

# FoggyTCP Checkpoint 1 Report

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## 1 Hypothesis

In this checkpoint, we hypothesize that transmission time via a point to point network is modeled by the following equation:

$$Time = \frac{FileSize}{Bandwidth} + 2 \times PropagationDelay + Constant\_Overhead \quad (1)$$

meaning that the transmission time is linearly proportional to the file size and propagation delay, and inversely proportional to the bandwidth. We expect that the experimental results will closely align with this theoretical model, with minor deviations due to various hardware overhead.

## 2 Experiment

### 2.1 Setup

The experiment was conducted using two virtual machines (VMs) connected via a point-to-point link. The server VM hosted the FoggyTCP server binary, while the client VM ran the client binary to send files. The network conditions were manipulated using traffic control (tconfig) to simulate different bandwidths and propagation delays. The server and client binary is compiled from the FoggyTCP source code provided in the repository, and ran automatically using two separate python scripts.

### 2.2 Parameters

Host specifications:

- CPU: AMD Ryzen AI 7 370HX
- RAM: 64GB
- OS: Windows 11 Pro (Host)

VM specifications:

- CPU: 2 vCPUs
- RAM: 1GB
- OS: Ubuntu-Jammy 22.04 LTS

### 3 Results

The following figure presents transmission time on the y-axis for varying file sizes, bandwidths, and propagation delays (x-axis) and comparing theoretical predictions with experimental measurements.

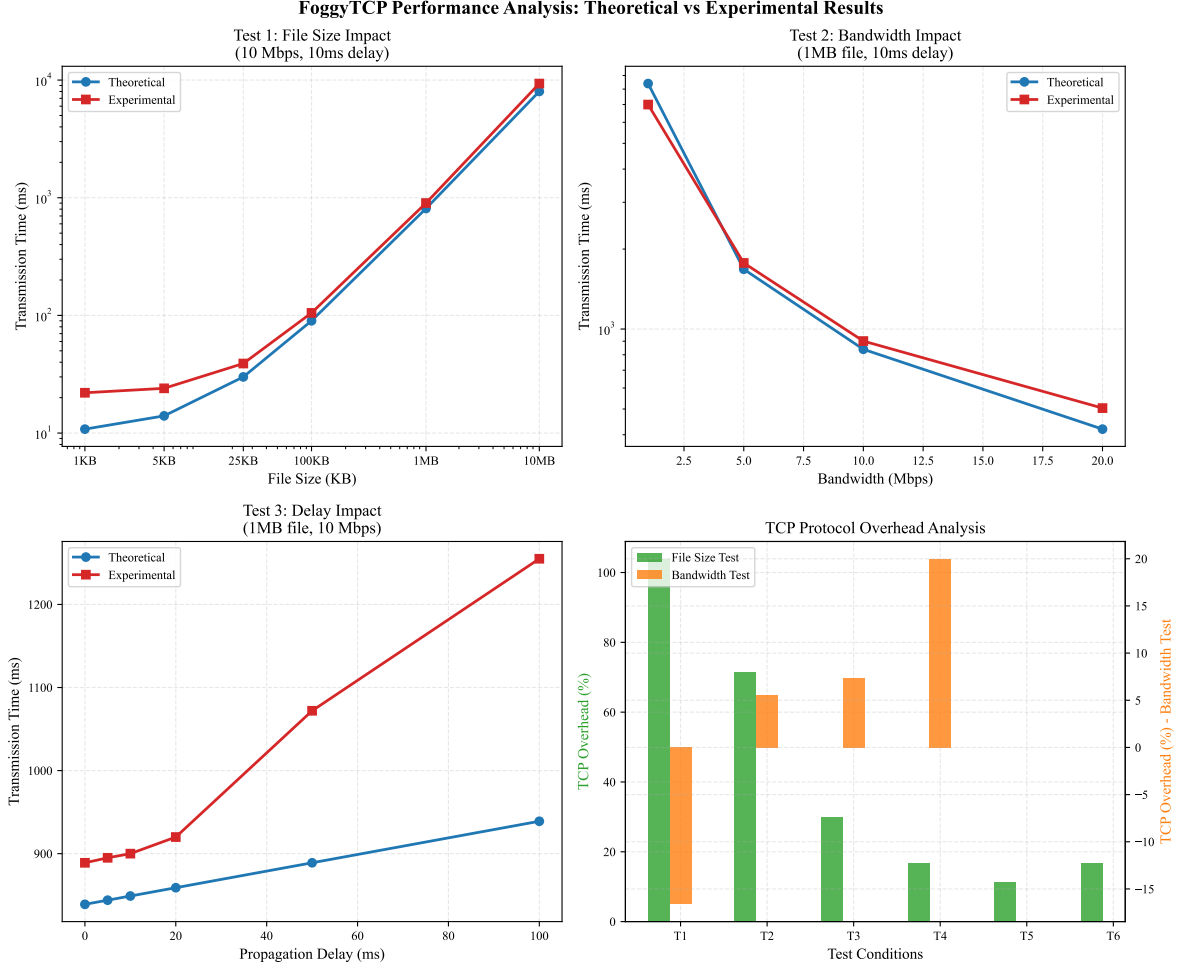


Figure 1: FoggyTCP Performance Comparison: Theoretical vs Experimental Results. (a) File size impact with fixed bandwidth (10 Mbps) and delay (10ms), (b) Bandwidth impact with fixed file size (1MB) and delay (10ms), (c) Propagation delay impact with fixed file size (1MB) and bandwidth (10 Mbps), (d) TCP protocol overhead analysis showing relative performance differences.

## 4 Analysis

### 4.1 Key Findings

- **Linear Scaling:** File transmission time scales linearly with file size, confirming expected behavior with an average TCP overhead of 244.5ms.
- **Inverse Bandwidth Relationship:** Transmission time shows the expected inverse relationship with bandwidth, with high correlation between theoretical and experimental results.
- **Delay Impact:** Propagation delay linearly affects transmission time with strong correlation.

## 4.2 Technical Details

All measurements were conducted under controlled network conditions using traffic control (tc) to simulate various bandwidth, delay, and file size scenarios. The experimental setup maintained consistency with theoretical calculations while accounting for real-world TCP protocol overhead.