LeoEM
ISL routing emulation

2024-06-24

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Stage 1

- Constellation Spatial Data
  - Using Starlink data
  - Satellite number: 1588
  - Cycles: 5731

Stage 2

- Route computation
  - Using ISL
  - Route
    - precomputed route from SD to Shanhei
    - compute route from Taipei to New York

Stage 3

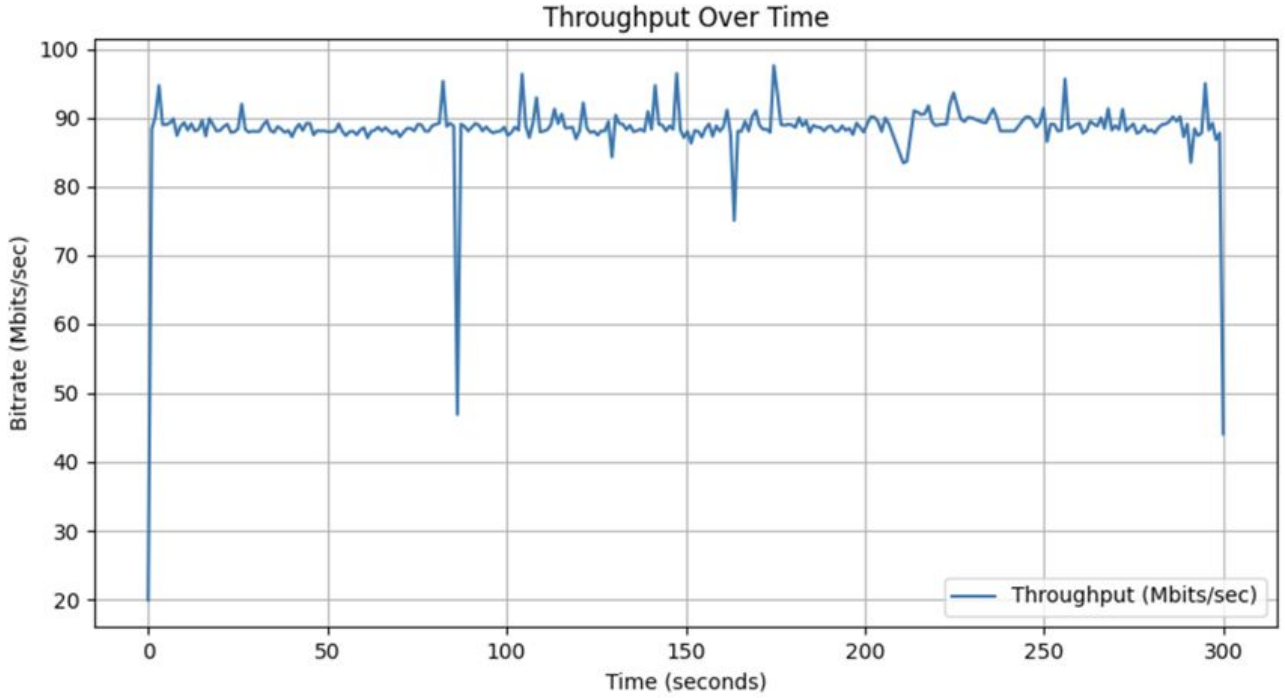
- Emulation
  - Using precomputed route from SD to Shanhei
  - Testing throughput and RTT from two endpoints
  - Setting up SaTCP
  - Testing with SaTCP

Emulation

- Setup
  - Ubuntu Server 24.04 on VM
  - Use Starlink_SD_Shanghai_15_ISL_path.log as route
  - Test throughput using iPerf3
    - h1(10.0.1.101) as client
    - h2(10.0.1.102) as server
  - Test RTT using tshark to capture iPerf traffic
  - Log handover time for analysis

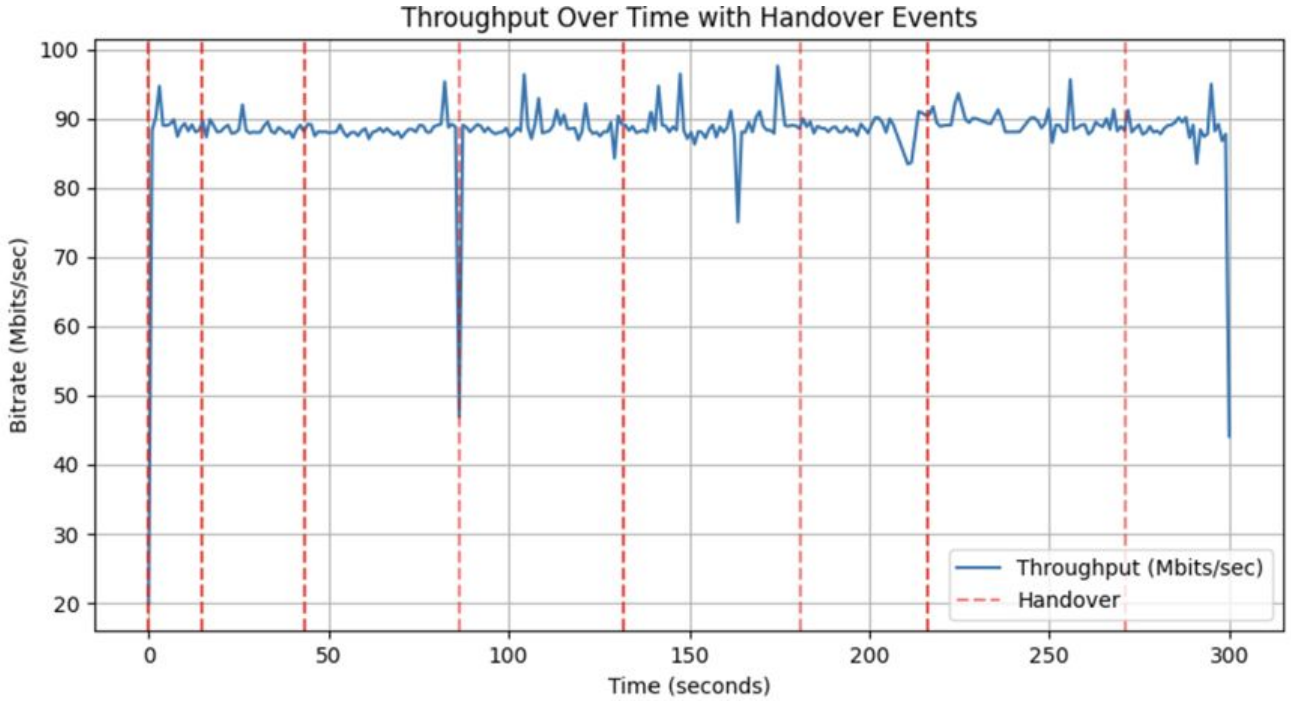
Emulation

- Throughput result



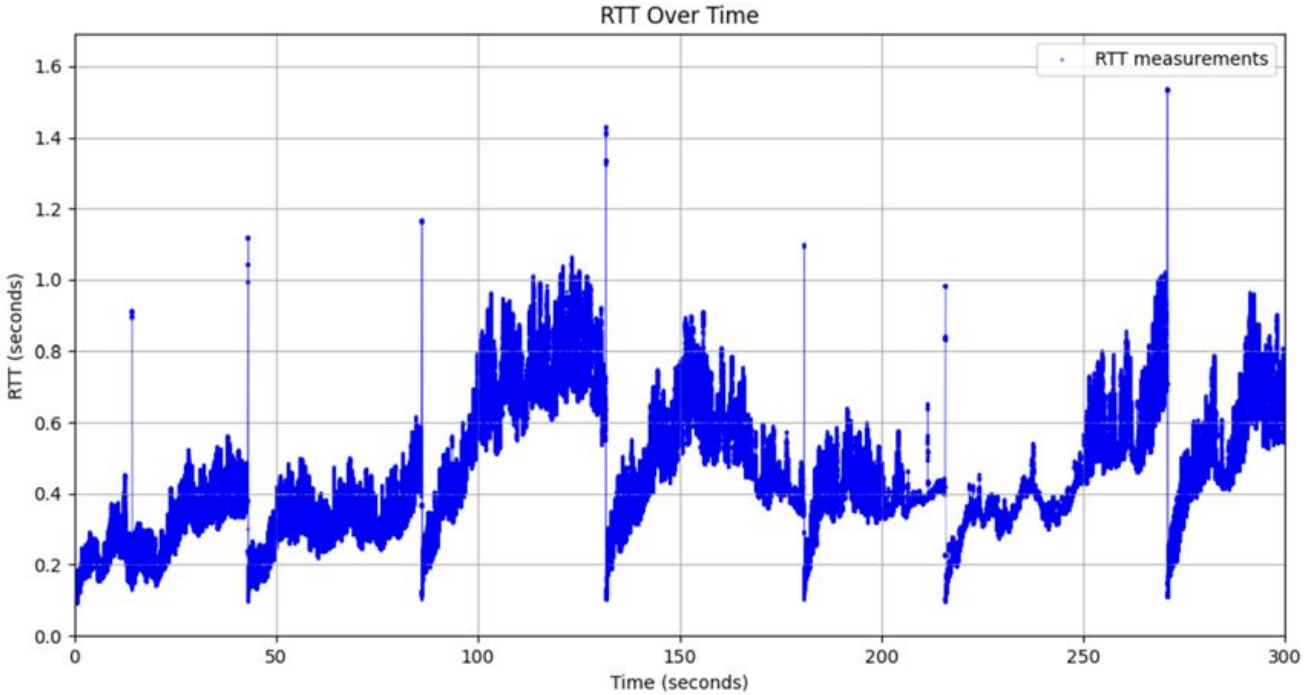
Emulation

- Throughput result



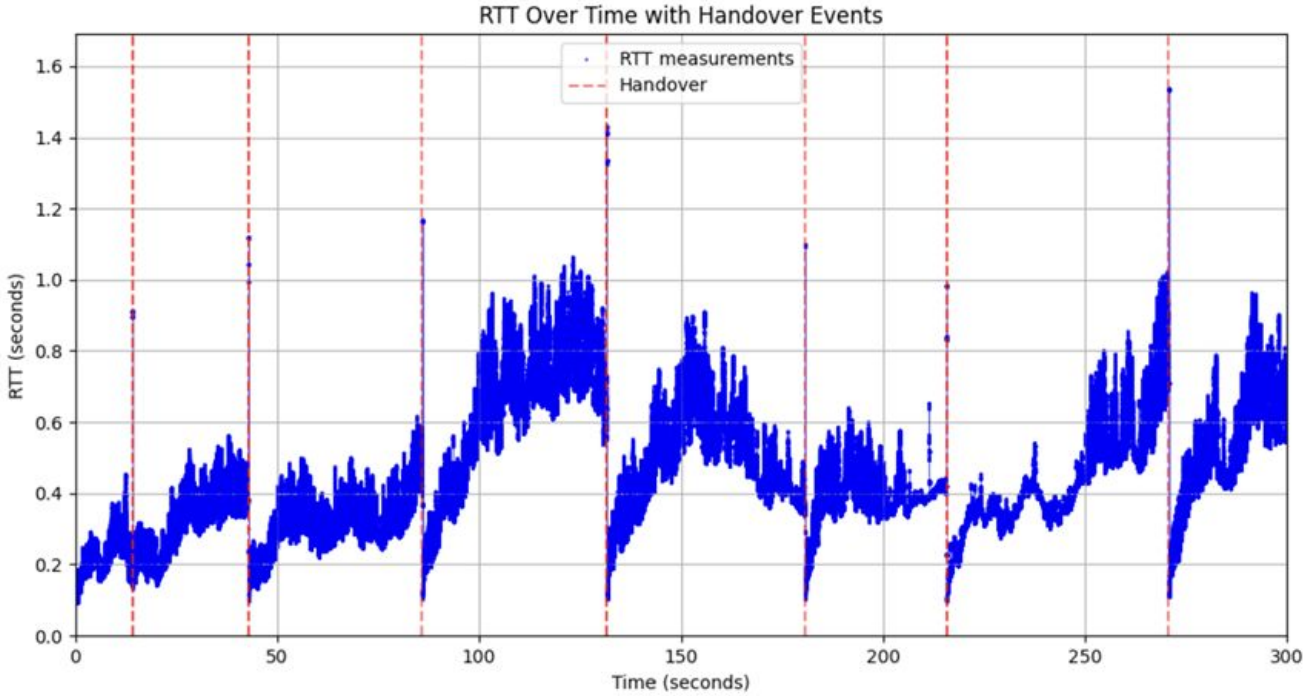
Emulation

- RTT result



Emulation

- RTT result



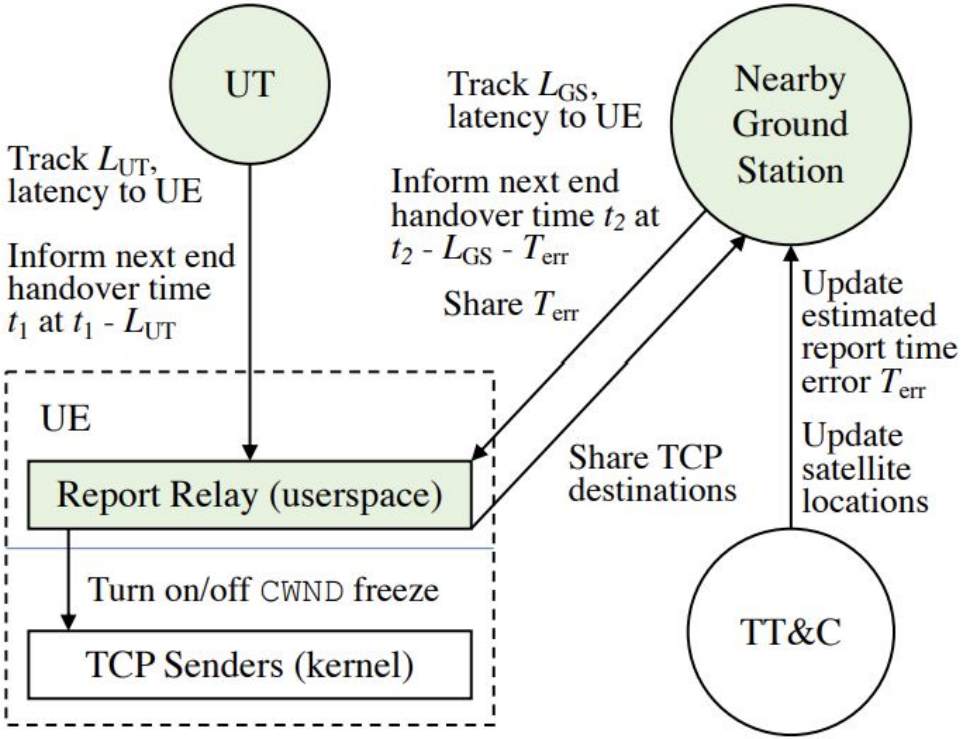
SaTCP

- Features of SaTCP [1]
  - Prediction of satellite location
    - Compute when a disruptive event will occur
    - Freeze congestion window during handover
  - Cross-Layer Integration
    - Collect real-time data from the link layer

[1] from SaTCP: Link-Layer Informed TCP Adaptation for Highly Dynamic LEO Satellite Networks, IEEE INFOCOM 2023

SaTCP

- Workflow [1]



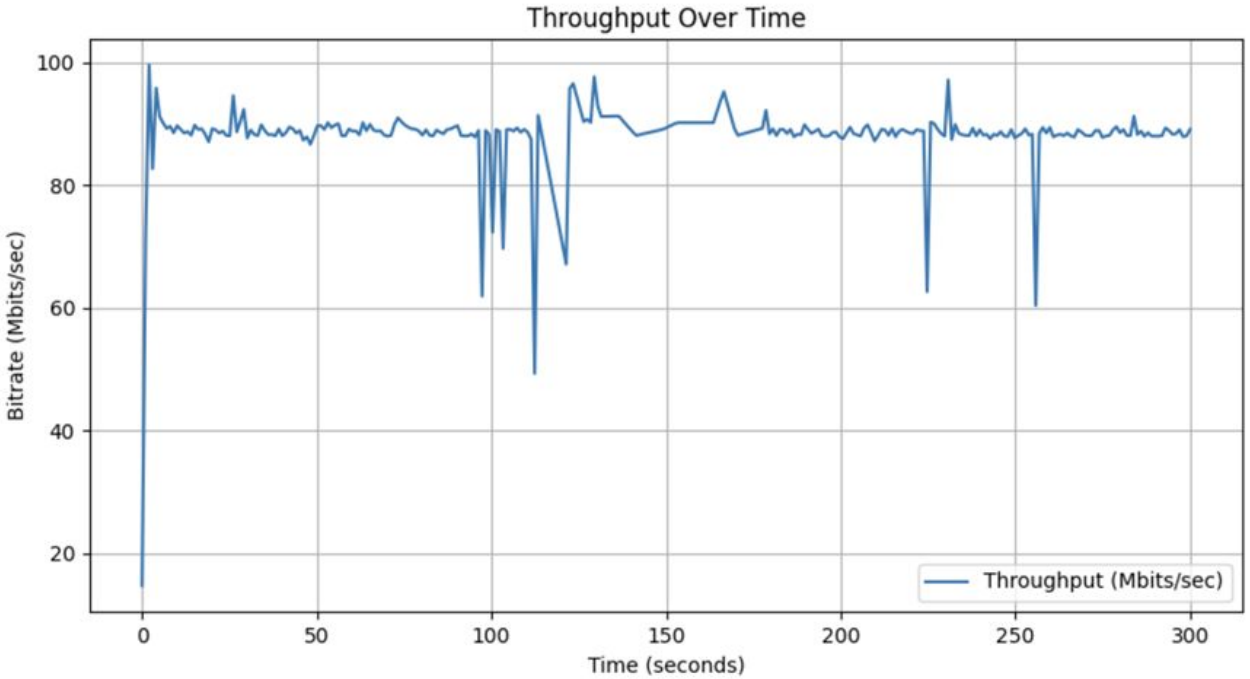
[1] from SaTCP: Link-Layer Informed TCP Adaptation for Highly Dynamic LEO Satellite Networks, IEEE INFOCOM 2023

SaTCP

- Setup
  - Install Linux kernel source code 6.9.6 on VM
  - Follow the intructions of SaTCP Implementation in LeoEM
  - Run the emulation and tests

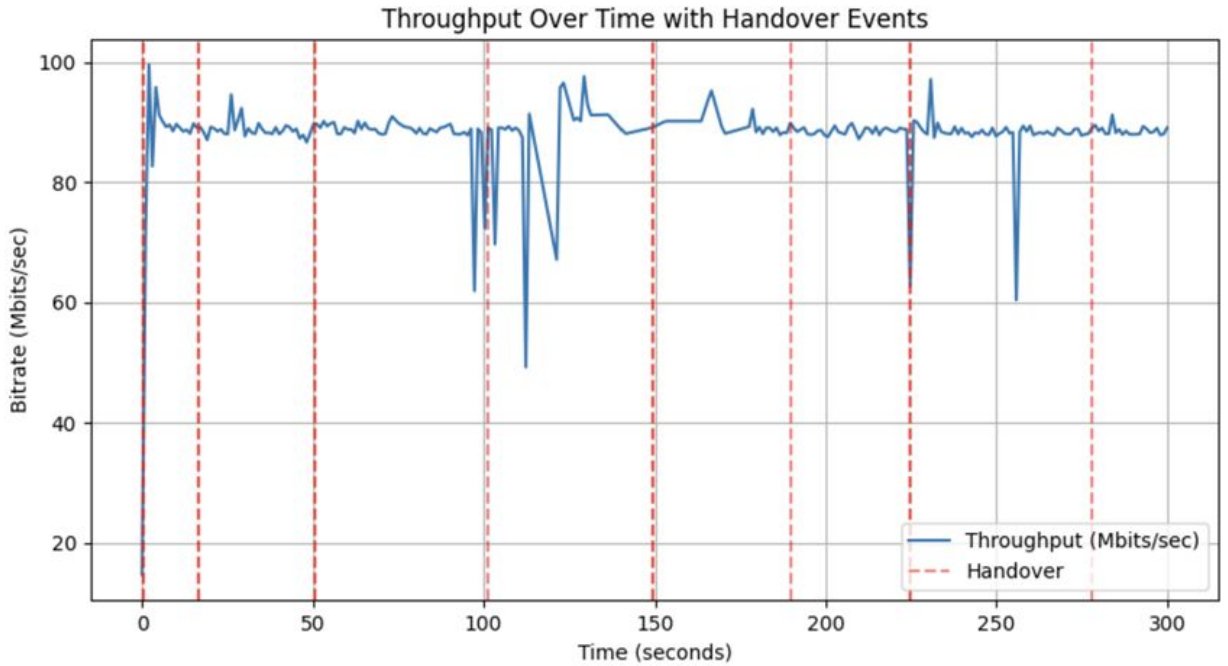
SaTCP

- Throughput result



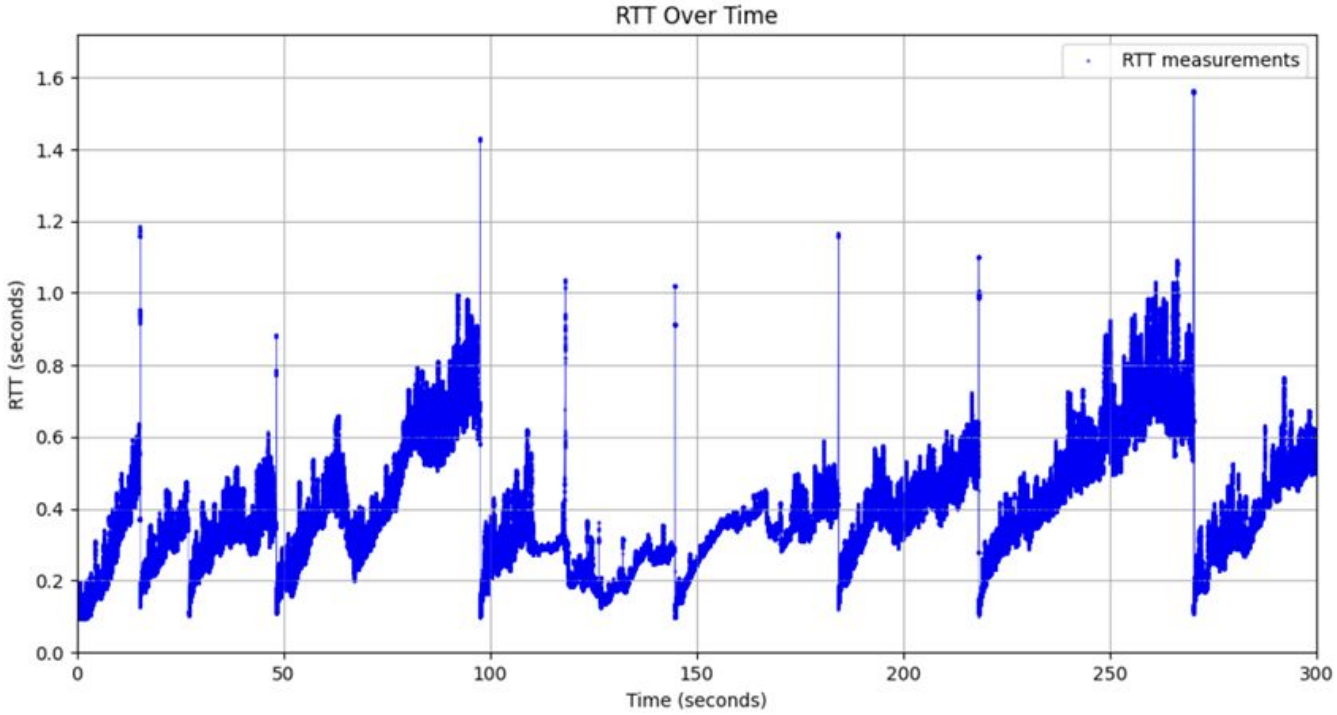
SaTCP

- Throughput result



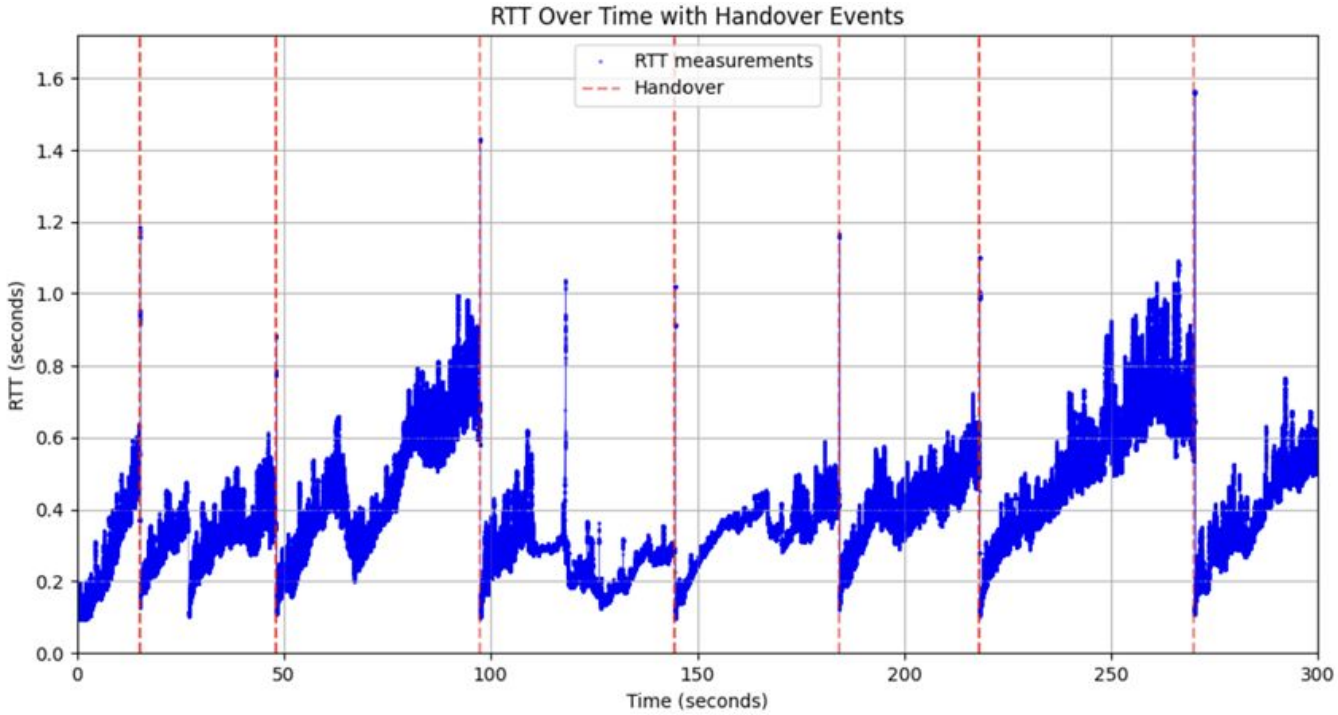
SaTCP

- RTT result



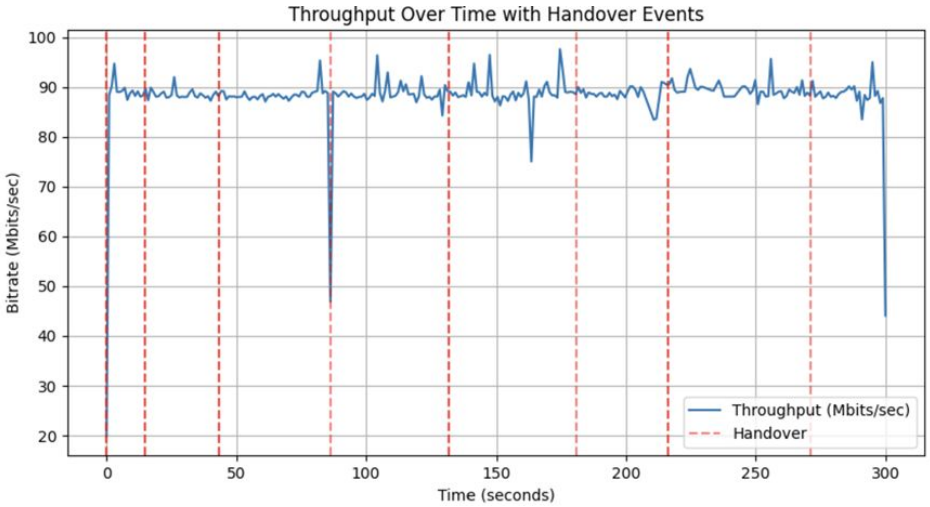
SaTCP

- RTT result

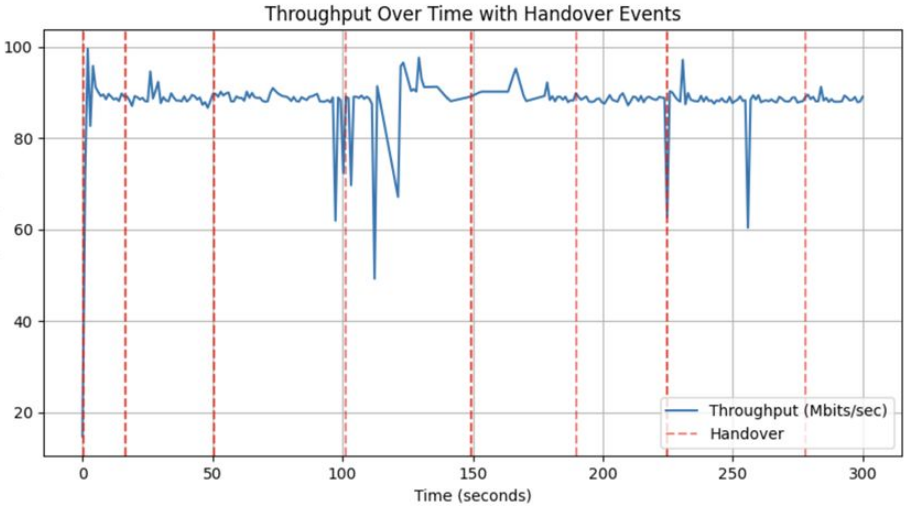


Comparison

TCP

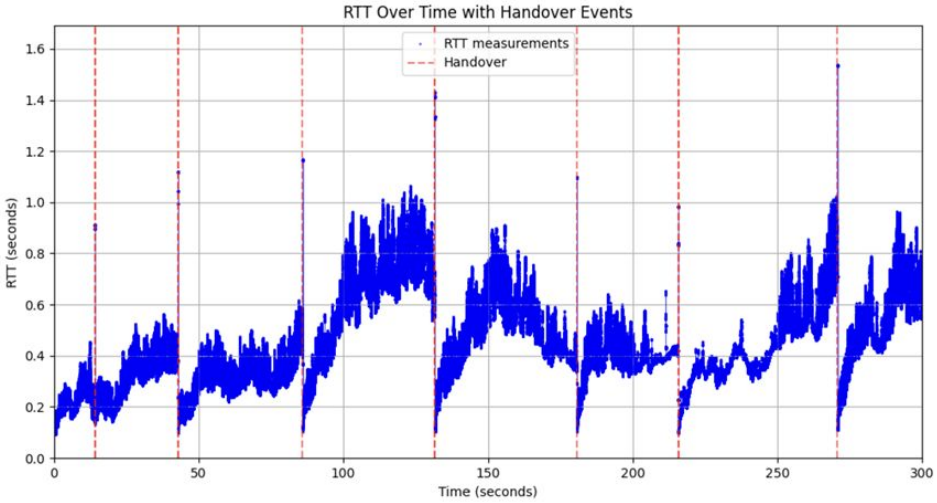


SaTCP

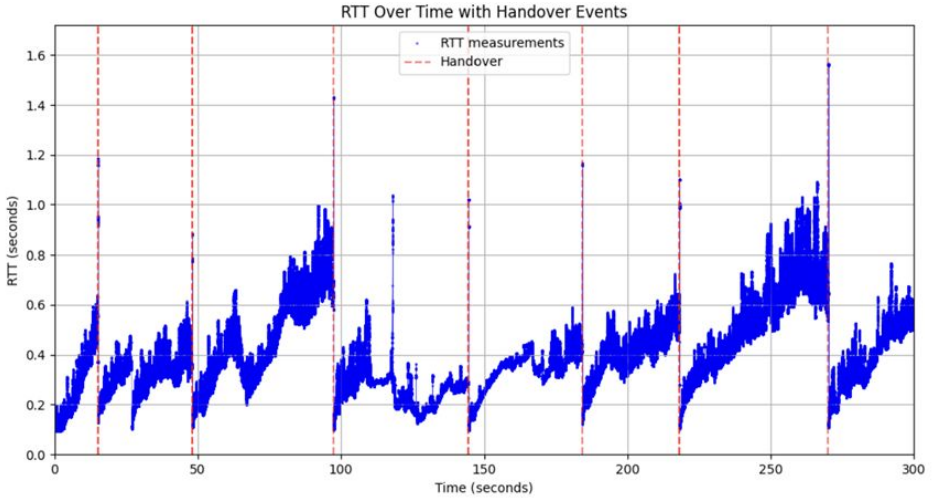


Comparison

TCP



SaTCP



Comparison

	TCP	SaTCP
Average Throughput (Mbits/sec)	89.84	88.05
MinimumThroughput (Mbits/sec)	47.94	14.70
Average RTT (sec)	0.44	0.38
Maximum RTT (sec)	1.54	1.56

The End