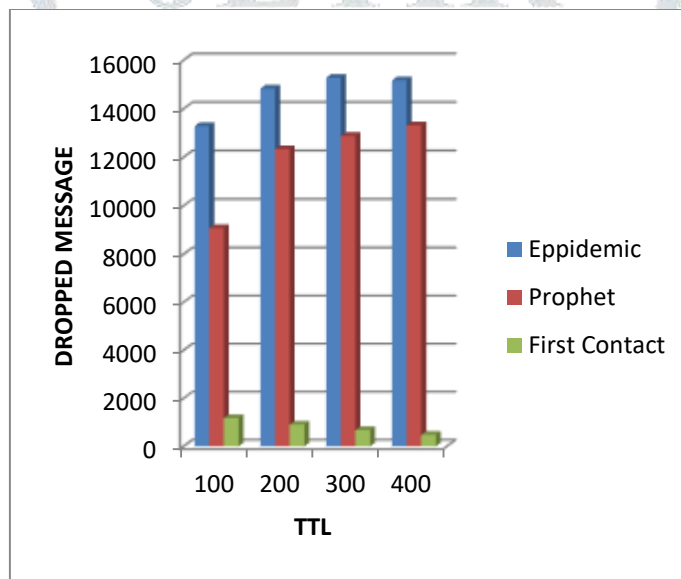


Fig.14 dropped messages v/s TTL

The graph shows Total Message Dropped during the data transfer session in DTN. Here the TTL Size varied from 100-400. The result shows that Message Delivered is more in case of Epidemic as compared to First Count and Prophet.

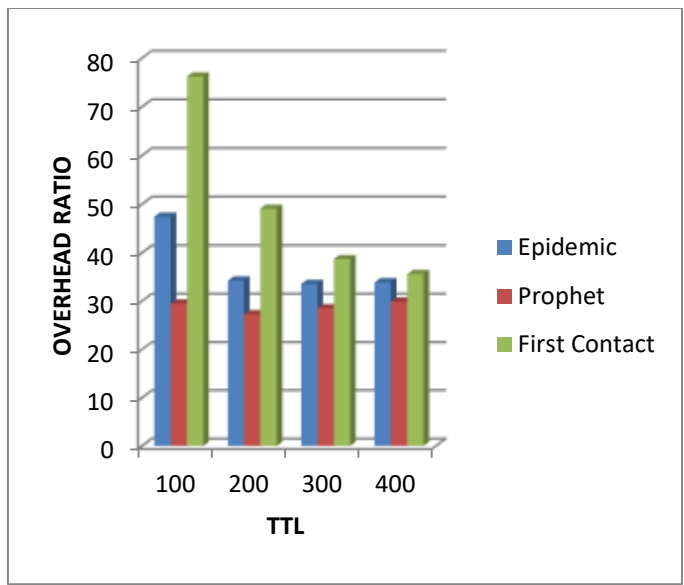


Fig.15overhead ratio v/s TTL

The graph shows Overhead Ratio Rate during the data transfer session in DTN. Here the TTL Size varied from 100-400. The result shows that Overhead Ratio is more in case of the First Contact as compared to Epidemic and Prophet.

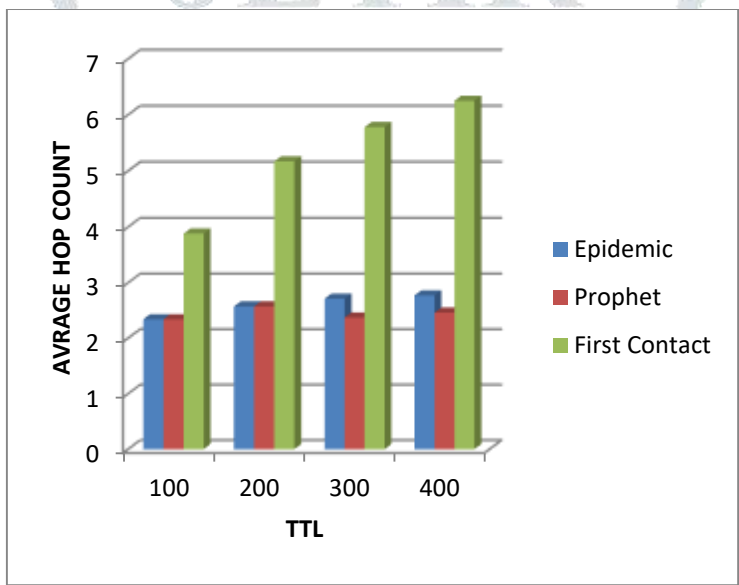


Fig.16Average Hop count v/s TTL

The graph shows Average hop count during the data transfer session in DTN. Here the TTL Size varied from 100-400. The result shows that Average Hop Count is more in case of the First Contact as compared to Epidemic and Prophet.

**VII. Conclusion**

IN this paper attempt are made to perform assessment of different routing protocol in prospective of movement of nodes. The routing protocols such as Epidemic, First contact, Prophet are used to perform assessment. To perform analysis ONE simulator is used. The result shows that in case of random waypoint movement model the epidemic router has best message delivery rate with the drawback of a large number of dropped message and overhead size when the buffer size is varied form 5MB-20MB and TTL is varied from 100-400.

Similar is the case for map based movement model in this movement model shows that Epidemic &Prophet routers shows nearly same result in case of message delivery rate and had a drawback of large message dropped and overhead ratio. In future attempts can be made to make our own simulator for advance simulating to get better result.

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