

Figure 5: Repair efficiency (Note that $S_4 - S_8$ are not shown, since all of them achieve a bandwidth = $6Mbps$)

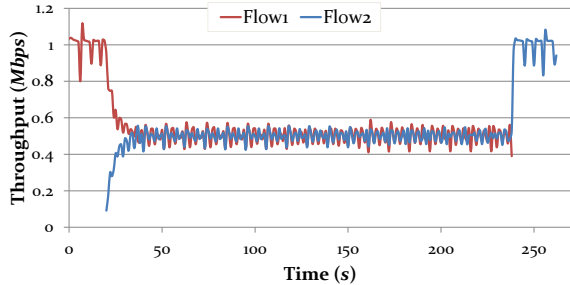


Figure 6: Fairness of two flows competing $1Mbps$ bottleneck

In Fig. 5, we investigate further into the individual throughput achieved by the subscribers (the $ACKer$ is $S_{bandwidth=6}$ in this case). We can observe that S_1 is able to achieve a throughput of about $2Mbps$ as long as the multicast is on ($1Mbps$ via multicast and $1Mbps$ via subscriber repair) and able to achieve a throughput of $1Mbps$ via local repair as soon as the multicast is over (at 23s). Other subscribers observe a similar trend. We can also observe that the subscribers take a while to achieve their max throughput since, at the beginning, very few subscribers have (and serve) the data packets that other subscribers want.

4.2 Fairness:

In Fig. 6, we evaluate the scenario of two publishers having the same $ACKer$ and starting 20s apart. We observe that the publishers are able to share the bottleneck bandwidth of the $ACKer$ fairly.

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5 Summary

R-COPSS enhances a content oriented pub/sub system with flow and congestion control and reliability. We show that the combination of multicast based delivery and query/response based local repair enables R-COPSS to support a rate that is faster than the slowest subscriber’s receive rate. In fact, the average throughput achieved across all the subscribers is greater than or equal to their bottleneck link rate, showing that the congestion control mechanism is effective. R-COPSS is also able to achieve fairness across publishers.

Much future work remains to be done. An analytical model of the $ACKer$ selection will be studied to provide more efficient multicast in terms of both throughput and network load. We will also seek the effectiveness of layered multicast

in the real application (*e.g.* video transfer, conferencing, *etc*) and provide better solution in the ICN world. Another direction of the research will be, how to reduce the wasted traffic on the minority so as to save the total network load and provide better service for the other flows.

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7 References

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