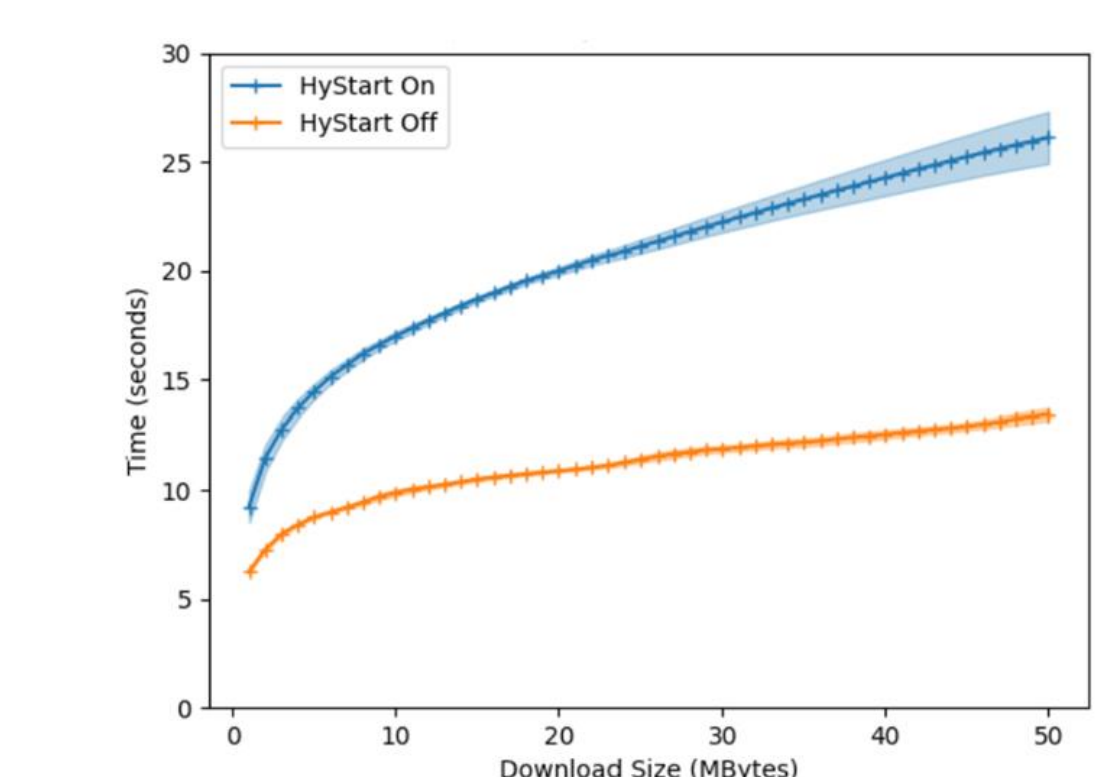
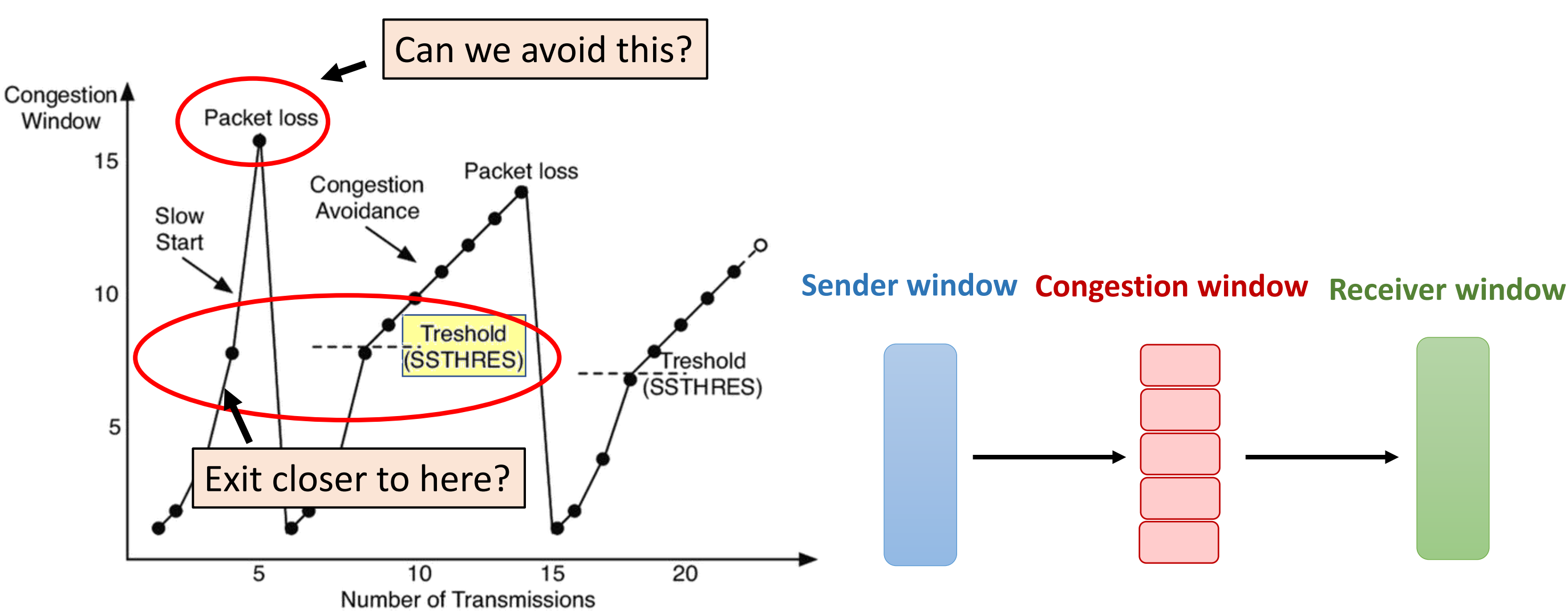
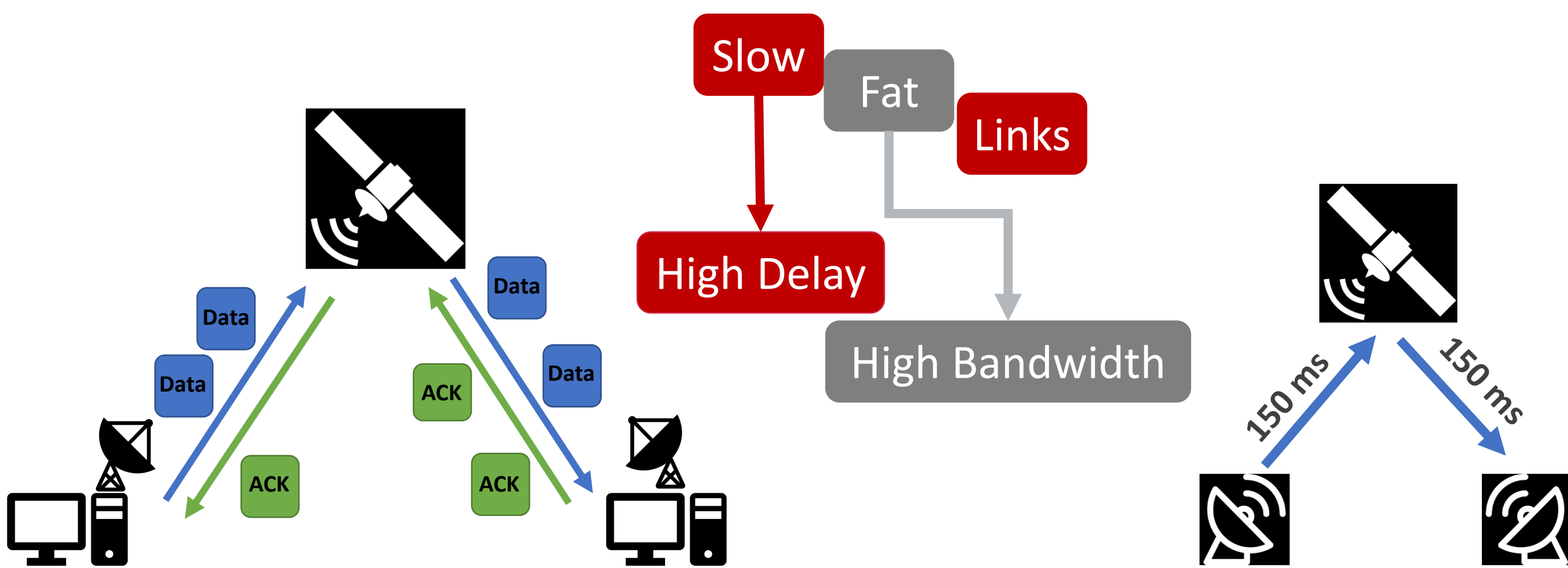


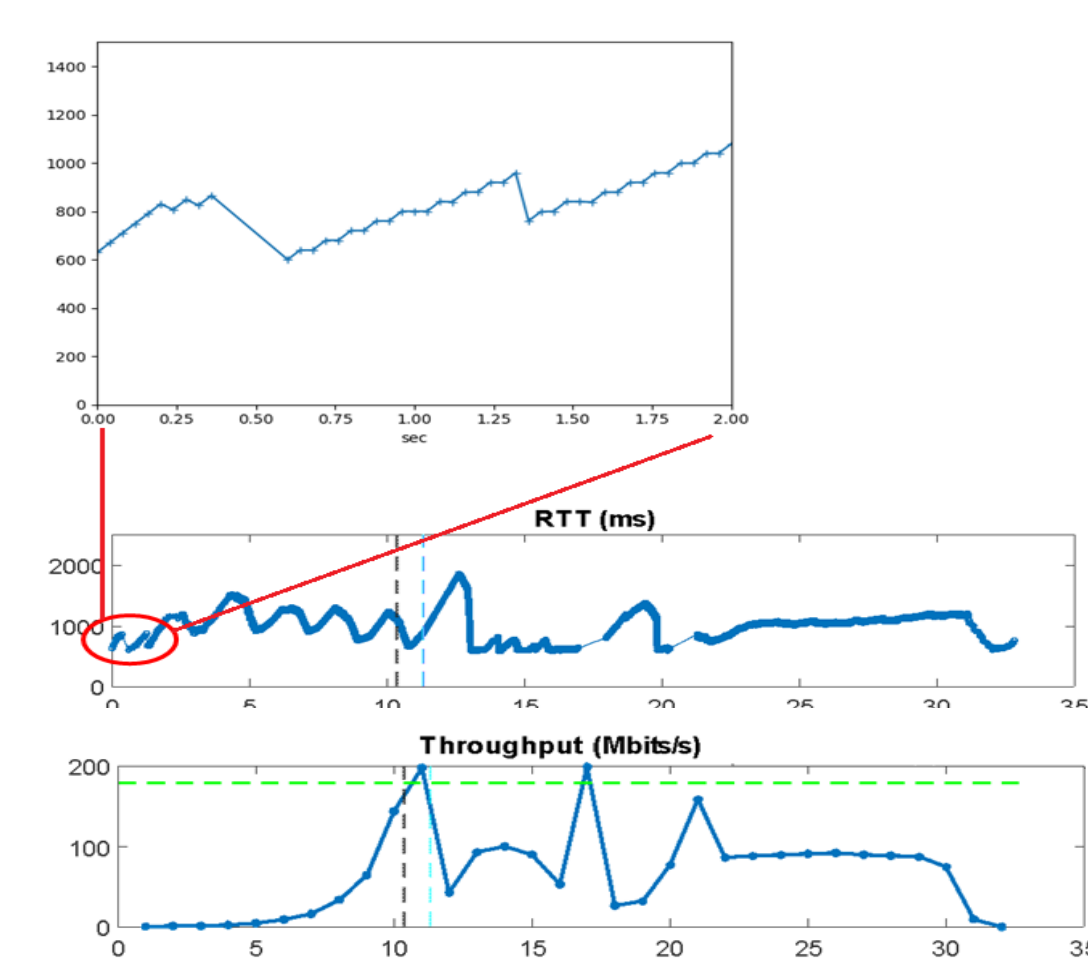
Abstract

Satellite networks are an essential part of modern network infrastructures. The critical challenge of these networks is to overcome the inherent high latencies that are detrimental to TCP throughputs. We improve TCP performance by using bandwidth estimation to more quickly increase throughput for links with high latency. We evaluate the proposed slow start algorithm over a commercial geostationary satellite link. Our preliminary results indicate that our proposed slow start adjustments improve start-up performance over satellite links, outperforming the measured alternatives.

Introduction

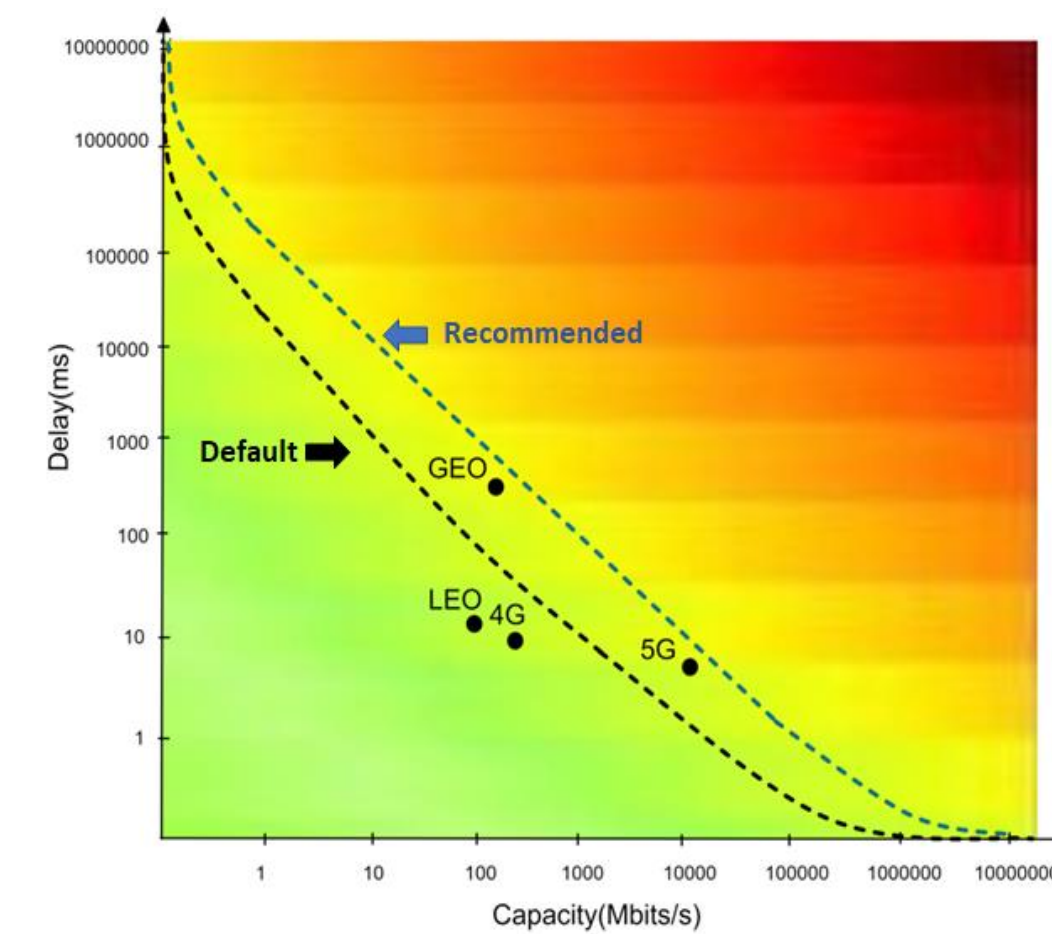


Time to download objects of different sizes



RTT and throughput with HyStart on

Approach



BDP limitations for the default(6291456) and Recommended(26214400) maximum Linux buffer sizes

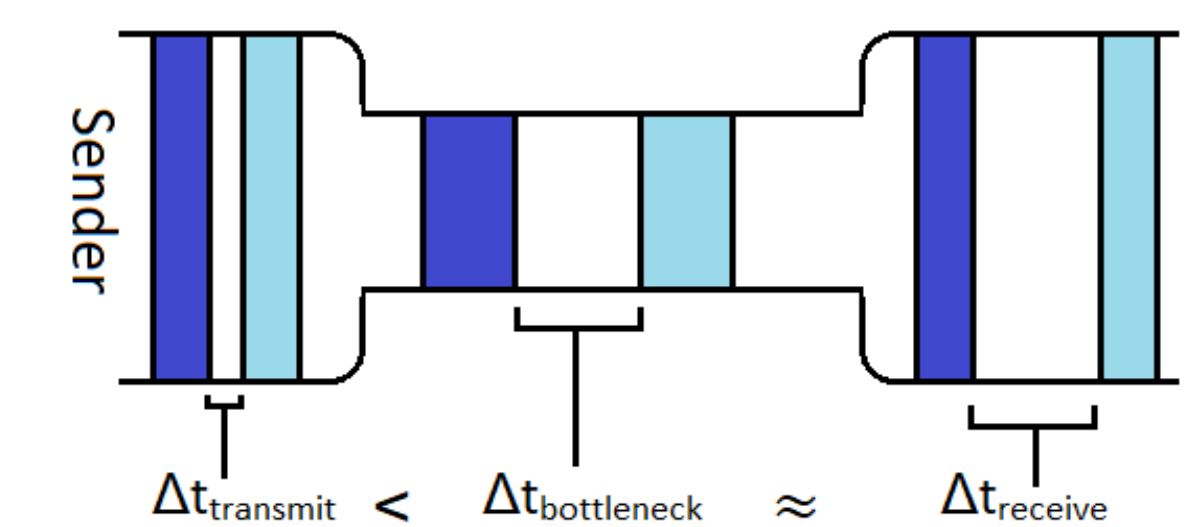
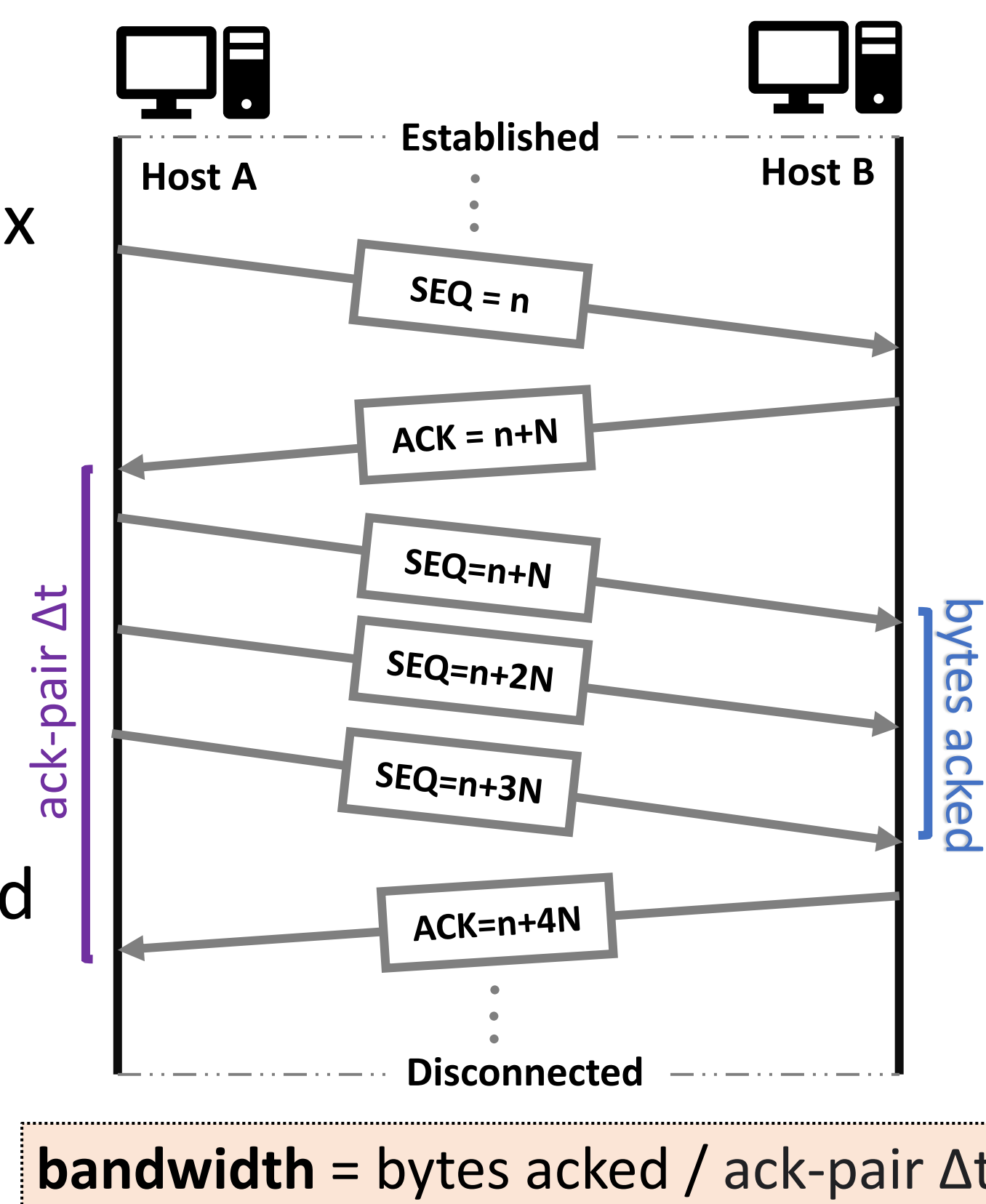
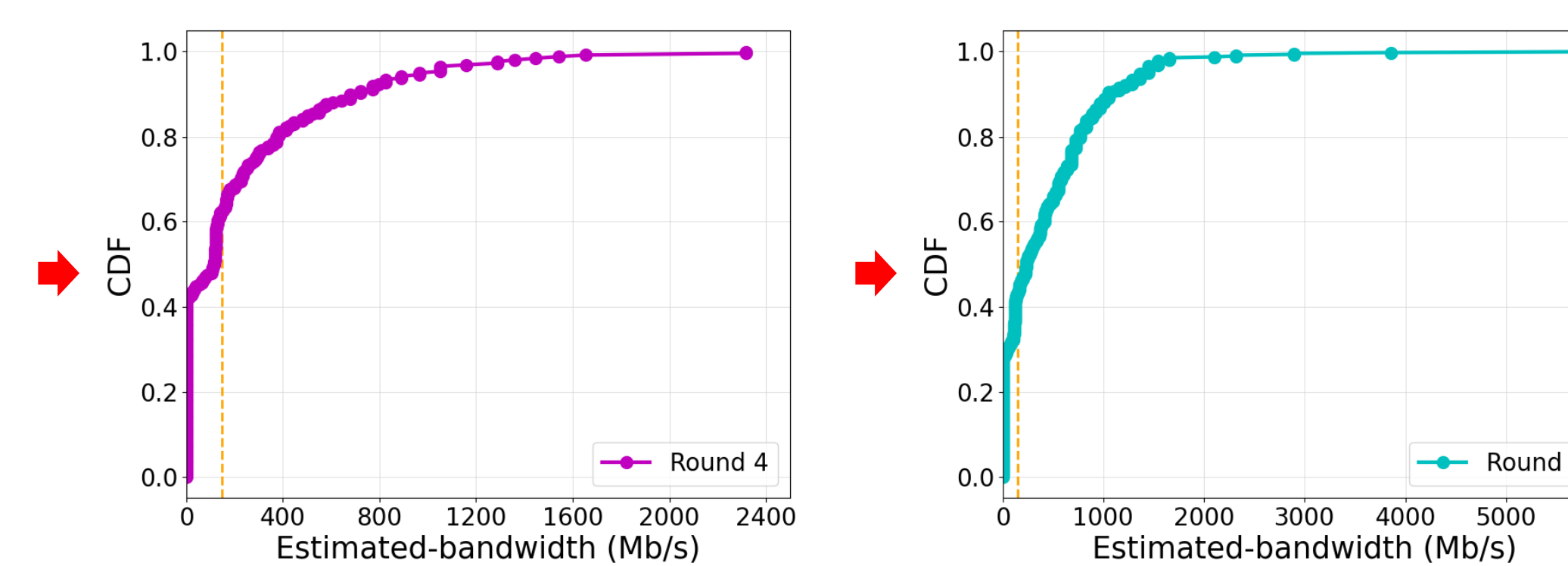
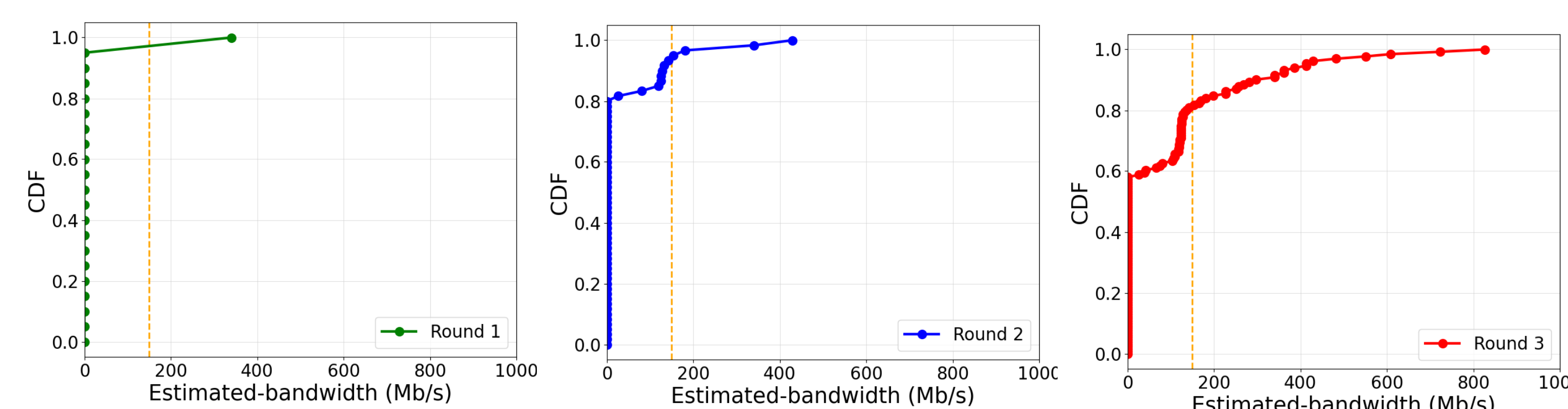


Illustration of packet temporal spacing through a bottleneck link

- Making change on TCP in Linux kernel
- Use information of log file
- Packet pairs for each RTT
- Estimate bandwidth
- Find the median of estimated bandwidths for each RTT
- Determine threshold to set BDP



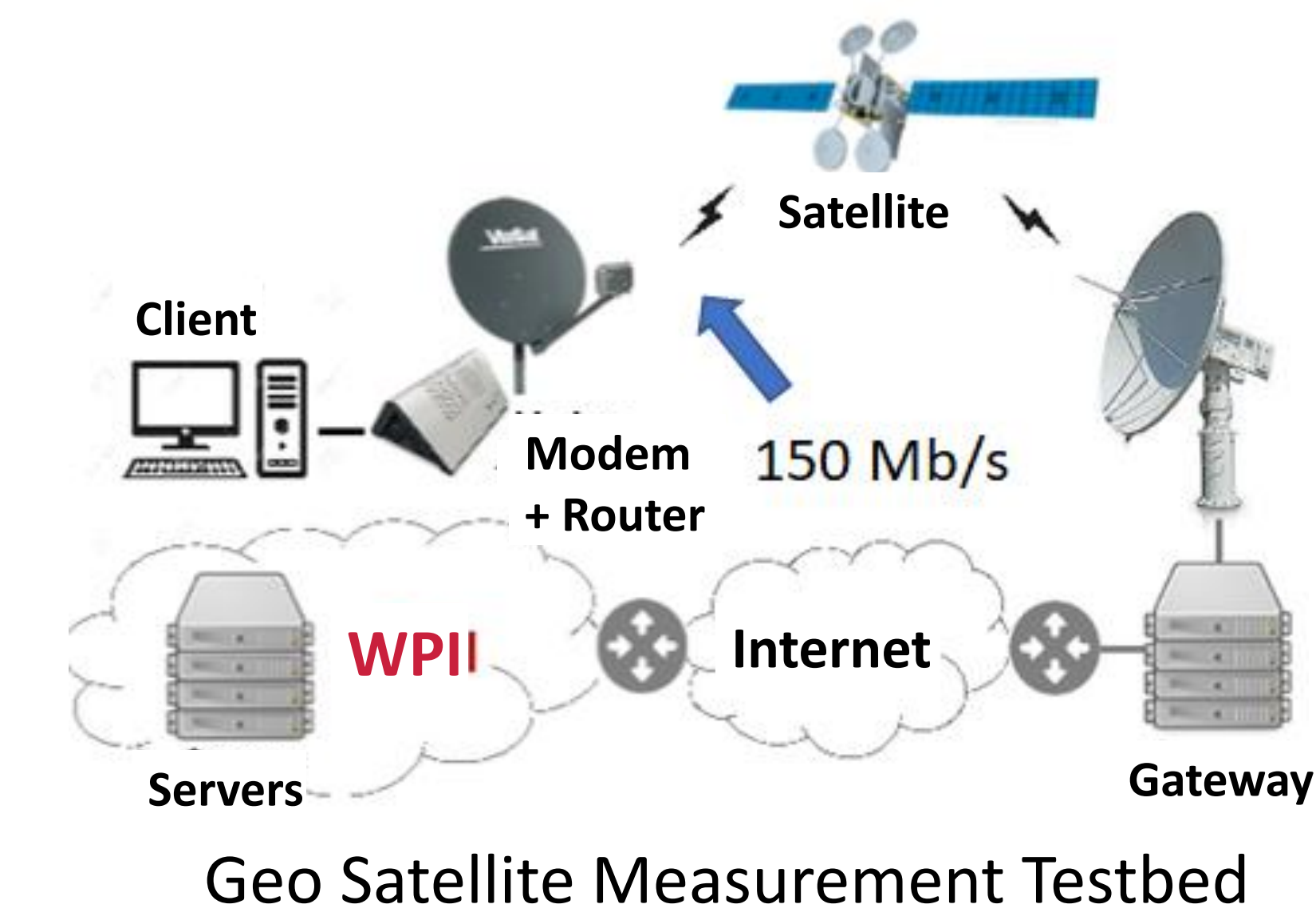
$$\text{bandwidth} = \text{bytes acked} / \text{ack-pair } \Delta t$$



Estimated bandwidth for each RTT (rounds 1 to 5)

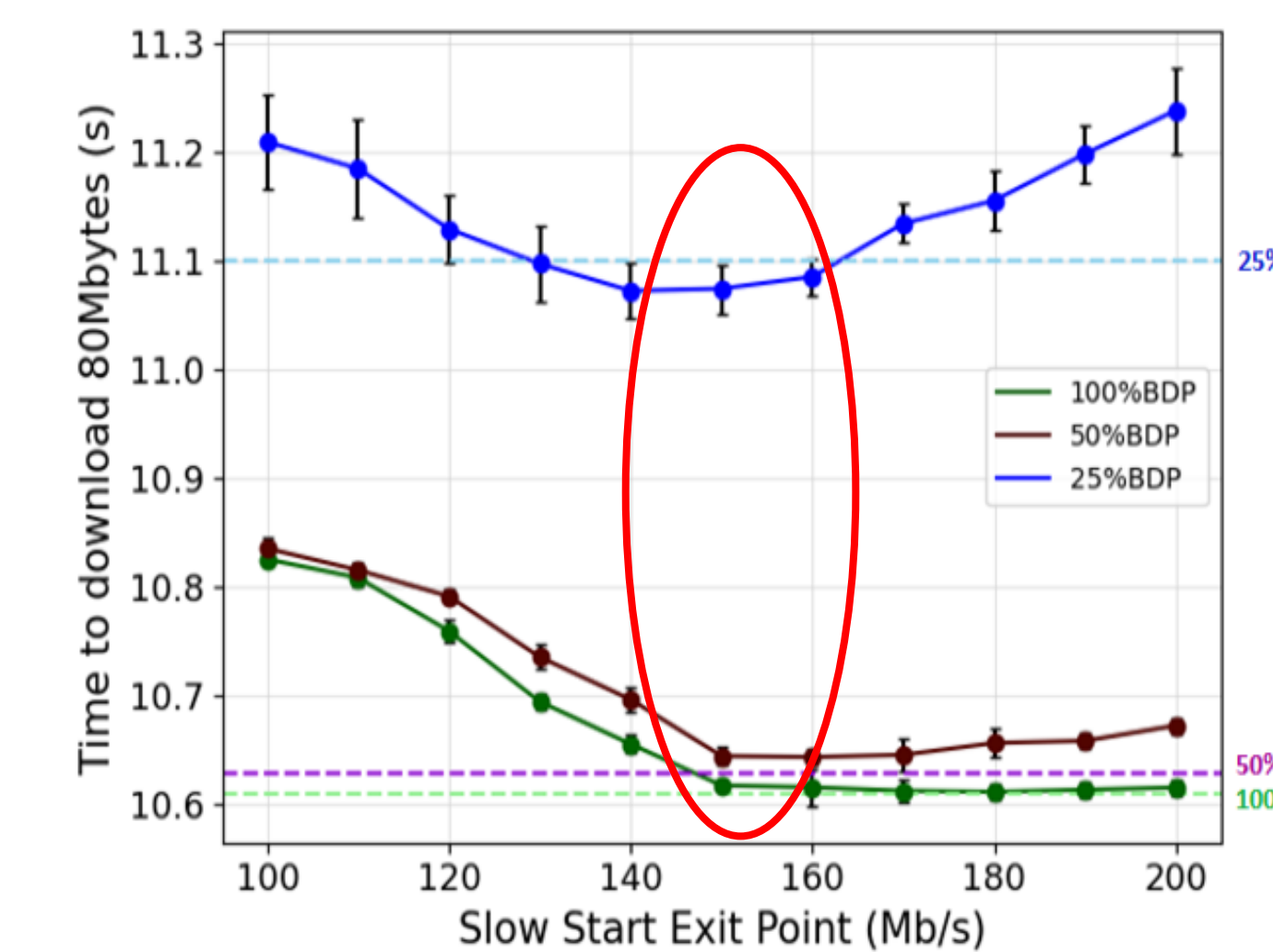
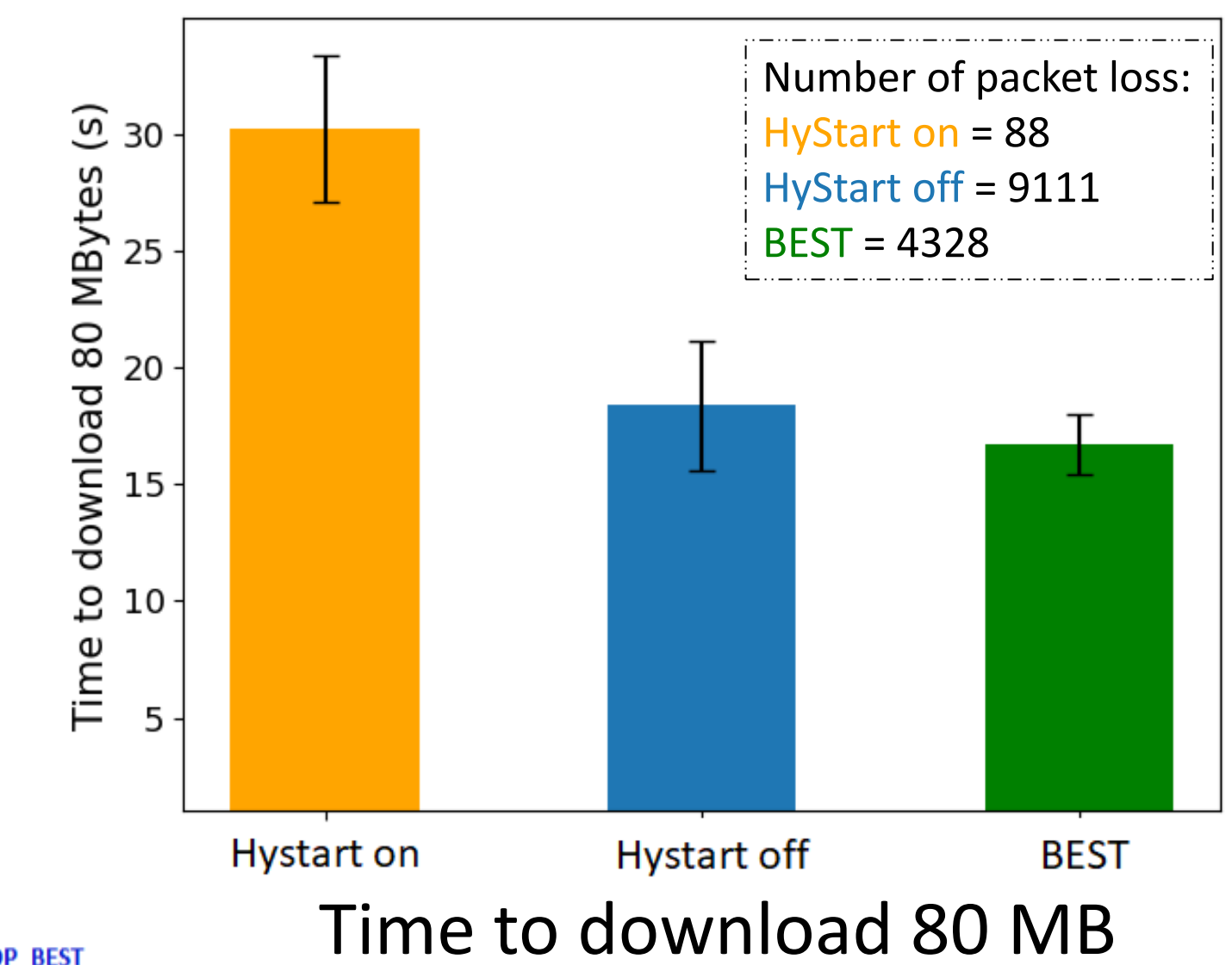
Evaluate

- Use Viasat testbed
- Several bulk downloads using Iperf3
- Compare BEST, HyStart on, and off



Result

The shortest download times and about half the packet losses of HyStart



Near the optimal exit points for different queue sizes

Performance of BEST for different queue sizes

Conclusion

- ✓ HyStart on: Exit too early, underutilization
- ✓ HyStart off: Exit too late, Overshooting, Packet loss
- ✓ BEST: Shorter download times for 80 MByte objects than HyStart on or HyStart off with more substantial improvements for smaller bottleneck queue sizes

Future Work

- Accommodate LEO link characteristic
- Evaluation in more networks and system configuration
- Consider other approaches including sending-delivery rate method and Ack Space method