



B.Tech. Project
on
Digital Payment Apps

Mid-Term Presentation
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Supervised by:
Prof. Tarun Mangla & Prof. Vireshwar Kumar

Submitted By :
Tushman Khalse 2019CS10411
Shreejeet Golhait 2019CS10351

Introduction

- **UPI apps are the backbone of India's digital economy**, enabling millions of secure, instant transactions daily.
- **The rapid adoption of UPI emphasizes the need to optimize transaction performance**, especially under varying network conditions.
- **We aim to analyze network traffic and interactions during UPI transactions**, identifying which steps take the most time.
- **By evaluating UPI apps under different conditions**, we establish benchmarks to improve transaction efficiency.
- **Our goal is to recommend measures to optimize transaction times**, ensuring UPI apps perform efficiently and minimize delays.



Project Objectives

- **Investigating network traffic** generated during UPI payment transactions to uncover patterns and key insights.
- **Automation** of UPI transactions for efficient testing and future use.
- **Testing and comparing network behavior** across different UPI apps to identify variations in traffic patterns.
- **Measuring the impact of network conditions** like latency, bandwidth, and packet loss on transaction success rates and performance.
- **Logging of PCAP files** related to UPI transactions for analysis and further study.
- **Establishing performance benchmarks** for UPI apps to ensure faster transactions and optimized efficiency under varying network conditions.

Methodology

1. Implemented Automation of UPI Apps:

- **Environment Setup** : Used an Appium server and scrpcy to establish connection.
- **App Launch**: Used Appium capabilities to initialize and launch the app on the device.
- **Transaction Automation**: Perform UPI payment steps, including selecting contacts and entering details, through automated scripts (analysing elements with Appium Inspector).
- **Performance Tracking**: Measure transaction times by recording start and end timestamps for each payment.
- **Apps automated**: GPay, PayTM, PhonePe, BHIM, Navigation, super.money, Mobikwik

2. Manipulating Network Conditions and Measuring Their Impact:

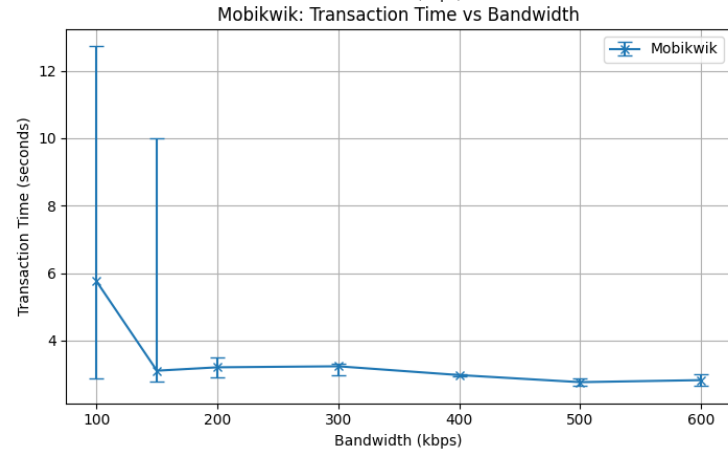
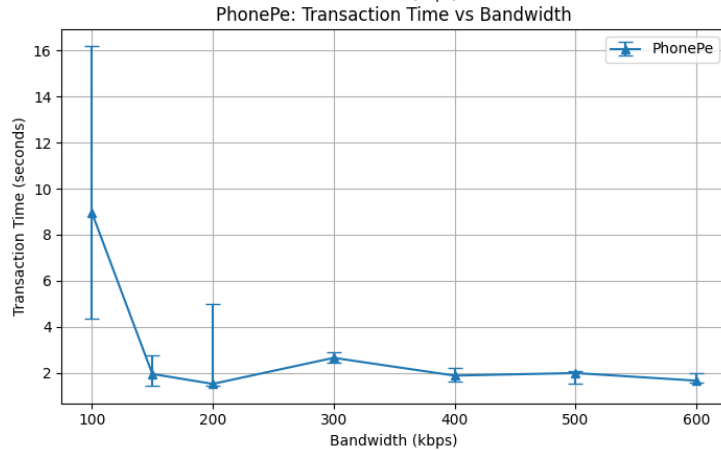
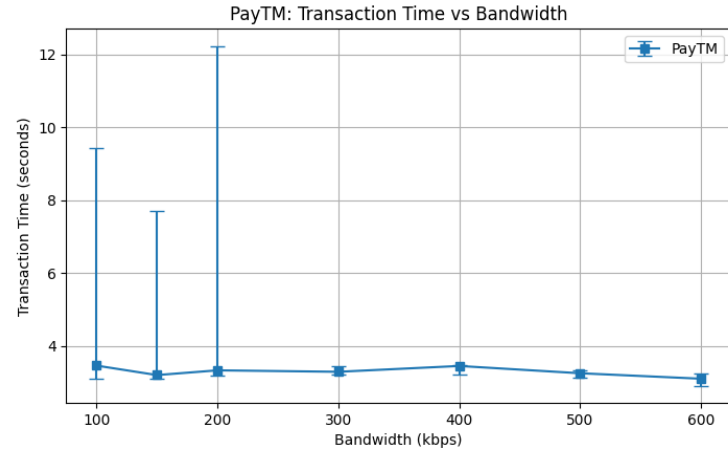
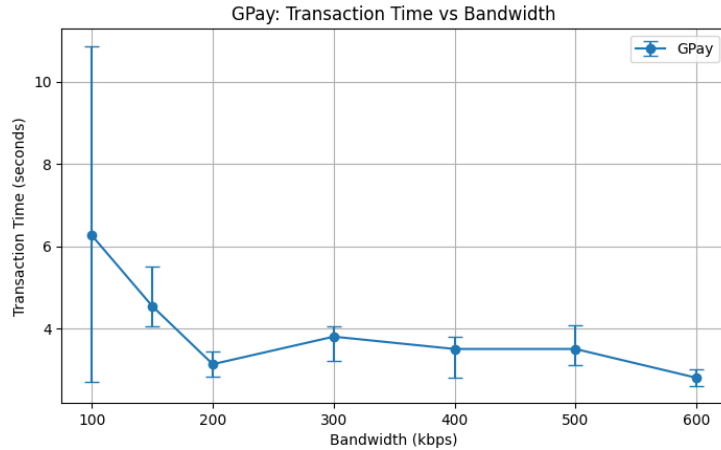
- **Network Shaping using tc:** Used tc to shape routers network components like bandwidth, latency and packet loss.
- **Established Reverse Tethering:** Used gnirehtet to establish a wired network connection from the router to the android device.
- **Network Analysis:** Ran multiple transactions for each network condition and measured the time taken.
- **Logging of Encrypted Data:** Collected encrypted network data corresponding to different network scenarios.

Methodology

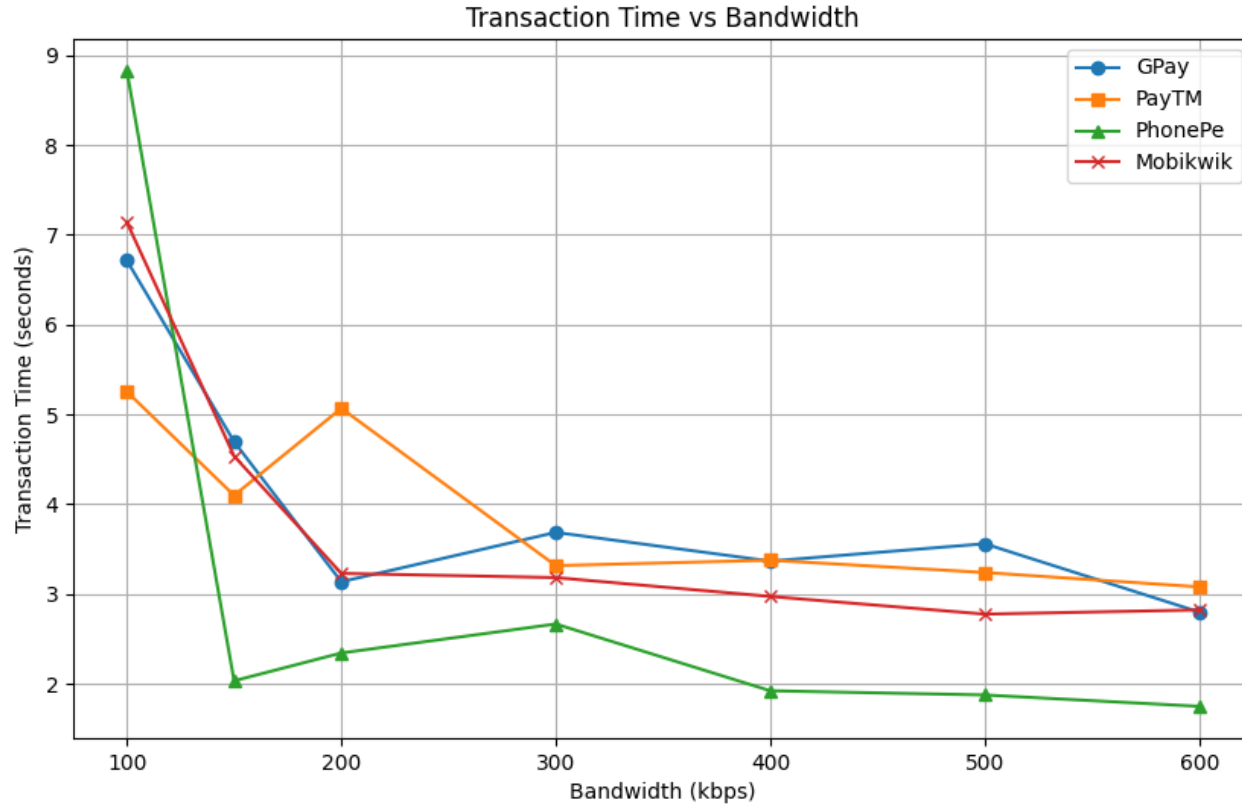
3. Analysed Collected Data and Compared Performance:

- **Comparative Study:** Experiments done for 4 major UPI applications.
- **Simulated Multiple Network Scenarios:** Tried to understand performance under critical latency, bandwidth and packet loss conditions.
- **Graphical Analysis:** Plotted graphs comparing transaction times with error bars for every network condition and every application.
- **Packet Capture:** Captured PCAP files for every transaction and created database.

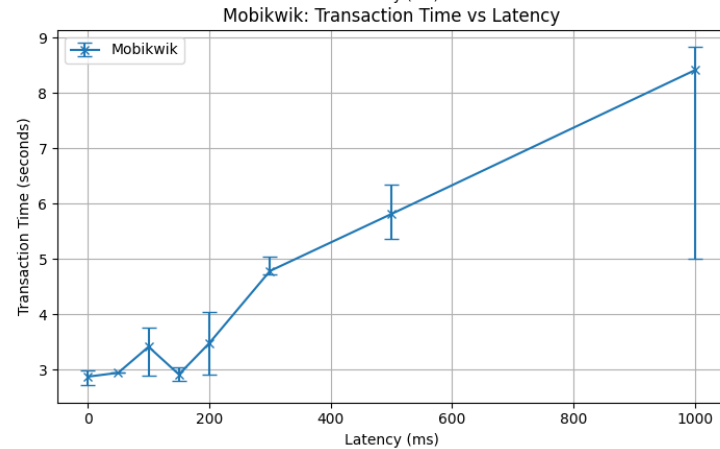
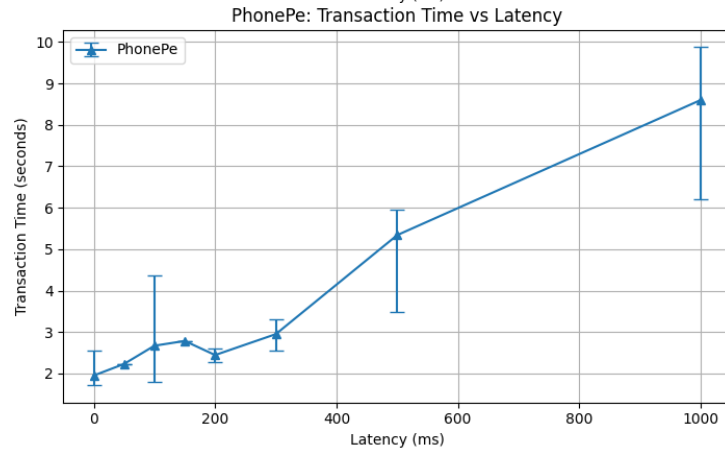
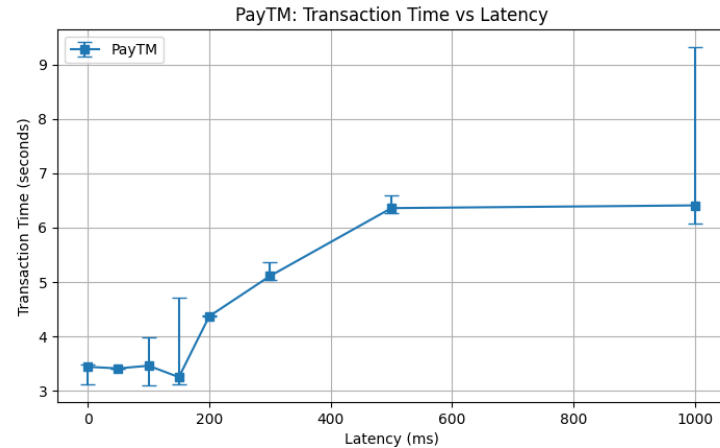
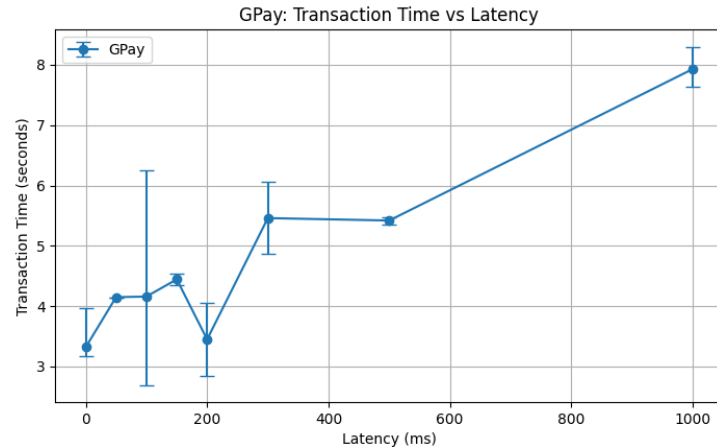
Transaction Time vs Bandwidth



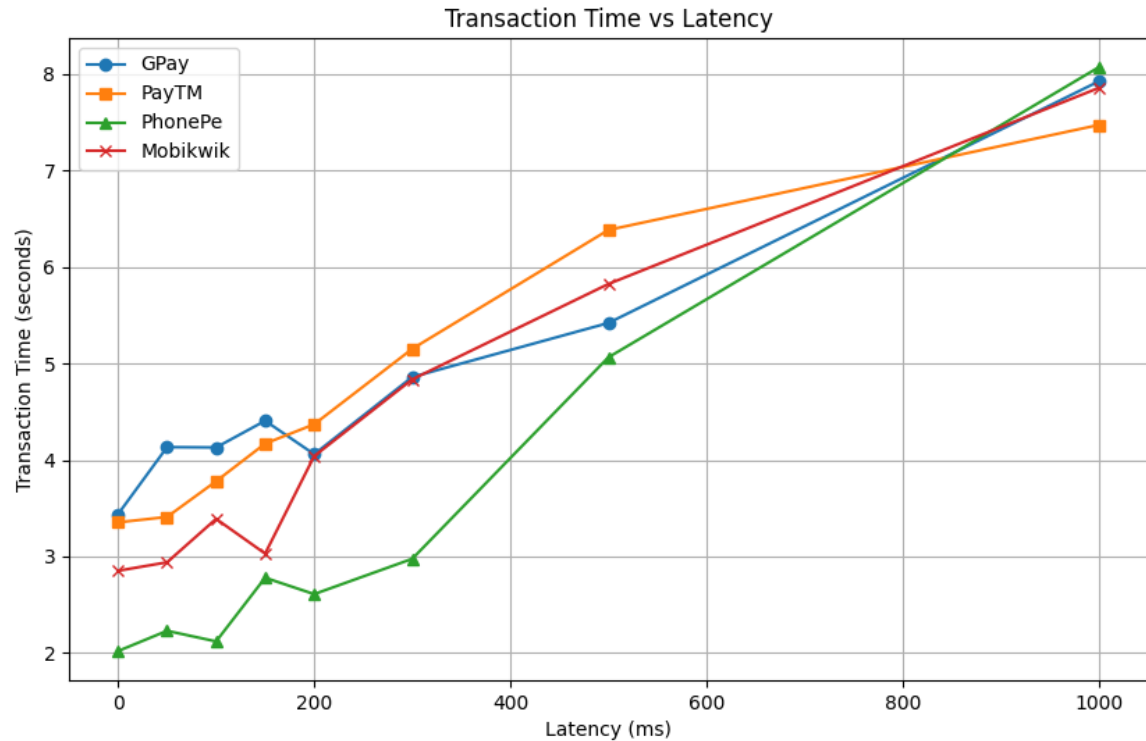
Transaction Time vs Bandwidth



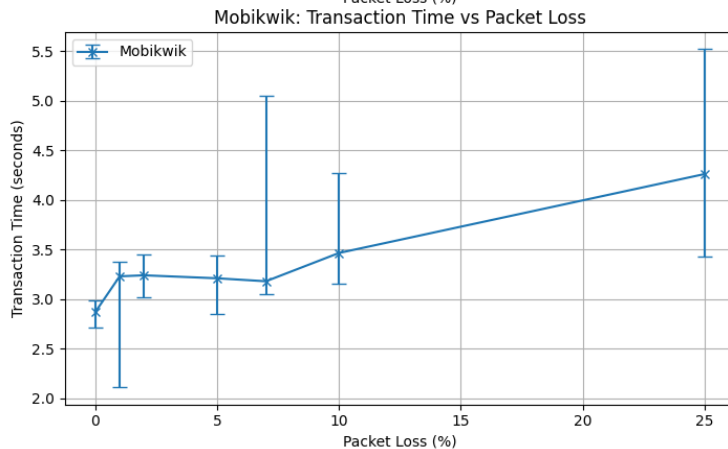
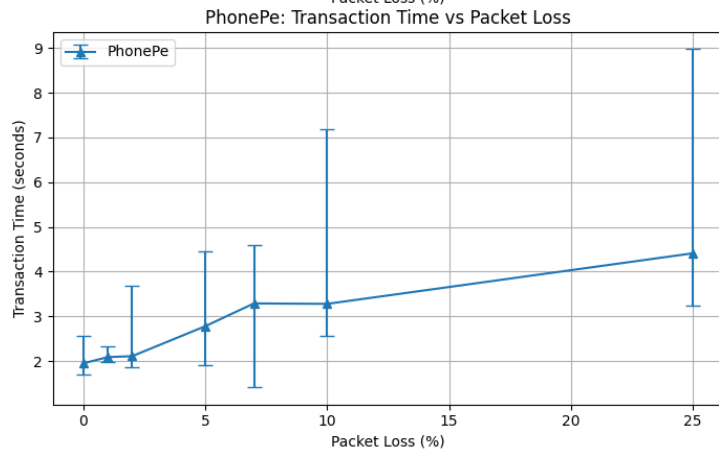
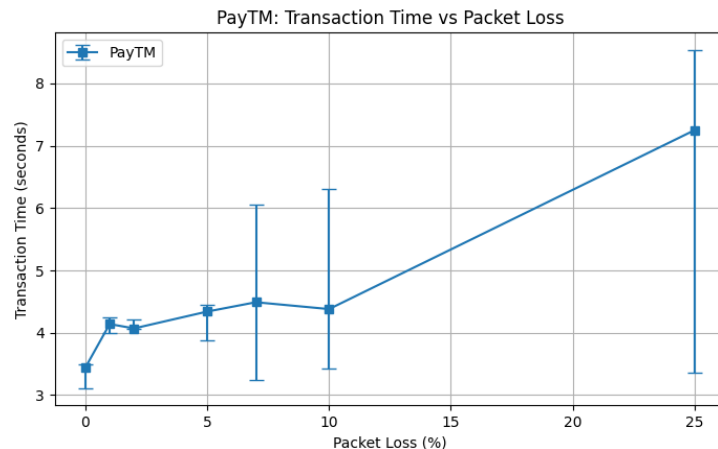
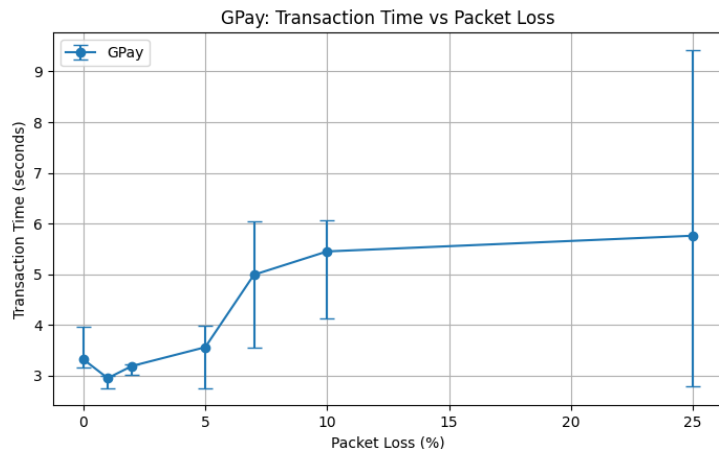
Transaction Time vs Latency



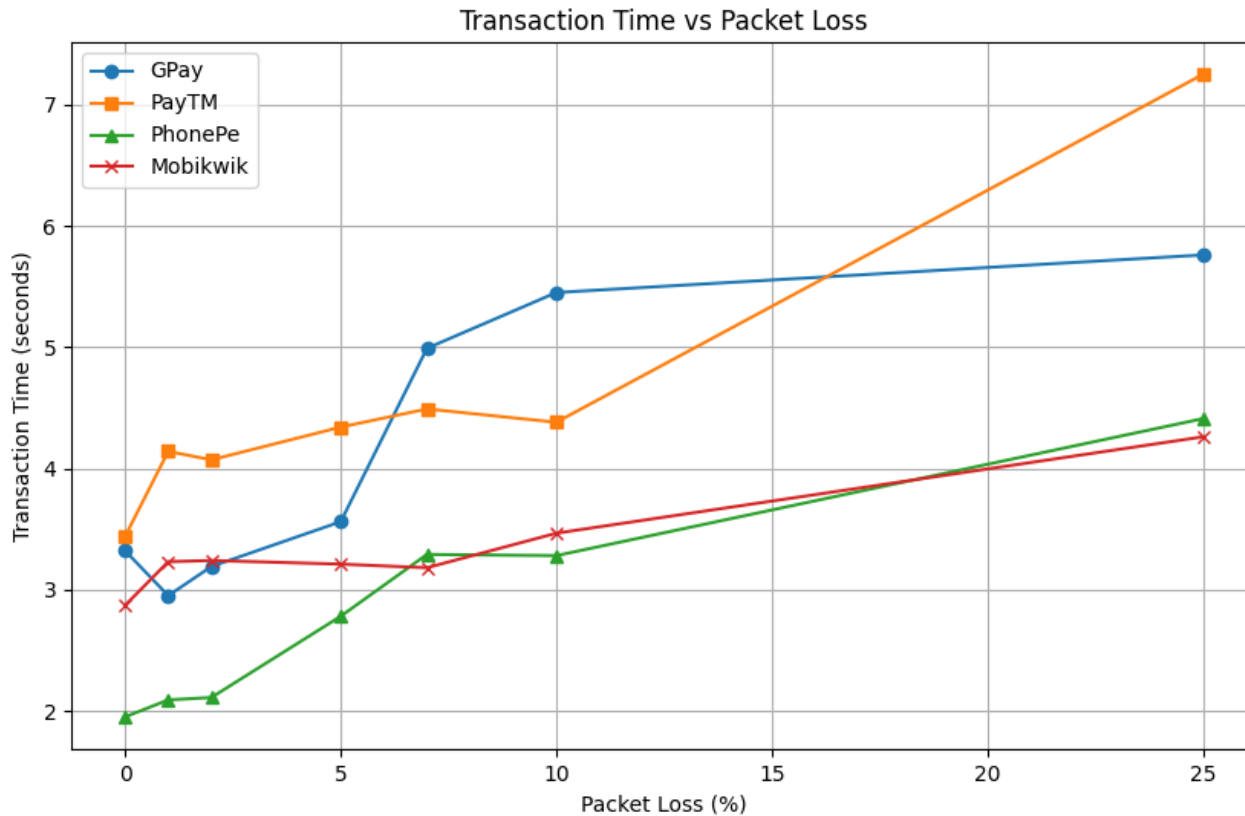
Transaction Time vs Latency



Transaction Time vs Packet Loss



Transaction Time vs Packet Loss



Plan for the Semester

- **PCAP Data:** Analysing the obtained PCAP files and understand the protocols for each UPI app.
- **Network Delay:** Distinguishing between computational time and observed time for transactions.
- **App Design:** Looking at the app design for each UPI application in order to understand protocols.
- **Setting Benchmarks:** Taking inspiration from the best performing UPI apps in critical situations, guidelines for UPI applications to improve upon their performance in terms of speed and success rate.
- **Further Work:** Based on obtained data, identifying ineffective network resource usage, and designing failover mechanisms.