Chair of Network Architectures and Services
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Implementation and Evaluation of an Available Bandwidth Estimation Tool

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Tuesday 25th February, 2020

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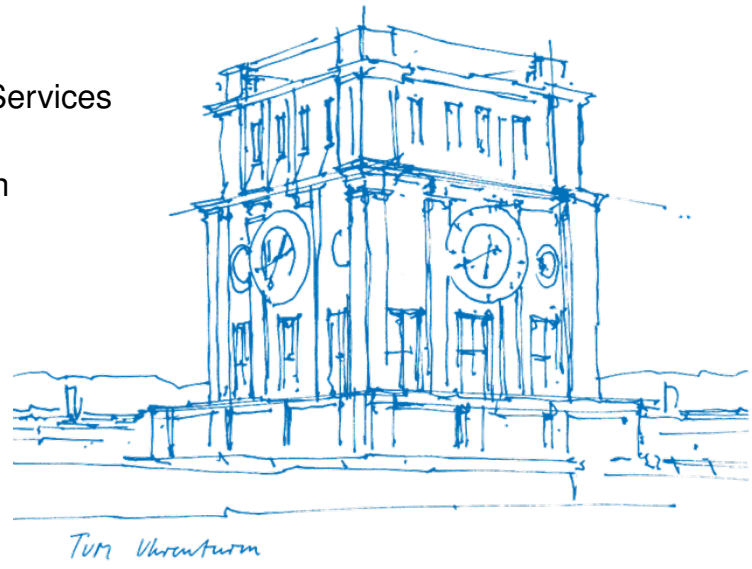
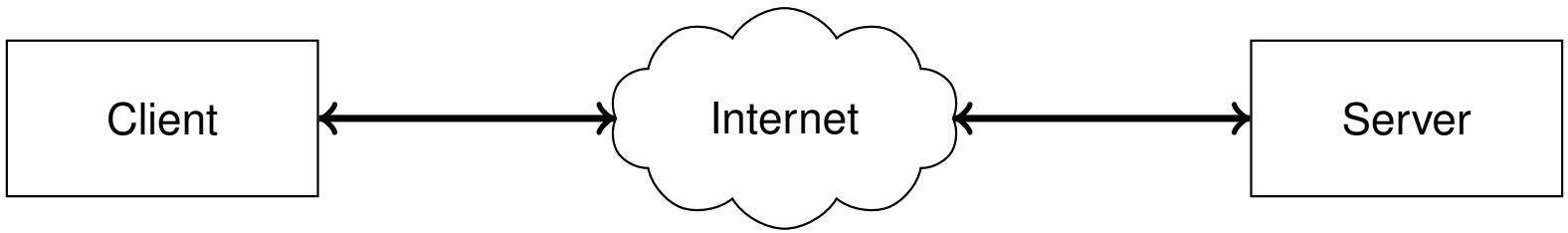



Client
Internet
Server

Introduction

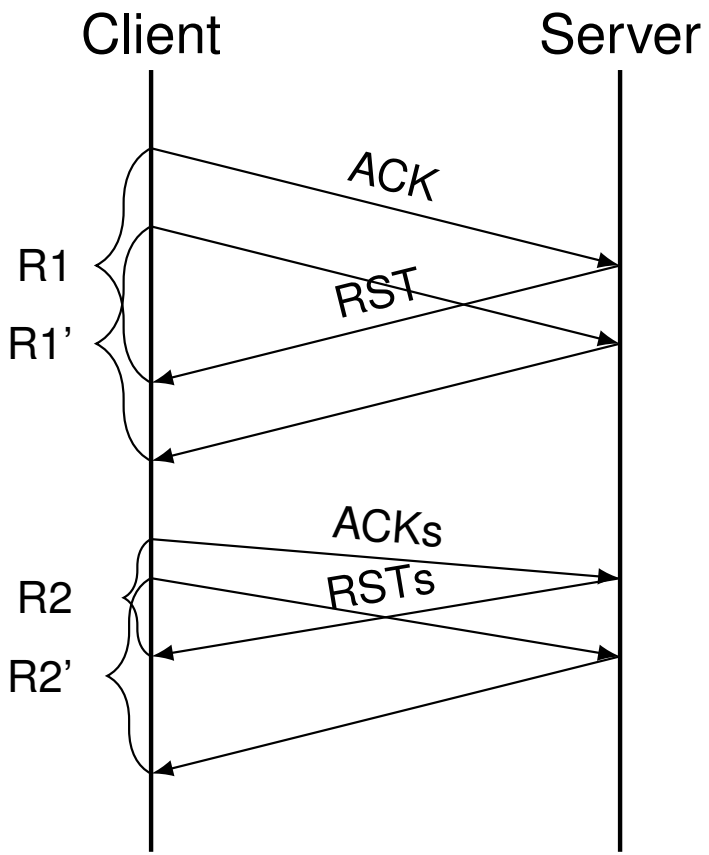
Creating an available bandwidth measurement Tool:

- Single-ended
- Probe Rate Model

Rate R and available bandwidth A

First Case: $R \leq A$

Second Case: $R \geq A$



Introduction

Motivation

- Enhance **quality-of-service (QoS)** requirements
- Detect anomalies
- Monitoring the network's state

Research questions:

1. How good is the accuracy?
2. Trade-off between accuracy and efficiency?
3. What limitations and restrictions constraint the usage on the internet?
4. What is the difference in accuracy of single-end and both-ended tools?

Approaches

Overview

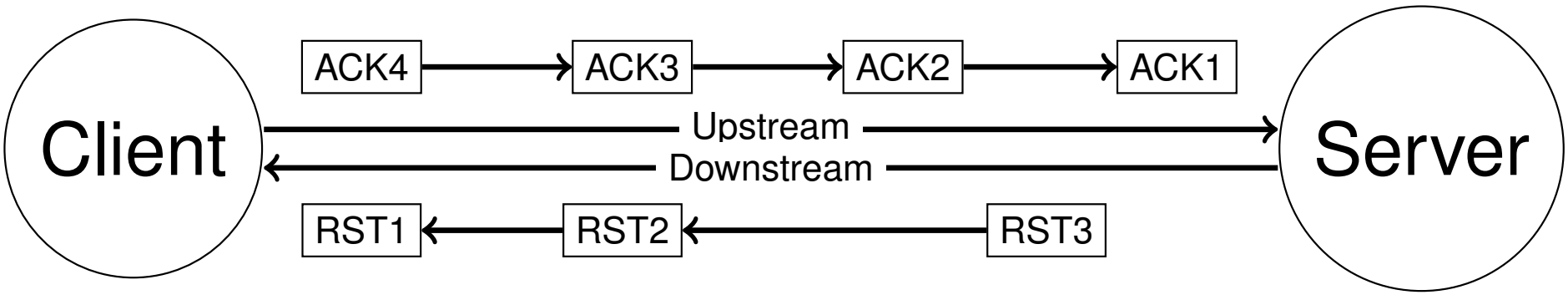
Probe Gap Model (PGM): Spruce[5]

- Packet trains/pairs are sent with rate set to the bottleneck's capacity
- Uses relation between input and output rates of probing packets
- Cannot estimate the available bandwidth of multi-hop paths [4]

Probe Rate Model (PRM): Pathload[3], abget[1] or fabprobe[2]

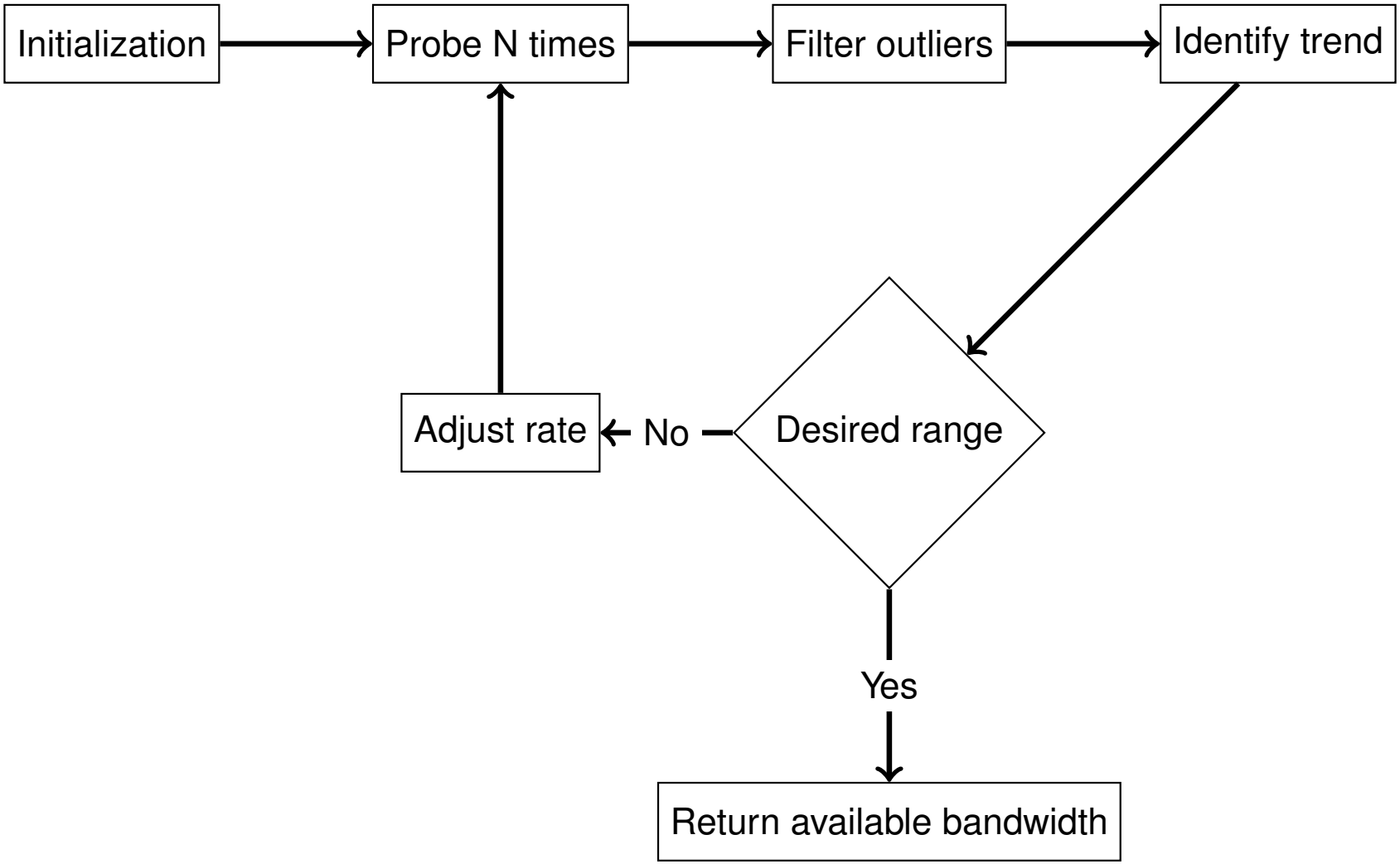
- Iterative probing
- Packet trains are sent at different rates
- Adjusts input rate depending on output rate
- Converges into a range of the available bandwidth

Tool

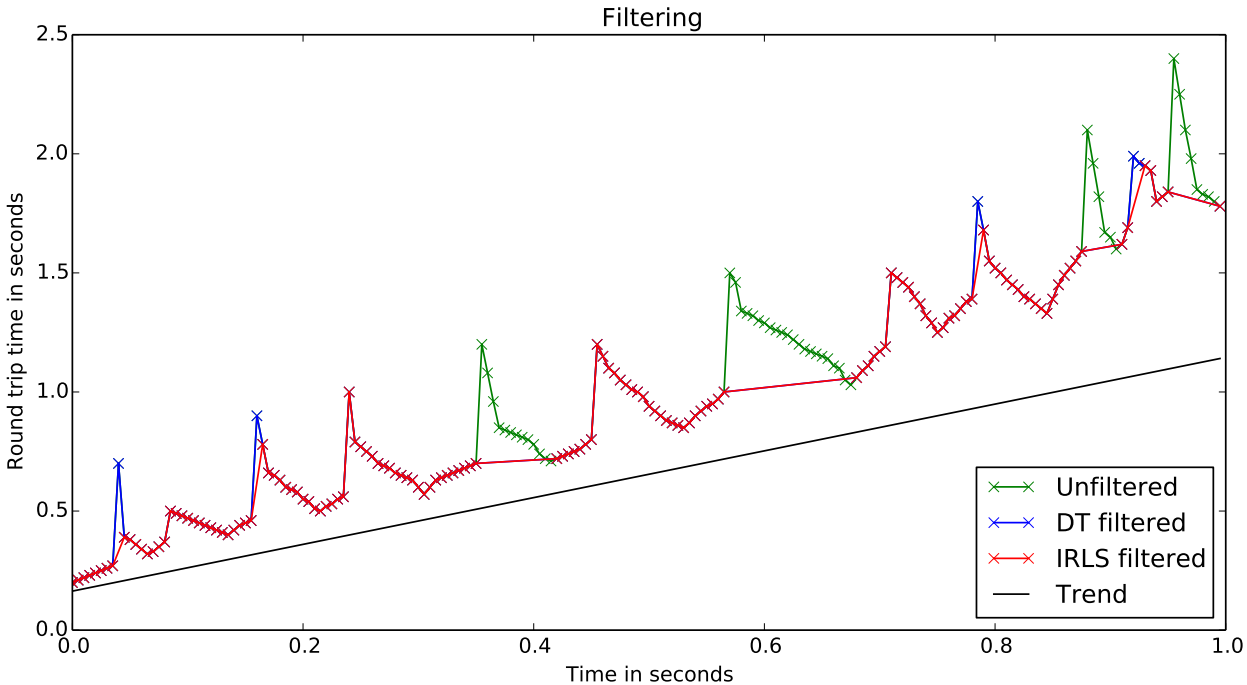

Client
ACK4
ACK3
ACK2
ACK1
Upstream
Downstream
RST1
RST2
RST3
Server

Tool

Design


Initialization
Probe N times
Filter outliers
Identify trend
Desired range
No
Adjust rate
Yes
Return available bandwidth

Tool



Filtering methods:

- Decreasing Trend filter
- Iterativly Re-weighted Least Squares

Outlook

What I have accomplished:

- Understanding and implementing the algorithms
- Building the test setup in mininet

What I will do next:

- Testing and validation in the testbed
  - Accuracy
  - Stability
  - Overhead
  - Mean relative error and derivation
- Internet measurement
- Writing the thesis

Bibliography

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