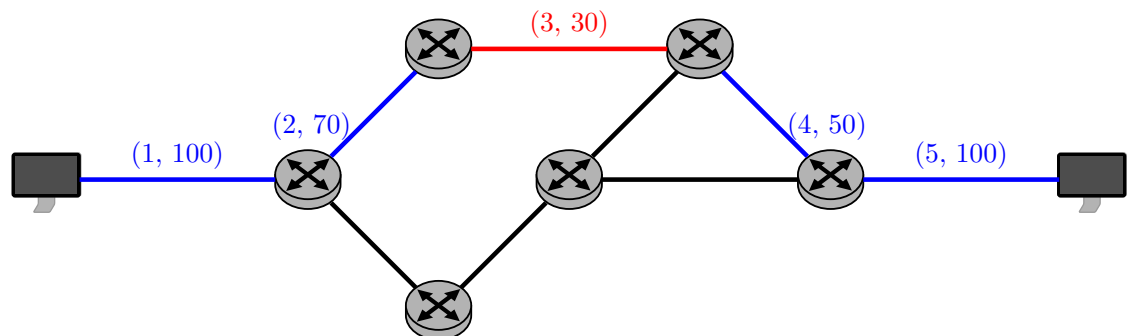


# Scalable Per-Hop Capacity Estimation

## Motivation



Path capacity is a metric of significant interest for service and infrastructure providers. Various approaches exist to measure end-to-end capacity actively or passively based on packet pair dispersion (PPD)<sup>ab</sup>. In addition to end-to-end capacity, per-hop capacity estimation allows to determine the position of the path's narrow link, i.e., the link that provides the smallest capacity. However, approaches to measuring per-hop capacity with PPD are not common.

So far, our chair surveyed capacity estimation with PPD based on passively captured TCP traffic and with actively generated ICMP echo requests. Regarding the applicability of such approaches regarding Internet-wide measurements, both approaches show critical limitations.

Therefore, this thesis is intended to survey capacity measurements with a hybrid approach out of TCP traffic and TTL exceeded packets in a traceroute-like manner. Also, this new approach's applicability and suitability should be compared to the existing approaches with first measurements in the Internet.

<sup>a</sup>En-Najjary, Taoufik, and Guillaume Urvoy-Keller. "Pprate: A passive capacity estimation tool." 2006

<sup>b</sup>Abut, Fatih. "Through the Diversity of Bandwidth-Related Metrics, Estimation Techniques and Tools: An Overview." 2018

## Your Task

- Implement a tool to estimate capacity based on TTL exceeded packets
- Compare your implementation to the approaches previously surveyed at our chair in a controlled test environment
- Design and conduct measurements to study the suitability of all approaches for Internet measurements
- Run large-scale capacity measurements in the Internet

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