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Minimizing Delivery Delay Using Novel Estimation Approach

G.Sabitha[1], S.Lalitha[2]

PG Scholar-M.E, CSE, Gnanamani College of Technology, Namakkal, T.N, India[1]

Assistant Professor, CSE, Gnanamani College of Technology, Namakkal, T.N, India[2]

Abstract: Developing a new utility-based message scheduling mechanism that incorporates with DTN message forwarding, where per-message utility is determined to optimize either message delivery ratio or delivery delay. Developing a novel estimation approach for network global knowledge to facilitate decisions on which message should be forwarded/dropped when the buffer of the encountered node is full. Evaluating and comparing the existing scheme with counterparts, and gaining understanding on its trade off between computation complexity and performance improvement. Each node maintaining limited buffer space is full in DTNs. So nodes are dropped the messages at processing unit. In this paper we proposed the network message delivered based automatic removal of unnecessary messages from buffer overflow in DTNs. So buffer space is only maintained for current transaction process in each node. Finally, the DTN node transaction is not delay approach and every time buffer space is free.

Keywords: Delay Tolerant Network, Message Scheduling, Buffer Management, Routing.

I. INTRODUCTION

Traditionally, communication networks, regardless of whether they are wired or wireless, have always been assumed to be connected almost all the time. Here, by connected networks, we mean that there exists at least one end-to-end path between every pair of nodes in the network most of the time. When partitions occur, they are considered transitory failures and core network functions such as routing react to these failures by attempting to find alternate paths. Networked environments which operate under such intermittent connectivity also referred to as episodically connected, delay tolerant, or disruption tolerant networks [12]. In a Delay/Disruption Tolerant Network (DTN), nodes play a role of relaying messages. Most DTN routing protocols have assumed negligible storage overhead without considering that each node could be with a limited buffer space. Note that buffering and forwarding unlimited number of messages may also cause intolerable resources and nodal energy consumption; and it is imperative to set up buffer limitations at the DTN nodes to better account for the fact that each node could be a hand-held and battery-powered device with stringent limitations on buffer space and power consumption [6]. With such buffer limitations at the DTN nodes, message drop/loss could happen due to buffer overflow. This leads to a big challenge in the implementation of most previously reported DTN routing schemes.

In homogeneous DTNs, deciding to optimize either the message delivery ratio or message delivery delay. For increasing the delivery ratio in a DTN, it is critical to select messages to be discarded upon a full buffer. For this efficient routing strategies and also effective buffer management schemes are described to enable an effective decision process on which messages should be forwarded and which should be dropped when the buffer is full. Such a decision is made by evaluating the impact of dropping each buffered message according to collected network information for either optimal message delivery ratio or message delivery delay [6]. There are two widely employed DTN routing schemes, namely; the epidemic and two-hop forwarding schemes. In the existing system provide the novel message scheduling framework for DTNs under epidemic and two-hop forwarding routing schemes. This paper investigates an automatic removal of unnecessary message from buffer for every process.

II. RELATED WORK

A. Delay Tolerant Network

A delay tolerant networking is an approach to computer network architecture that seeks to address the technical issues in heterogeneous networks that may lack continuous network connectivity. A DTN is a network of smaller networks. DTNs support interoperability of other networks by accommodating long disruptions and delays between and within those networks, and by translating between the communication protocols of those networks [7]. A node in a DTN is allowed to buffer a message and wait until it finds an available link to the next hop. The next hop node

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buffers and forwards the received message accordingly if it is not the destination of the message. This process continues until the message reaches its destination. In DTN, the storage places (such as hard disk) can hold message indefinitely. They are called persistent storage, as opposed to very short-term storage provided by memory chips and buffers. Internet routers use memory chips and buffers to store (queue) incoming packets for a few milliseconds while they are waiting for their next-hop routing-table lookup and an available outgoing router port.

DTN routers need persistent storage for their queues for one or more of the following reasons [7]:

i. A communication link to the next hop may not be available for a long time.
ii. One node in a communicating pair may send or receive data much faster or more reliably than the other node.

B. *Routing*

The ability to transport, or route, data from a source to a destination is a fundamental ability all communication networks must have. Based on some specific information, a routing strategy is then applied in order to decide which message to forward. File transfer is a generic term for the act of transmitting files from source to destination over a computer network like the internet. There are numerous ways to transfer files over a network. Files are transferred using the form of packets. Packets are pieces of a complete block of user data (e.g., pieces of an email message, file or a web page) that travel independently from source to destination through a network of links connected by routers. Routers switch the direction in which the packets move. The source, routers and destination are collectively called nodes [7]. Each packet that makes up a message can take a different path through the networks of routers. If one link is disconnected, routers redirect the packets to use an alternate link. Packets contain both application-program user data (the payload part) and a header (the control part). The header contains a destination address and other information that determines how the packet is switched from one router to another. The packets in a given message may arrive out of order, but the destination's transport mechanism reassembles them in correct order [7].

A common technique used to maximize the probability of a message being successfully transferred is to replicate many copies of the message in the hope that one will succeed in reaching its destination. Multicopy routing strategies have been considered the most applicable approaches to achieve message delivery in DTNs. In the DTN context, when nodes encounter each other they perform pair-wise exchanges of messages with the goal that each message will eventually be delivered to its destination [3]. Fig.1 shows the nodes are encountered with each other and message can be transferred from one node to another. A relay *A* carrying a copy of *m* can decide to spawn a new copy of *m* and forward it to a newly encountered node, (*B*). This decision will depend on the message vectors of the two nodes as well as on the "context" of the two nodes.

Epidemic routing and two-hop forwarding routing are two well-reported approaches for delay tolerant networks routing which allow multiple message replicas to be launched in order to increase message delivery ratio and/or reduce message delivery delay [6].

Delivery ratio: it is given by the ratio between the number of delivered messages and the number of generated messages [9].

Delivery delay: it is given by the time duration between the messages generation and their delivery [9].

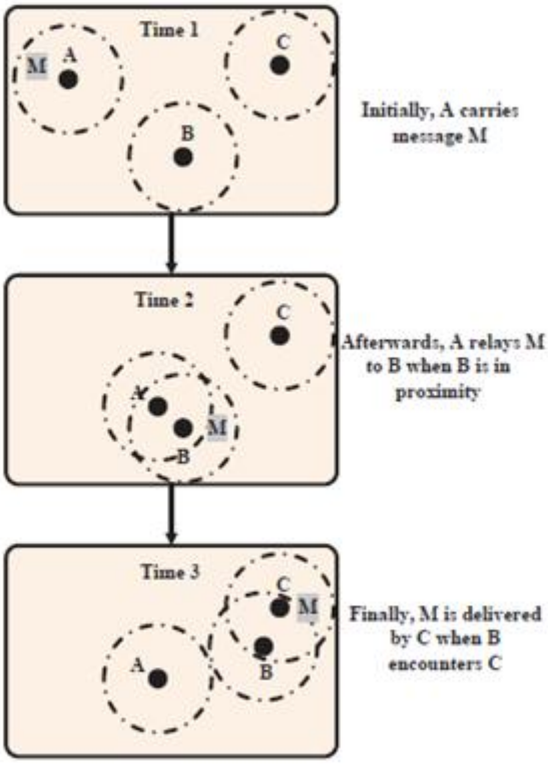

Fig. 1. Routing in DTNs

III. PROPOSED METHOD

A. *Epidemic Routing*

Multicopy routing strategies have been considered the most applicable approaches to achieve message delivery in DTNs. The fastest way to deliver messages is to spread the

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messages to all hosts [6]. Host means computers that are the sources or destinations of data [7]. With the epidemic scheme, whenever two nodes encounter each other, they exchange all messages they do not have in common. Therefore, the message copies are spread like an "epidemic" throughout the network to every node using the maximum amount of resources [2], [6]. The goals of epidemic routing are to [2]:

i. Efficiently distribute messages through partially connected networks in a probabilistic fashion
ii. Minimize the amount of resources consumed in delivering any single message
iii. Maximize the percentage of messages that are eventually delivered to their destination

Theory of epidemic algorithms by doing pair-wise information of messages between nodes as they come in contact with each other to eventually deliver messages to their destination [10]. Hosts buffer messages if no path to the destination is currently available. An index of these messages, called summary vector, is kept by the nodes, and when two nodes meet they exchange summary vectors. After this exchange, each node can determine if the other node has any message not previously received by it. In that case, the node requests the message from the other node [11], [13]. The message exchange is illustrated in fig.2. This means that as long as buffer space is available, messages will spread like an epidemic of a disease through the network as nodes meet and encounter each other [8].

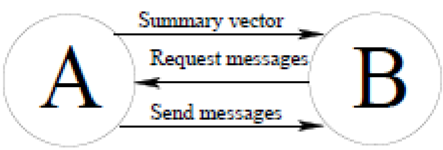

Fig. 2. Epidemic Routing Message Exchange

B. Controlled Flooding

With controlled flooding, a limited number of copies of each message are generated and disseminated throughout the network. The source node forwards a message copy to the first L-1 nodes it encounters, and then each encountered node keeps a copy of the message until it meets the destination node of the message. This strategy of message forwarding is known as two-hop forwarding or source forwarding. Controlled flooding has been shown to achieve competitive delays with only a small fraction of the copies used by uncontrolled flooding policies such as epidemic routing. Controlled flooding performs especially well when nodes are homogeneous and move frequently around the network [12].

C. *Buffer Management*

A buffer is a data area shared by hardware devices or program processes that operate at different speeds or with different sets of priorities. The buffer allows each device or process to operate without being held up by the order. In order for a buffer to be effective, the size of the buffer and the algorithms for moving data into and out of the buffer need to be considered by the buffer designer. An optimal buffer management policy uses global information about the network either to maximize the average delivery rate or to minimize the average delivery delay [3].

Messages are buffered during message transaction. Each node maintaining the limited buffer space is full in DTNs. During buffer overflow messages are scheduled using different strategies [3]. Buffer space is free at every time of message transaction will produce quick delivery of messages. For this purpose, buffers are cleaned at every transaction. But, in existing system buffers are cleaned manually.

D. *Message Scheduling*

DTN routing approaches can be employed in connected networks to harness node mobility for capacity reasons. Due to mobility of nodes, the contact duration is limited. The contact duration may not be sufficient for a node to transmit all messages it has. Therefore decision has to be made on which message to forward. Similarly, in order to cope up with long disconnections, messages are buffered for a long period of time. If buffer capacity is reached, nodes must decide on which message to be dropped [5]. In existing, per-message utility values, which are calculated based on the estimation of two global parameters: the number of message copies, and the number of nodes which have "seen" this message (the nodes that have either carried the message or rejected acceptance of this message).

The per-message utility values are calculated at each node and then used for the decision on whether the buffered messages should be dropped in any contact. With the per-message utility, the node first sorts the buffered messages in a descending manner. The messages with smaller utility values have higher priorities to be dropped when the nodes buffer is full, while the messages with higher utility values have higher priorities to be forwarded to an encountered node. It is known as novel message scheduling framework for DTNs [6]. The novel message scheduling framework approach was compared with three well-known policies listed as follows [3]:

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i. History-based drop (HBD) is based on the history of all messages (on average) in the network after an elapsed time. The variables of the message utility are estimated by averaging the variables of all messages in the network after the elapsed time.

ii. Drop oldest (DO) drops the message with the shortest remaining time to live.

iii. Drop front (DF) drops the message that entered the queue the earliest when the buffer is full.

Each node maintaining the limited buffer space is full in DTNs. So nodes are dropped the messages in the processing unit. The problems are solved in the proposed system. Its focused automatic removal of unnecessary messages from buffer overflow in DTNs. Messages is transferred to destination and the acknowledgement sends to source.

E. *Node Confirmation*

By using routing schemes, the file or message is successfully transferred to destination and the acknowledge message is sent to source or sender. After receiving the acknowledgement, buffer space is automatically free for that message. So buffer space is only maintained for current transaction process in each node. Finally, DTN node transaction is not delay approach and every time buffer space is free.

IV. CONCLUSION

Epidemic routing and two-hop forwarding routing are two well-reported approaches for DTN routing which allow multiple message replicas to be launched in order to increase message delivery rate and/or reduce message delivery delay. A novel message scheduling framework in homogeneous DTNS, aiming to optimize either the message delivery ratio or message delivery delay [6]. The proposed work can focus network message delivered based automatic removal of unnecessary messages from buffer overflow in DTNs. So buffer space is only maintained for current transaction process in each node. Finally, the DTN node transaction is not delay approach and every time buffer space is free.

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