# A SURVEY ON DELAY TOLERANT NETWORK

M.KOWSALYA[1] M.SORANAMAGESWARI[2]

[1]Research scholar, Department of computer science, Government Arts college, Coimbatore

[2]Assistant Professor, Department of computer science, Government Arts college, Coimbatore

***Abstract- Delay-Tolerant Networking(DTN) is an approach to computer network architecture that seeks to address the technical issues in heterogeneous networks that may lack continuous network connectivity.DTN is feasible only on networks with large amounts of local storage and internodes bandwidth relative to the excepted traffic. Application of DTN includes vehicular networks and sensor networks in suburban and rural areas. This paper includes the different protocols, application and characteristics in DTN***

***Index Terms: DTN, Routing Protocols, Multipath Routing, Sensor Networks, Mobile Networks***

## I.INTRODUCTION

Delay Tolerant Networking (DTN) [1] is a new communication standard that can span across multiple networks and cope with harsh conditions not imagined in the Internet model. Applications of DTN include vehicular networks and sensor networks in suburban and rural areas. The intermittent connection in DTN creates a new and challenging environment that has not been tackled before in wireless and wired networks. Traditional routing protocols fail to deliver data packets because they assume the existence of continuous end-to-end connections. To overcome the frequent disconnections, a DTN node is required to store data packets for long periods of time until it becomes in the communication range of other nodes. In addition, to increase the delivery probability a DTN node spreads multiple copies of the similar packet on the network. So any one copy will reach its destination.

## II. DTN ROUTING PROTOCOL

Routing protocols are classified according to the amount and type of information used to take the routing decision [2].

Blind routing protocols [3][4][5] aim at fast spreading of packets in the network. They do not collect information about other nodes because they do not use a node selection criterion. They vary according to their spreading mechanism and amount.

Guided routing protocols [6][8] aim at efficiently selecting the relay nodes to enhance the



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delivery probability in case of limited storage and energy resources. To select relay nodes, they have to collect information about other nodes in the network. Guided routing protocols collect information about other nodes in the network to guide packets to their destinations.[9][10].Guided routing protocols outperform blind protocols in the delivery ratio, but increase the average packet delay. [11] [12]

Epidemic Routing [3] was historically the first DTN routing protocol. In Epidemic Routing, nodes transfer copies of all the packets they have to all the other nodes they become in contact (limited by the contact duration). Packets be dropped when they expire or a destination delivery acknowledgment is received. Because of the limited storage space and contact durations, the protocol performance drops significantly with the high-traffic rates.

Spray-and-Wait (SnW) [4] protocol proposed a simple scheme that manages to overcome the shortcomings of epidemic routing and other flooding-based schemes, and avoids the performance problem inherent in utility-based schemes. Spray-and-Wait (SnW) [4] protocol limits the number of copies by associating with each copy the number of extra copies to spread. When no more spreading is allowed the carrying node keeps the packet until it either meets the destination or the packet is dropped due to buffer overflow or lifetime expiry.

These protocols assign weights to nodes using information collected from the network. This information could be topological [8][9][11][12] environmental and energy aware [13] or content based [14]. The collected information can be used to detect social relations among the network nodes as in [8] [9] [10] [16] and [17]. One of the earliest papers, and well known protocols, that predict contacts among DTN nodes is the PROPHET protocol [8]. PROPHET estimates a node metric by tracing the number of meetings between nodes. When two nodes meet, they increase their link weight toward each other and toward the nodes met by the other node.

## III.DTN APPLICATION

### A.Inter-planet satellite communication networks:

The objective of the interplanetary Internet was to define the architecture and protocols for interoperation of the internet resident on the earth with over remotely located residents on other planets or spacecrafts. The Earth's Internet is basically a network of interconnected networks. This network is may therefore be therefore be thought of as a network of disconnected Internets.[18]

### B. Space mobile ad hoc networks:

This network may have unexpectedly intermittent connection due to mobility or space


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deployment. At times sporadic connectivity in the network could be periodic or predictable.[18]

**C.Country-side area networks:**

DTN can bring digital connectivity to rural areas and other environments with limited or non-existing infrastructures. The scenarios transportation system such as cars, buses and boats are used to provide relaying of messages by moving around and delivering message to various nodes.

**D. Military battlefield networks:**

In a military setting DTN allows for a rich set of applications including dissemination of mission-critical information in battelefield. These type of applications, the delay tolerant protocol should transmit messages across multi-hop network consists of different sun networks based on network parameters such as delay and loss.[18,19]

**E.Wireless sensor networks:**

Wireless sensor networks are often characterized by limited end-node resources including energy, memory and CPU power. Communication with in these networks is often aimed at limited usage of these resource. Lack of infrastructure may force sensor network gateways to be intermittently connected to operators network. Scheduled down time, interference, or environmental hostility may cause the interruption of operable communication links.[20]

**F. Exotic media Networks**

Exotic communication media includes near-earth satellite communications, very long distance radio links, acoustic transmission in air or water, free spaces communications and nano-networks[21].

## IV. DTN CHARACTERISTICS

To discuss the routing problem,we need capturing the most important characteristics of a DTN network. This section explores them concentrating on those the produce the most on routing and forwarding protocols implementation.

**A.Intermittent connection:**

One of the most important characteristics of DTNs is that end-to-end connection between communicating end system may not exist. Generally intermittent connections may be broadly categorized as due to a responsibility or not. Non faulty disconnections happen in wireless environment and mostly caused by two source: mobility and short duty cycle of system operation. Intermittent connection mobility depends on the application area of DTNs. Intermittent connections caused by short duty cycles are common among devices with limited resource.

**B.Delivery latency and low data rate:**

Delivery latency is the amount time between message injection into the network and its successful reception at the destination. Latency delivery delay consists of transmission, processing, propagation time over all links as well as queuing


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delay at each system along the path. The latency may vary from a few minutes to hours or even das and a fraction of messages may not be delivery. DTN with high latencies and low link rates, the key is to design the routing protocols and forwarding algorithms matching actual mobility.[22,23]

**C. Long queuing delay**

The queuing delay is the time it takes to drain the queue of messages ahead of tagged one. The queuing delay depends on data and the amount of competing traffic traversing network. In DTNs where a disconnected end-to-end path is rather common situation, the queuing time could be extremely large e.g. minutes,hours or even days.[24]

**D. Resource limitation:**

Nodes in DTNs often have very limited energy sources either because they are naturally mobile or because the power grid is non-existent in their area of location. End system consume energy by sending, receiving, storing message and by performing routes discovery and compution.[25]

**E. Limited longevity**

The DTNs nodes may be broken down and not be expected to last long. Recalling that the end-end path between two communicating entities may not exist for a long period of time there could be the case when the delay of message delivery may exceed the life time of a transmitter node.

**F.Security:**

The use of intermediate nodes as relays offers extraordinary opportunities for security attacks, including compromising information integrity, authenticity, user privacy and system performance. It is important to the research on DTN security is more challenging compared to conventional mobile ad hoc networks due to its unique security characteristics. These characteristics include exceptionally long delivery delay, sporadic connectivity, opportunistic routing, and make most existing security protocols designed for conventional unsuitable for DTN.[26,27].

## V.CONCLUSION

Delay Tolerant Networking is a new communication standard that can span across multiple networks. In this paper protocols used in the DTN are specified elaborately also its application in different fields are also discussed. Moreover the advantage and dis- advantages of the DTN is also explained

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