Forwarding Policies for Delay and Disruption Tolerant Networks

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I. Introduction

In Delay and Disruption Tolerant Networks (DTNs) [1], packet forwarding is based on the store-carry-and-forward paradigm. Basically, each node has a buffer and is able to store messages persistently, until an appropriate forwarding opportunity arises. In addition, several routing protocols for DTNs employ message replication as an alternative to increase the message delivery rate.

The role of a forwarding policy for DTNs is to determine the packets a node should forward to a neighbor during a contact. Forwarding a packet, in this context, implies sending a replica and does not mean discarding it, which may lead to frequent buffer overflow. Thus, node must employ a buffer management policy to define which message should be dropped if its buffer is full. In this paper, we evaluate three well-known forwarding policies – FIFO, random, and GRTRMAX – jointly with our proposed buffer management policy named Least Recently Forwarded (LRF) [3]. Our goal is to identify the forwarding policy that is more suitable to be used with LRF.

II. Results

Results are obtained through simulation using the Opportunistic Network Simulator (ONE). Two datasets, hereinafter referred to as Rollernet and Infocom06, are used to evaluate the forwarding policies jointly with LRF. These two datasets differ in the average number of contacts per hour and also in the length of these contacts. The PRoPHET [2] routing protocol is used.

Figure 1 shows the delivery rate as a function of the buffer size for the Infocom06 scenario. Results show that both Random and GRTRMAX policies achieve a similar delivery rate as the buffer size increases. On the other hand, FIFO provides a lower delivery rate because it suffers from the head-of-queue problem. With FIFO, older messages in the buffer are forwarded first by a node during a contact. Consequently, messages at the head of the queue are forwarded often whereas messages at the end of the queue are rarely forwarded. On the other hand, the random policy does not prioritize any message and the GRTRMAX policy gives priority to messages that are theoretically more likely to reach the destination. This result indicates that a forwarding policy should consider the number of replicas of a message as forwarding heuristic. The idea is to forward messages that are not currently spread in the network.

The head-of-queue problem also explains the difference among random and GRTRMAX to the FIFO policy increases with the buffer size. In this case, the higher the buffer size, the less the number of times the buffer management policy is triggered. Thus, messages prioritized by FIFO remains in the buffer for a longer time and are more replicated. Results for the Rollernet scenario are quite similar and are suppressed for the sake of brevity.

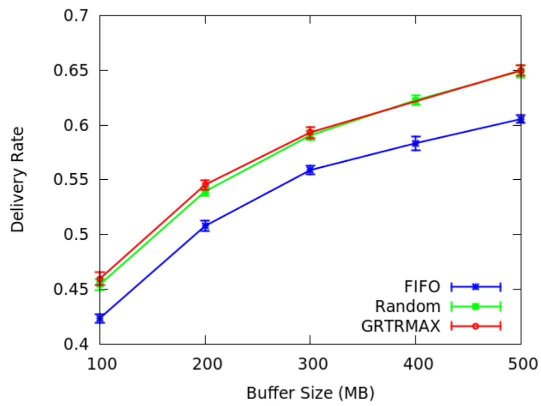

Fig. 1. Delivery rate vs. buffer size for Infocom06 scenario.

III. Conclusions and Future Work

In this paper, three forwarding policies for DTNs were evaluated jointly with the LRF buffer management policy. The results show that the FIFO policy gives priority to the same group of messages leading to a poor performance. As a future work, we intended to evaluate other different combinations of forwarding and buffer management policies to determine how the buffer management impacts the forwarding strategy.

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References

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