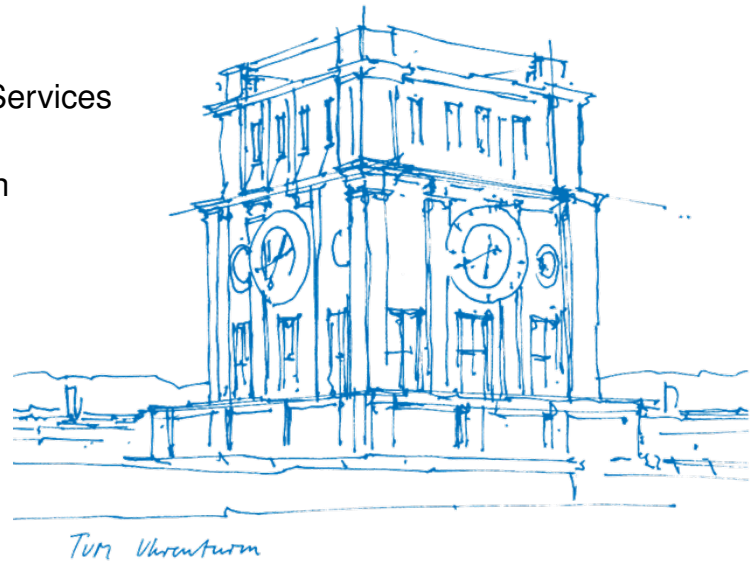
Chair of Network Architectures and Services
Department of Informatics
Technical University of Munich

Implementation and Evaluation of an Available Bandwidth Estimation Tool

Huu Tung Nguyen

Friday 14th February, 2020

Chair of Network Architectures and Services
Department of Informatics
Technical University of Munich



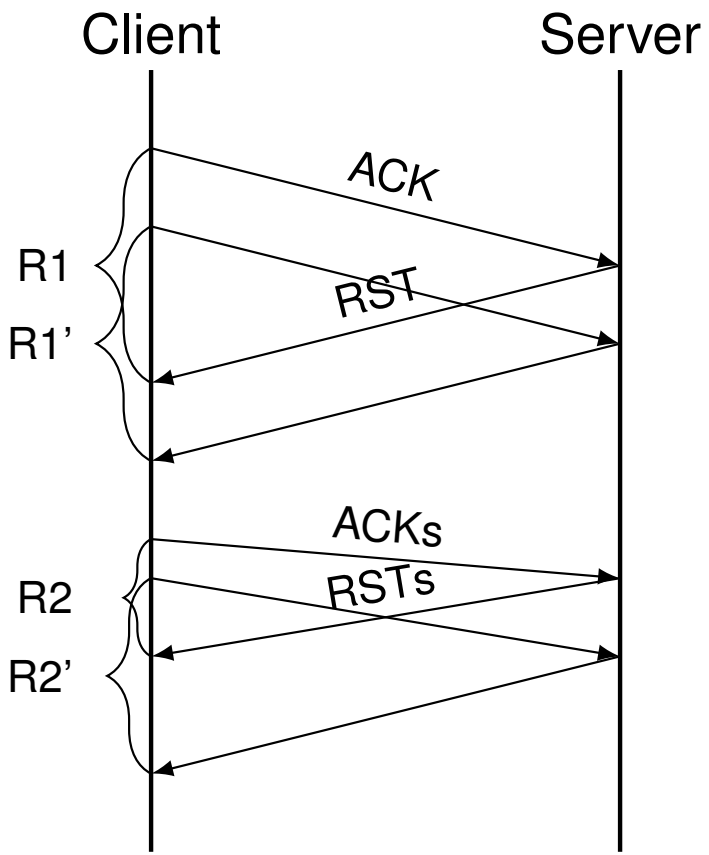
Introduction

Important network metrics:

- Throughput
- Latency
- Availability

Creating an available bandwidth measurement Tool:

- Single-ended
- Probe Rate Model



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

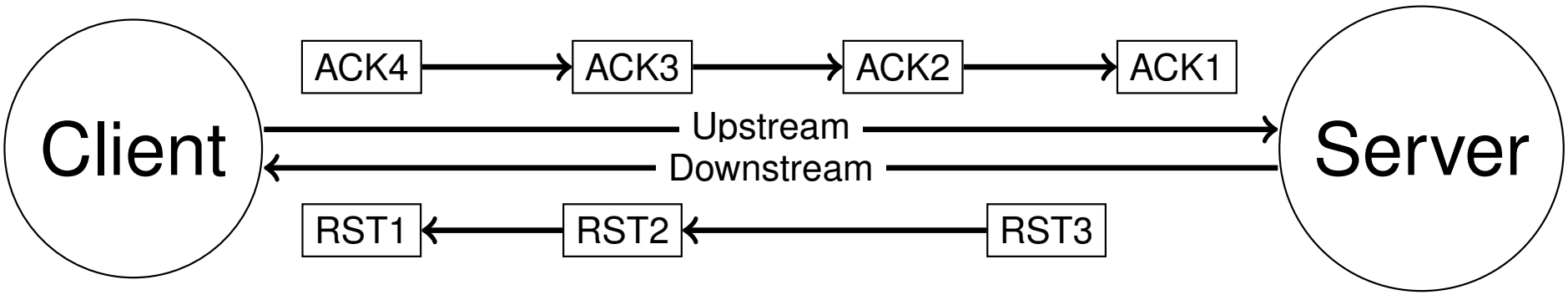
Probe Gap Model (PGM): Spruce[5]

- 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]

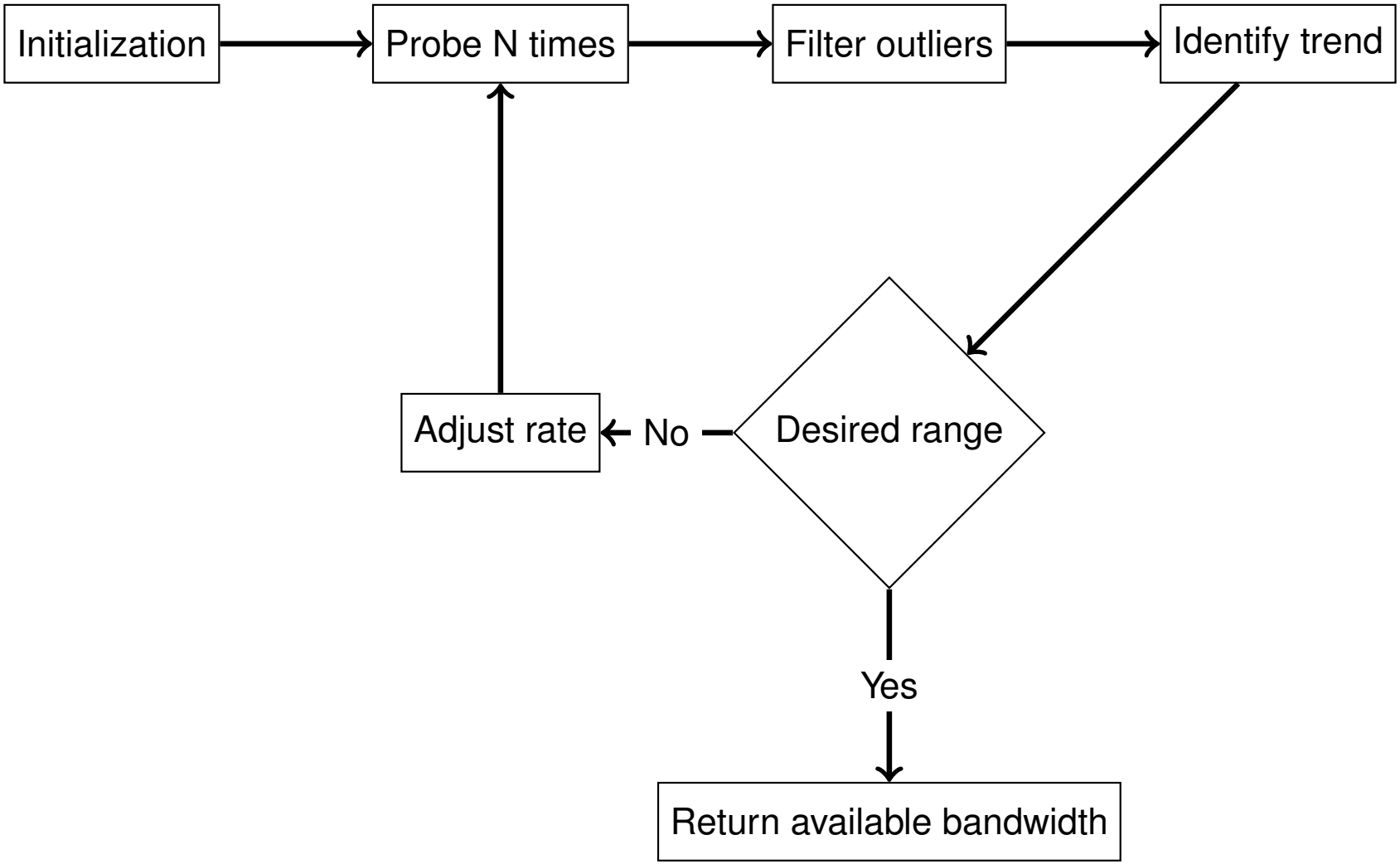
- Iterative probing
- Packet trains are sent at different rates
- Adjusts input rate depending on output rate
- Converges into a range of the available bandwidth

Tool

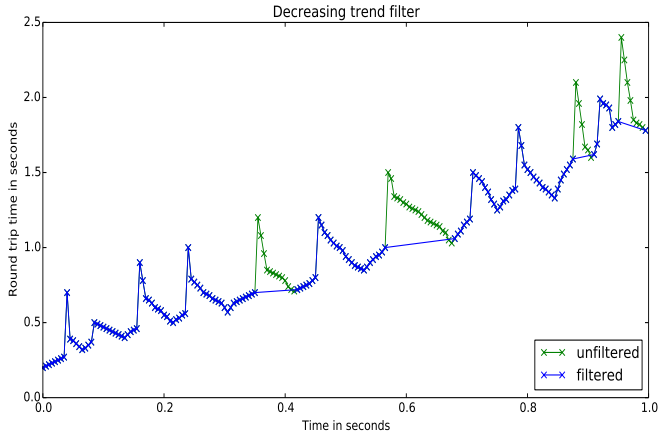

Client
ACK4
ACK3
ACK2
ACK1
Upstream
Downstream
RST1
RST2
RST3
Server

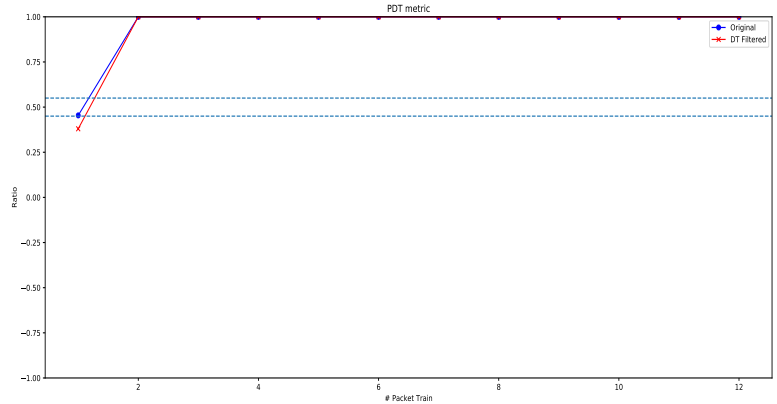
Tool

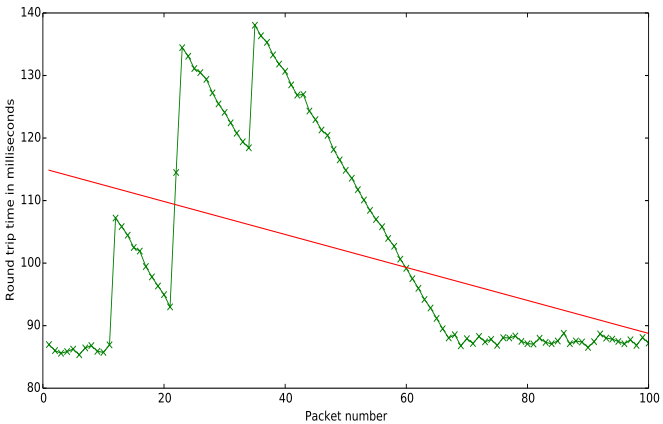
Design

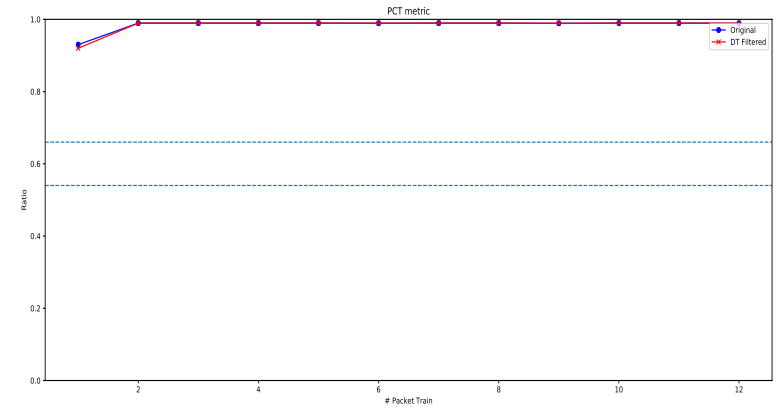

Initialization
Probe N times
Filter outliers
Identify trend
Desired range
No
Adjust rate
Yes
Return available bandwidth

Tool

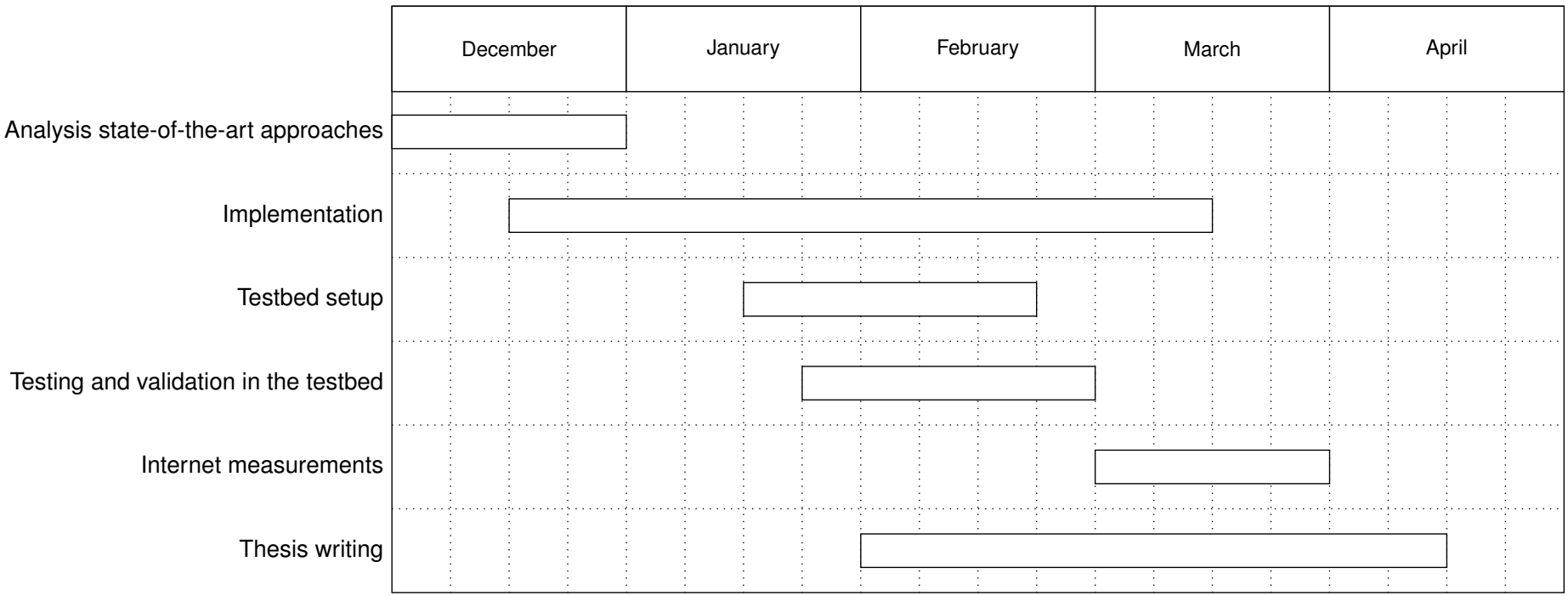

Decreasing trend filter
Round trip time in seconds
Time in seconds
unfiltered
filtered


PDT metric
Ratio
Packet Train
Original
DT Filtered


Round trip time in milliseconds
Packet number


PCT metric
Ratio
Packet Train
Original
DT Filtered

Outlook


December
January
February
March
April
Analysis state-of-the-art approaches
Implementation
Testbed setup
Testing and validation in the testbed
Internet measurements
Thesis writing

Bibliography

[1] D. Antoniades, M. Athanatos, A. Papadogiannakis, E. P. Markatos, and C. Dovrolis.
Available bandwidth measurement as simple as running wget.
In *Proc. of Passive and Active Measurement Conference (PAM 2006)*, pages 61–70. Citeseer, 2006.

[2] D. Croce, T. En-Najjary, G. Urvoy-Keller, and E. W. Biersack.
Fast available bandwidth sampling for adsl links: Rethinking the estimation for larger-scale measurements.
In *International Conference on Passive and Active Network Measurement*, pages 67–76. Springer, 2009.

[3] M. Jain and C. Dovrolis.
Pathload: A measurement tool for end-to-end available bandwidth.
2002.

[4] L. Lao, C. Dovrolis, and M. Sanadidi.
The probe gap model can underestimate the available bandwidth of multihop paths.
Computer Communication Review, 36:29–34, 10 2006.

[5] J. Strauss, D. Katabi, and F. Kaashoek.
A measurement study of available bandwidth estimation tools.
In *Proceedings of the 3rd ACM SIGCOMM Conference on Internet Measurement*, IMC ?03, page 39?44, New York, NY, USA, 2003. Association for Computing Machinery.