



Efficient Bulk-Data Transmission using Pipelined DSNC Technique in Delay Tolerant Networks

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Abstract— Delay/Disruption Tolerant Network (DTN) is a wireless network. The nodes in DTN are mobile in nature and contain no continuous connection among them. Due to this existing routing protocols cannot be implemented. Epidemic routing with Replication using Random Linear Network Coding mechanism is studied and it has proved to be efficient for small size of data. In order to transfer bulk stream of data existing method cannot be used. Thus segmented network coding method is implemented using Pipeline technique which adapts to the mobility of nodes in the network. This Dynamic Segmented Network Coding method is deployed and lower bound of expected delivery is also observed. This method is effective in utilizing the transmission opportunities which is scarce in DTNs.

Keywords— delay tolerant networks, segmentation, pipeline technique, stop and wait protocol, performance comparison

I. Introduction

DTN is a good complement to the traditional wireless networks and it supports many delay tolerant applications. They are also known as opportunistic networks because of unexpected connections. To resolve this issue, epidemic routing with application is applied. Epidemic routing is flooding based in nature where “store and forward” approach is adopted. In this method, random combinations of packets are sent. Here packets are of different size. During each transmission, the packets are replicated exponentially in a hope that at least one packet reaches the destination. But for large number of packets, this approach is fatal as replication of too many packets lead to decoding problem at destination.

II. Network Model and Parameters

The model consists of $N+1$ mobile nodes with source node and destination node and $N-1$ relay nodes. The size of a packet is the maximum segment one can transfer from one node to another. This can be done only when pair of nodes move into the transmission range. Stop and wait protocol is used for transmission.

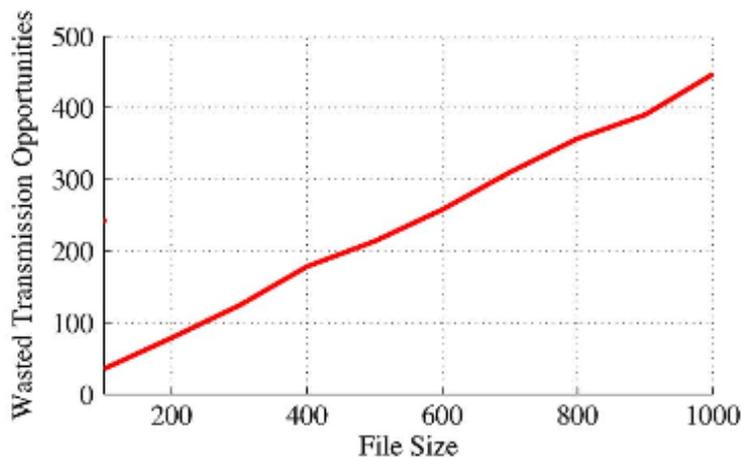
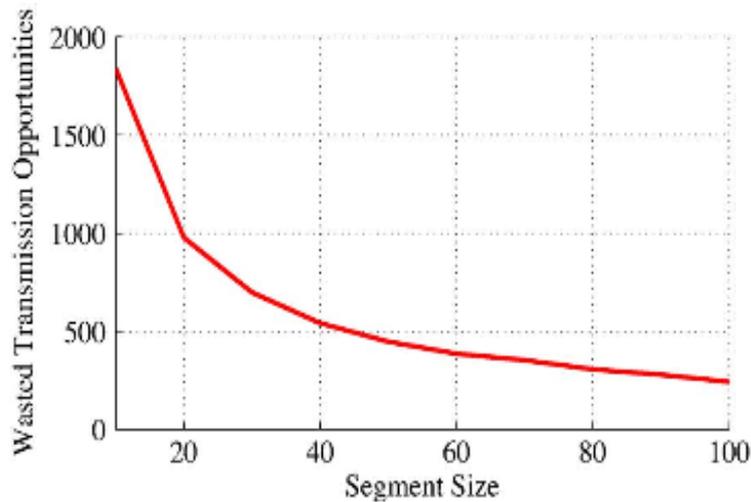
Packets are assigned with unique ID. Segments are created to hold these packets. Each segment is given separate ID. Buffers are used to carry the segments all over the network. Pair of buffers is used and they cannot exceed the maximum size limit.

III. Existing Method

Epidemic Routing using RLNC method. In this method, data to be sent are divided into packets of random sizes. Combinations of these different sized packets are sent through the network using stop and wait protocol. As the packets arrive at each node, they are replicated exponentially. When these packets are received at the destination, the original packet is decoded according to the assigned ID. Finally the acknowledgement is sent to the sender after retrieving the original packet. If the packet is lost in the journey or if it is fabricated, acknowledgement is sent accordingly and a new packet is transmitted again.

Since the packets are of varied sizes, it is difficult to select the combination of them. Due to replication of packets at each node, large number of packets is received at the destination. Thus, decoding the original packet is difficult. Due to this, the acknowledgement transmission is also delayed. As a result, waiting time of next packet is increased which results in long waiting gap. This also consumes lot of transmission opportunities if the network is ready to accept the data hence it remains idle.

To overcome the disadvantages of the existing system, dynamic segmented network coding mechanism using pipeline technique is implemented in which the data packets are of fixed size and pair of buffers are used to carry them through the network using enhanced stop and wait protocol.



IV. Proposed Method

In Dynamic segmented Network Coding (DSNC) method, three phases of transmission is observed.

SEEDING PHASE:

In this phase, source node transmits the pair of buffers carrying segments with fixed size of packets. It is done in pipeline manner. When one buffer has filled and is on its way to destination, the other buffer starts filling.

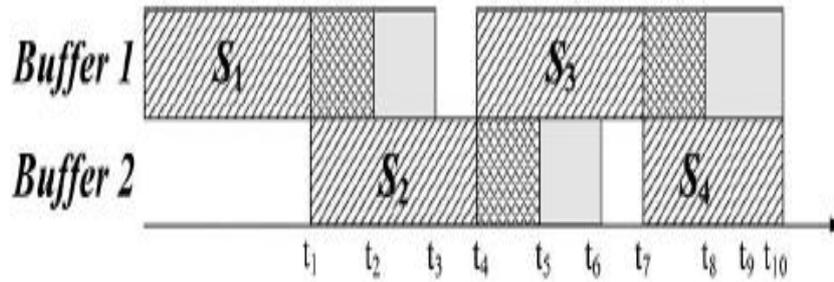


Figure1. Illustration of Pipeline Technique

PROPAGATION PHASE

Each segment is assigned with a particular Time To Live (TTL) value. When the buffer is sent from the source the TTL value is high and it goes on decrementing during transmission. If TTL becomes zero before it is reached, then that segment is dropped and new buffer is resent.

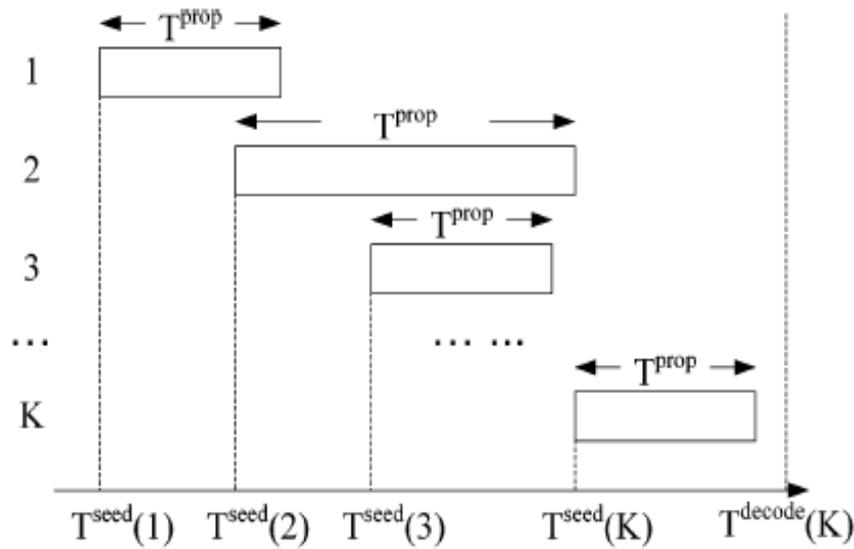


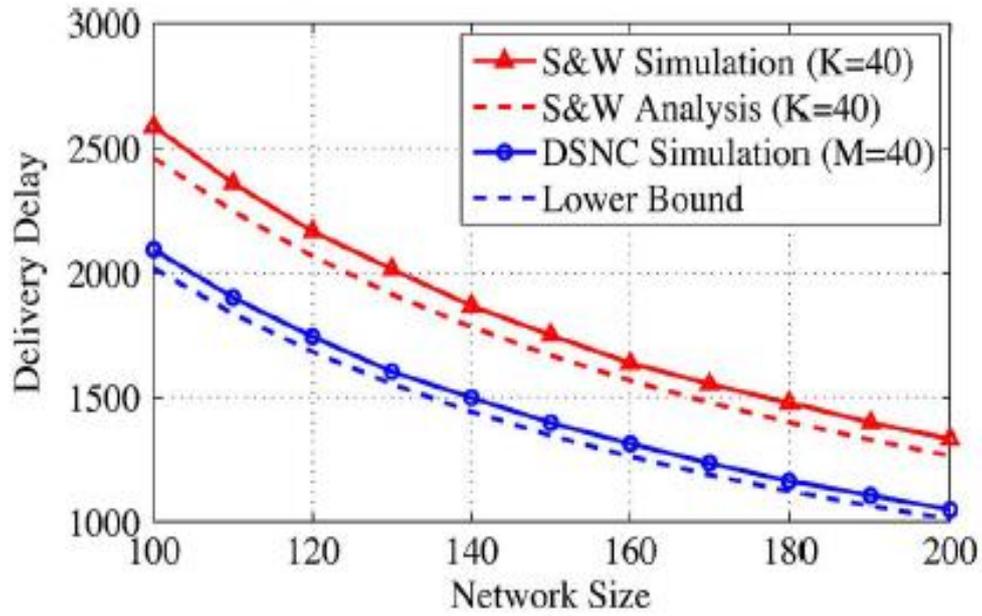
Figure2. Illustration of Propagation Phase

ACK PHASE

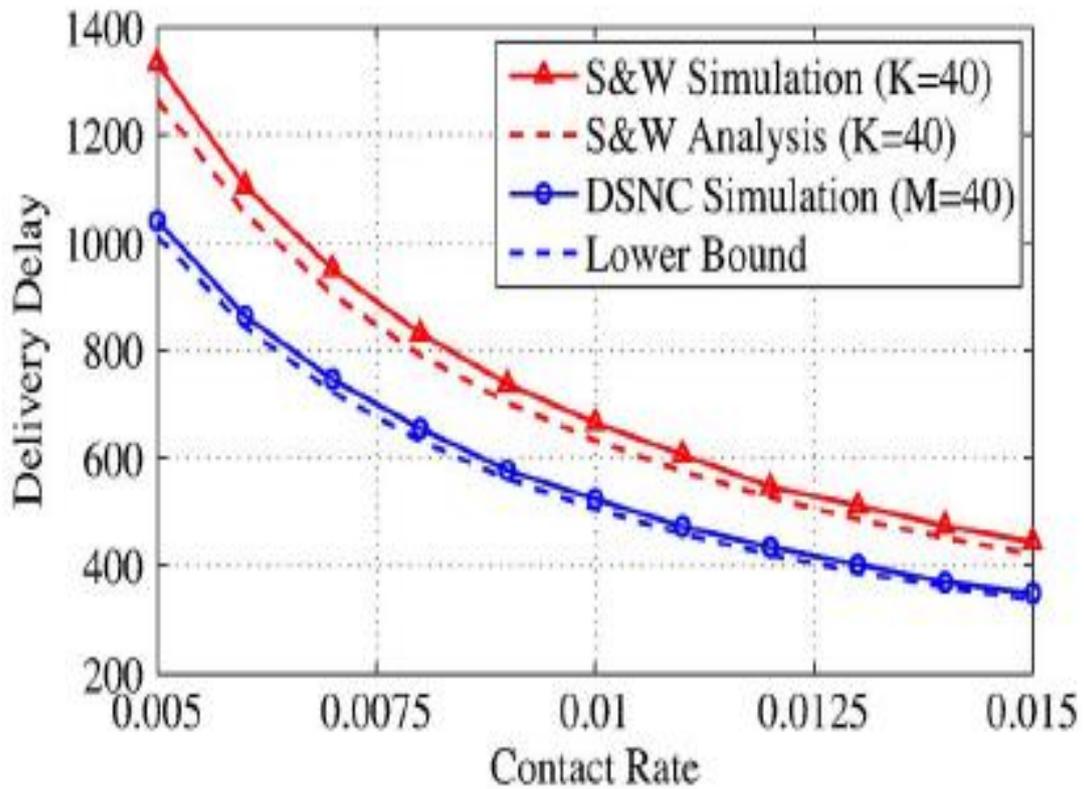
When destination receives the packets, it sends an acknowledgement back to the source in the same buffer it had received the packet. Buffer is evacuated once ack is received. This process continues and empty buffers are filled with packets and resent.

V. Results and Snapshots

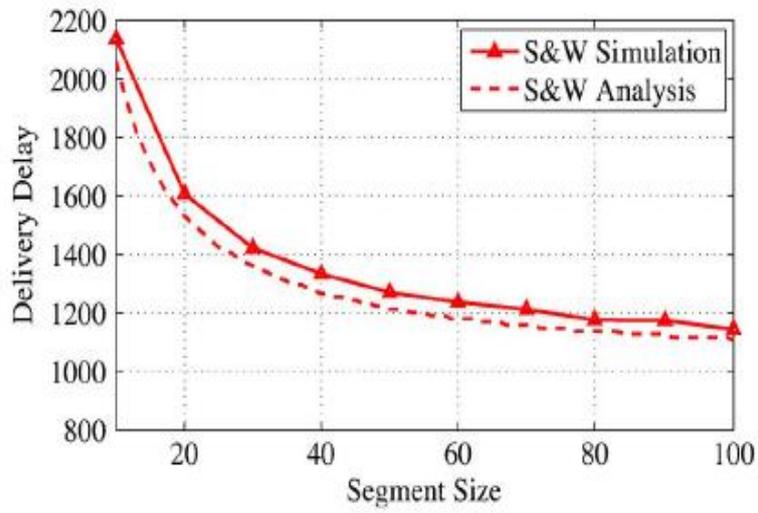
On Network Size



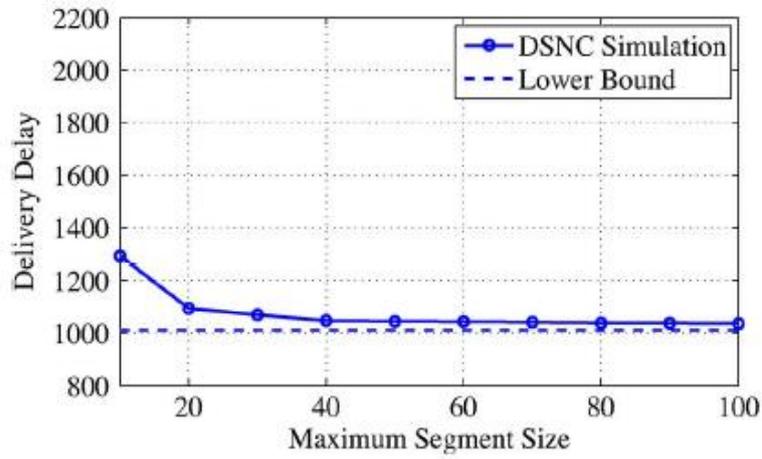
On Contact Rate



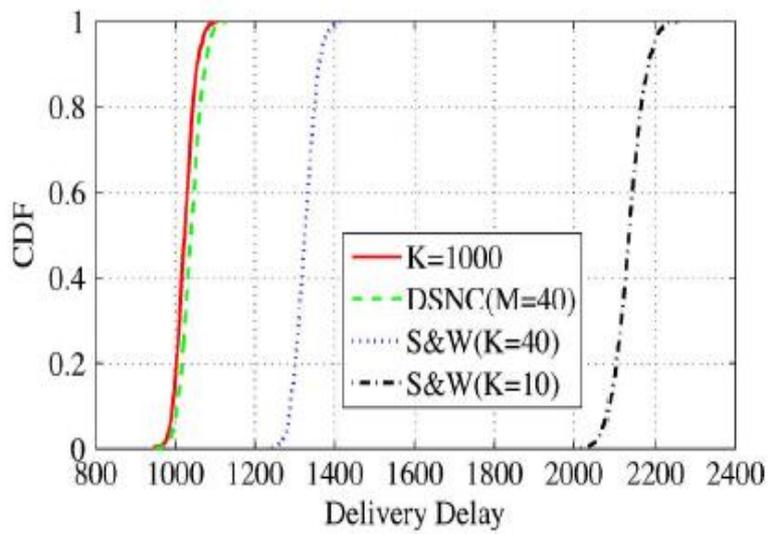
On Segment Size



On Maximum Segment Size



On Delivery Delay



VI. Conclusion

Existing procedures fail to transmit large data in DTNs in reliable manner. Stop and wait protocol does not transfer the data efficiently in existing RLNC method. To adapt to the dynamics of the network, advanced stop and wait protocol is used using pipelined DSNC technique. Lower bound of expected delivery is also extracted.

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