

Assignment 4, Part 1: Reliability Analysis

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1 Experimental Analysis

1.1 Experiment 1: Download Time vs. Loss

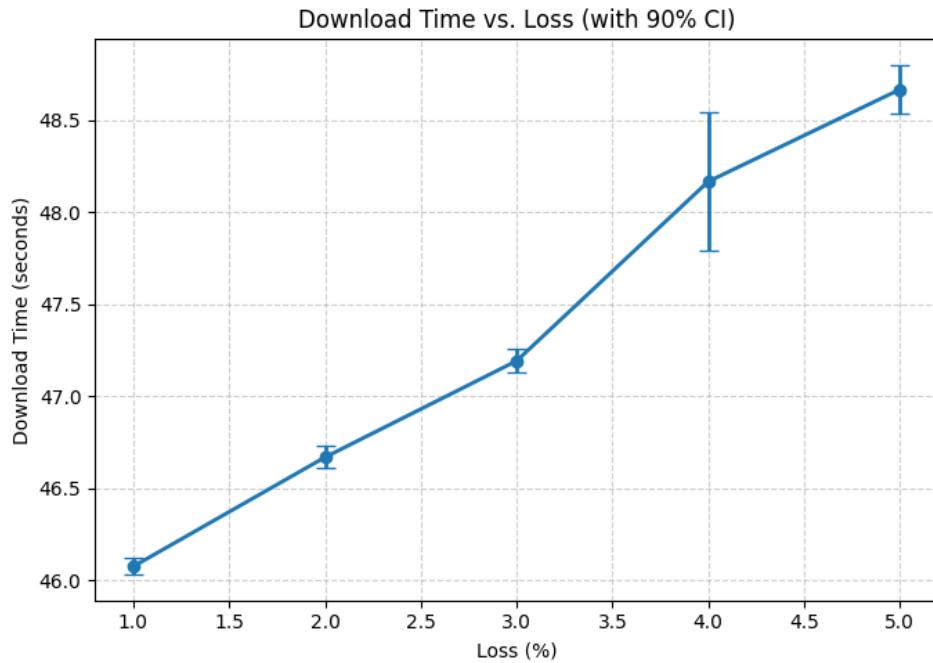


Figure 1: Download Time vs. Loss (with 90% CI)

Observations:

- There is a clear positive correlation between packet loss and download time. As the loss rate increases from 1% to 5%, the average download time rises from approximately 46 seconds to over 48.5 seconds.
- The relationship appears roughly linear, with each percentage point of loss adding a significant time penalty.
- The 90% confidence intervals (error bars) become noticeably wider at higher loss rates (e.g., at 4% and 5%), suggesting that packet loss not only slows down the transfer but also makes its performance more variable and less predictable. This is likely due to the compounding effect of retransmission timeouts.

1.2 Experiment 2: Download Time vs. Jitter

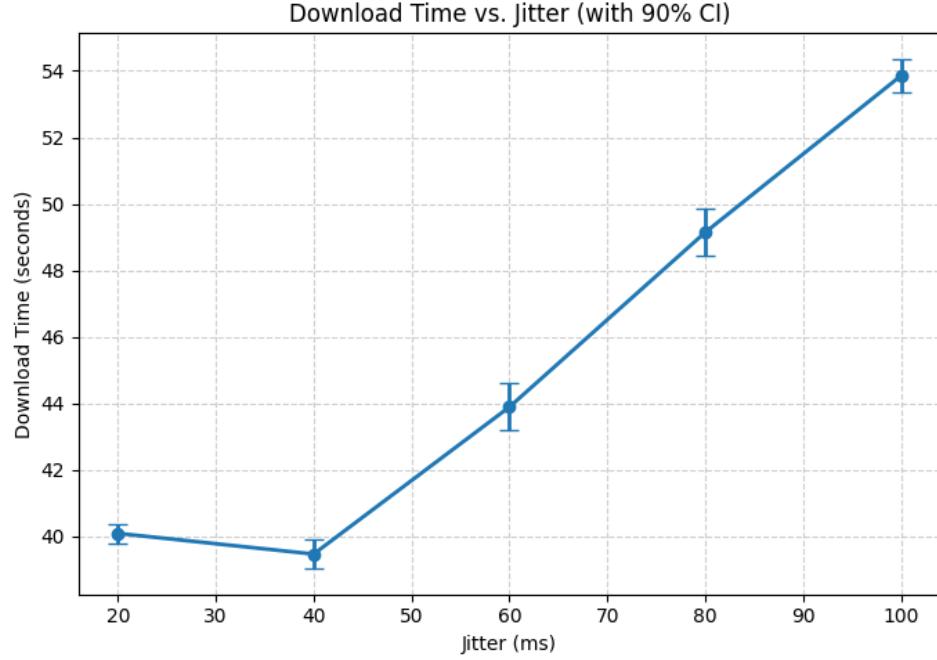


Figure 2: Download Time vs. Jitter (with 90% CI)

Observations:

- Increasing network jitter has a significant negative impact on download time, especially at higher values.
- While performance is stable between 20ms and 40ms, the download time increases dramatically as jitter rises from 40ms to 100ms (from $\sim 39.5\text{s}$ to $\sim 54\text{s}$).
- This performance degradation is likely because high jitter causes the round-trip time (RTT) to fluctuate. This can lead to a poorly estimated RTO (Retransmission Timeout), causing the sender to time out prematurely and retransmit packets that were not actually lost, only delayed.