Peering vs. Transit

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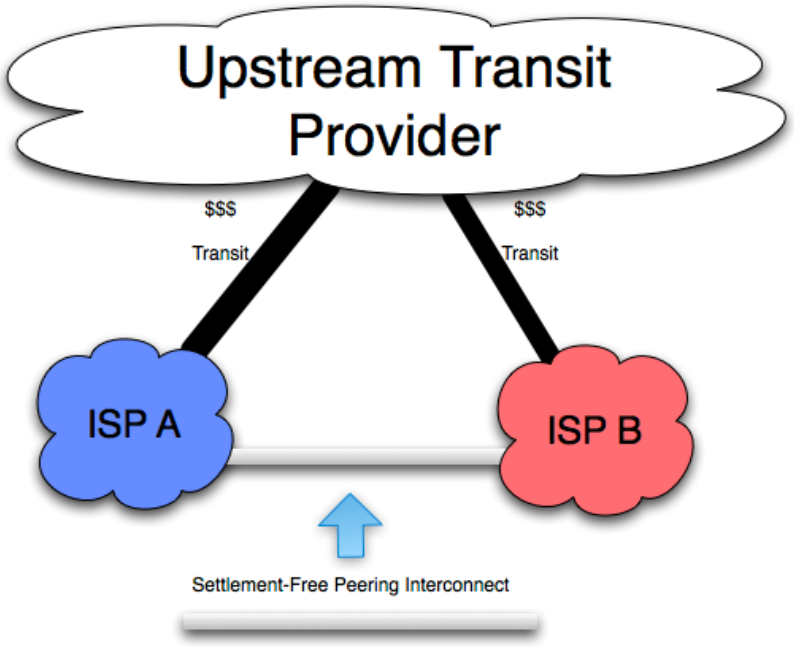
Introduction

- Transit
  - Provides connectivity to the Internet
  - Traffic volume based fees
- Peering
  - Bilateral exchange
  - Settlement-free (no fee)



Related work

Interconnection strategies in peering ecosystem

- Agent-based analysis [Lodhi-Dhamdhere, SIGMETRICS ’12]
- Open-peering [Lodhi et al., Infocom ’14]
- Game-theoretic models [Accongiagioco et al., IFIP ’14][Badasyan-Chakrabarti, Telecommunications Policy ’08]
- Complexities in decision making [Lodhi et al., Infocom ‘15]

Evolution of peering and topological Impact

- Network model [Dhamdhere-Dovrolis, CoNEXT ’10]
- Remote peering [Castro et al., CoNEXT ‘14]
- IXP study [Ager et al., SIGCOMM ‘12]
- PeeringDB analysis [Lodhi et al., SIGCOMM CCR ’14]

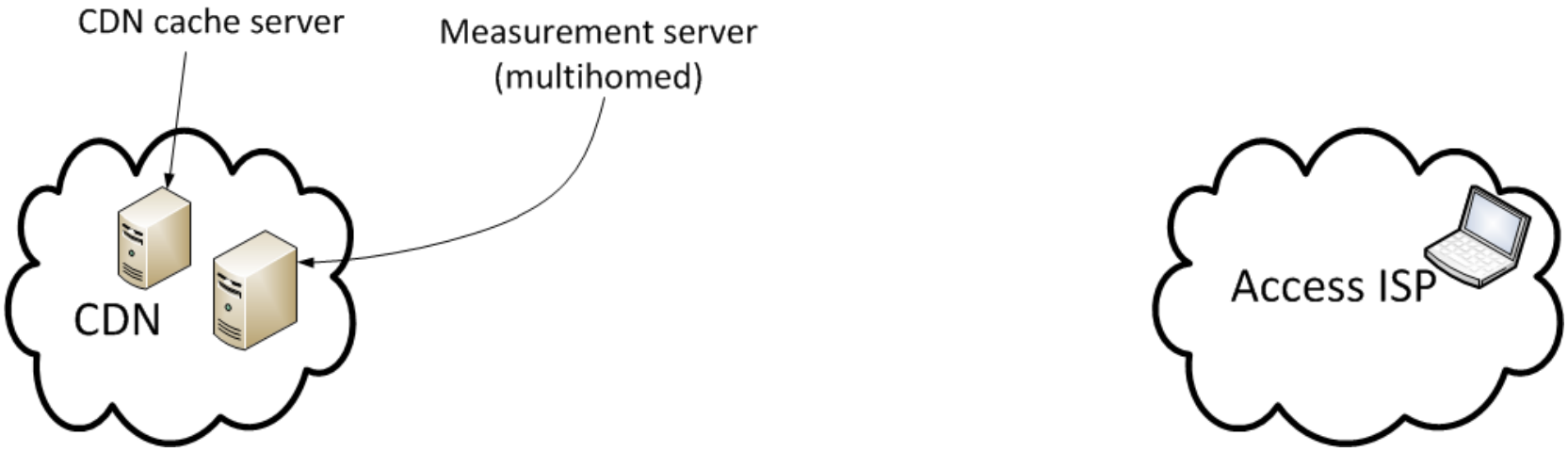
Our focus

- Large-scale measurement based performance comparison

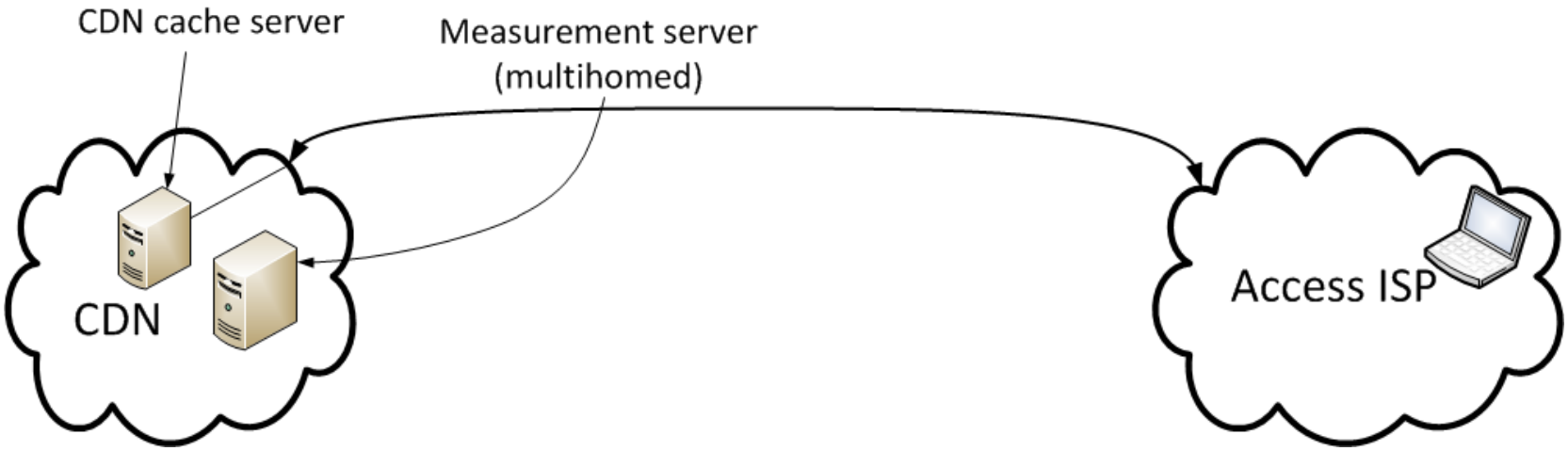
Methodology

- Throughput measurements
  - Strain the network
- Delay measurements using ICMP packet probing
  - Rate limiting at ISPs
- Our approach
  - HTTP based end-to-end delay measurements

The big picture



The big picture



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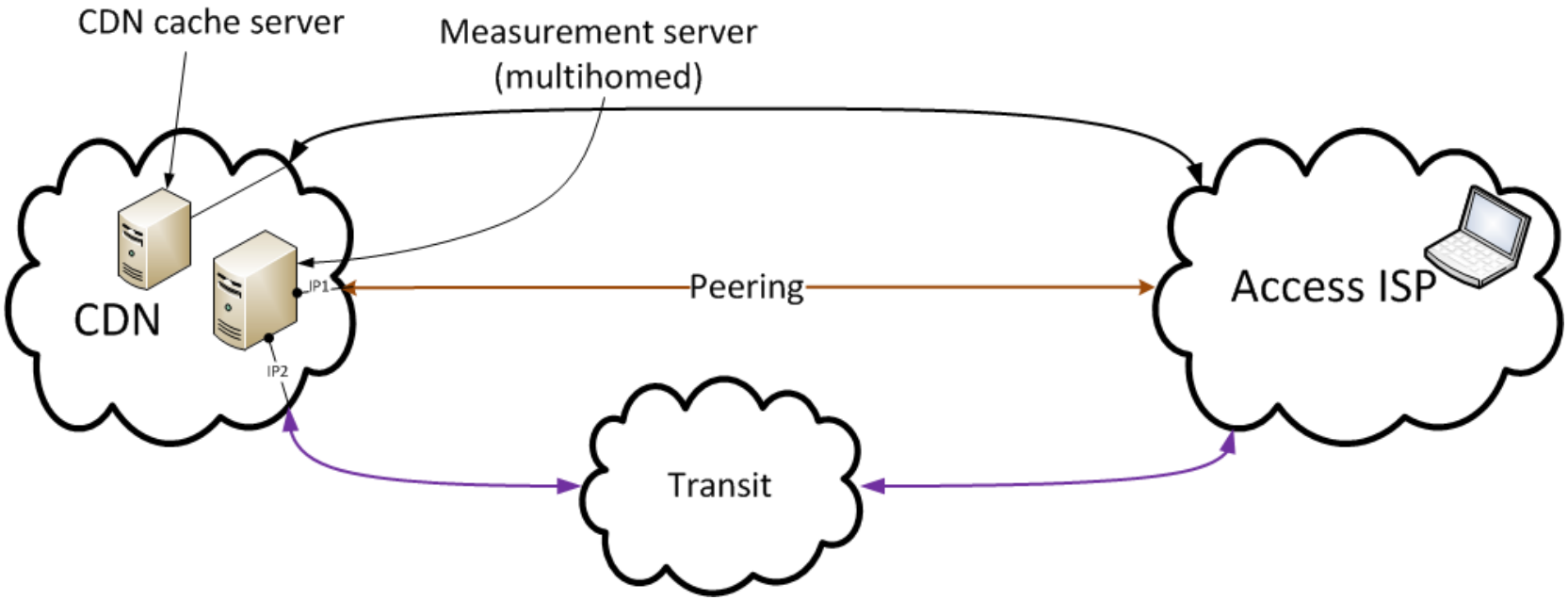
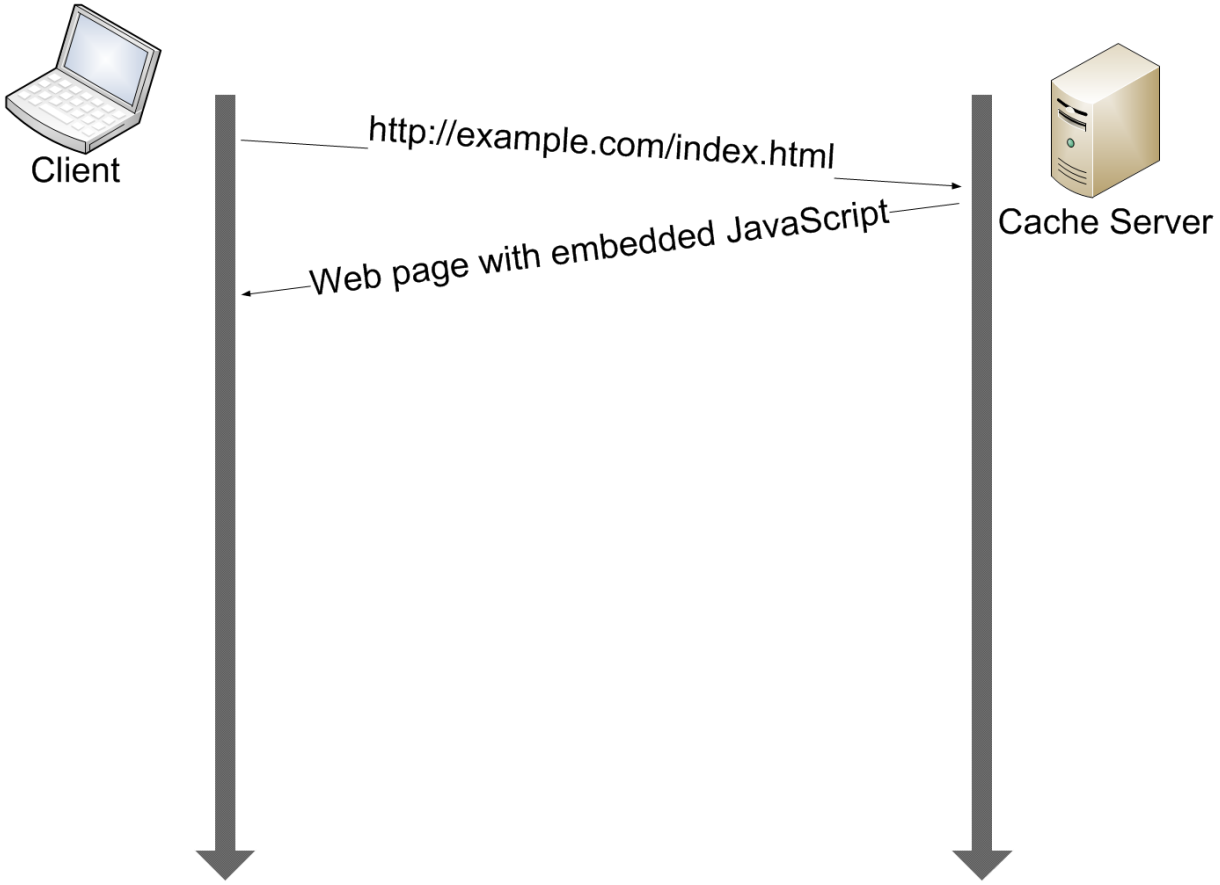


Our approach

Client

Cache Server

Our approach



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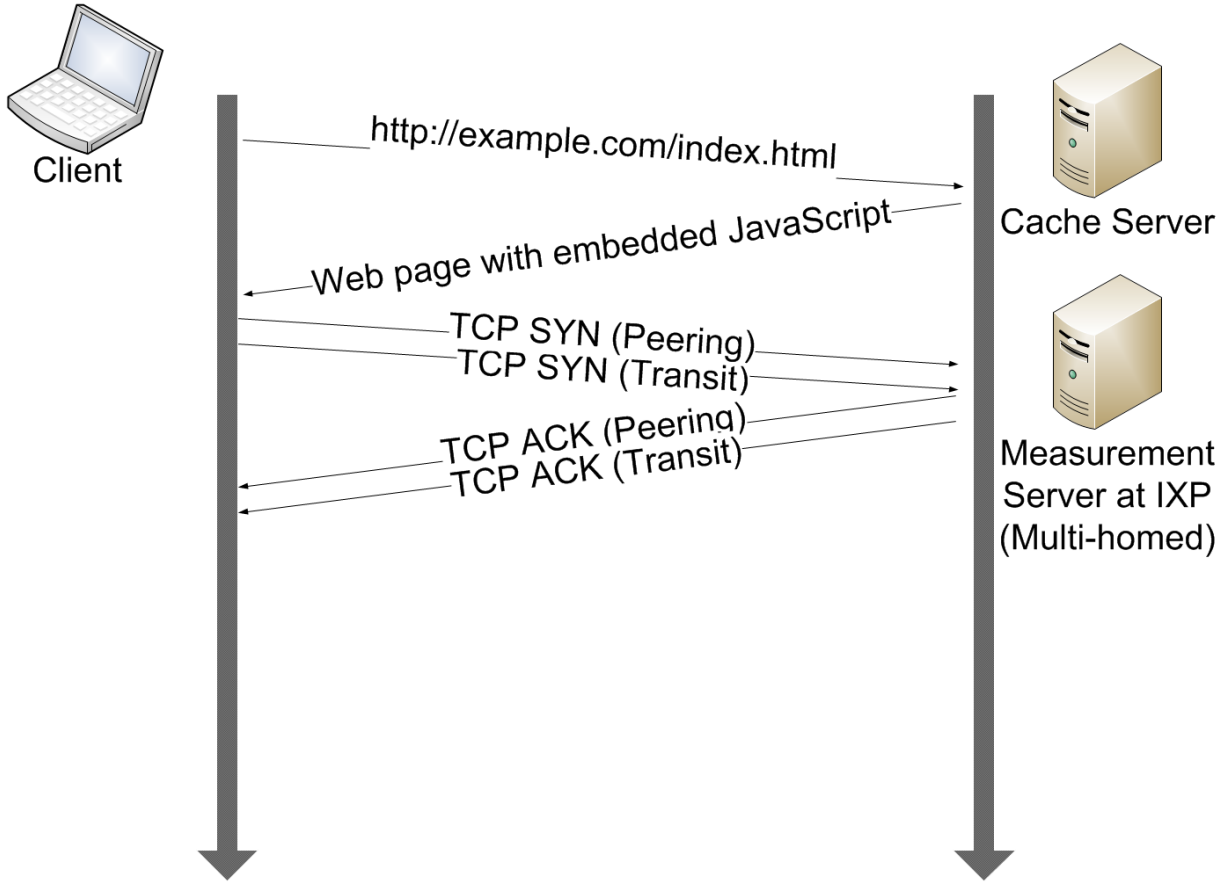

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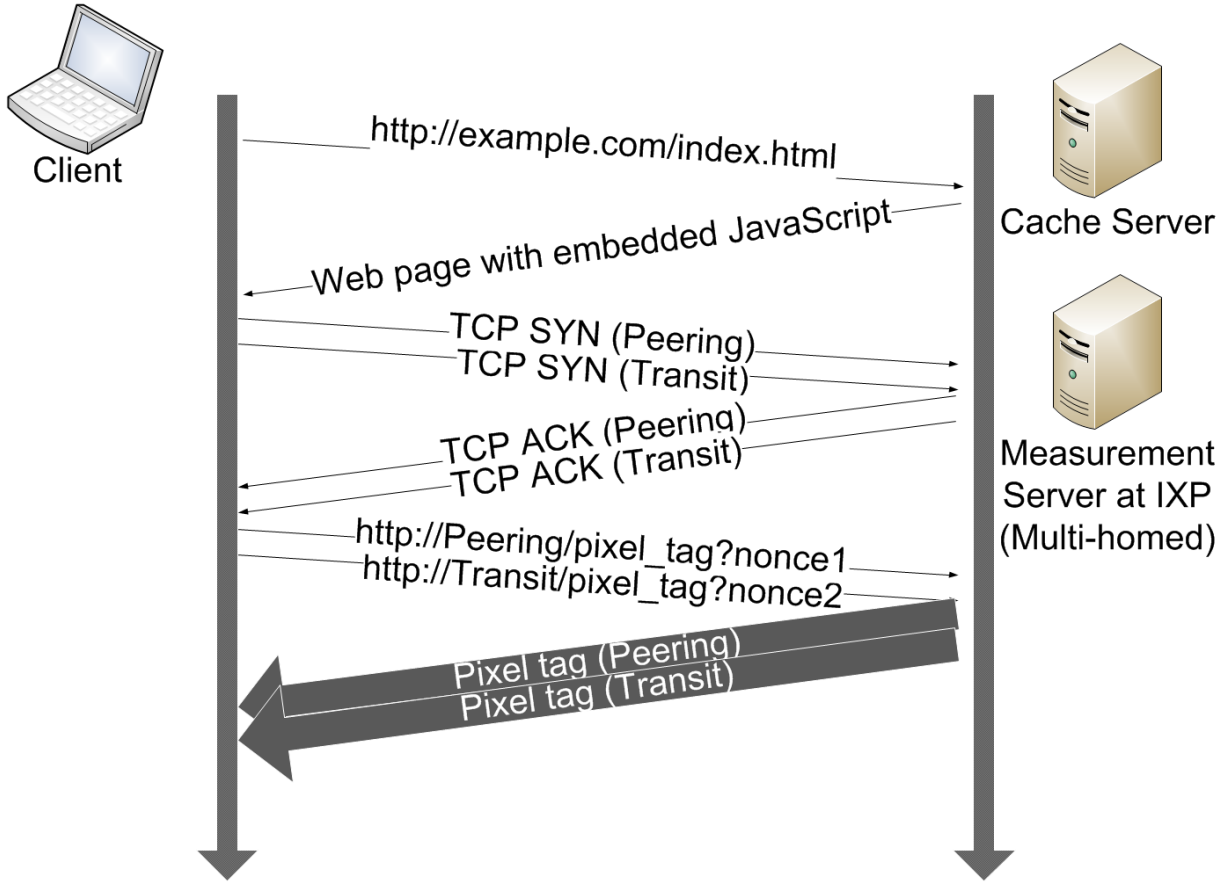

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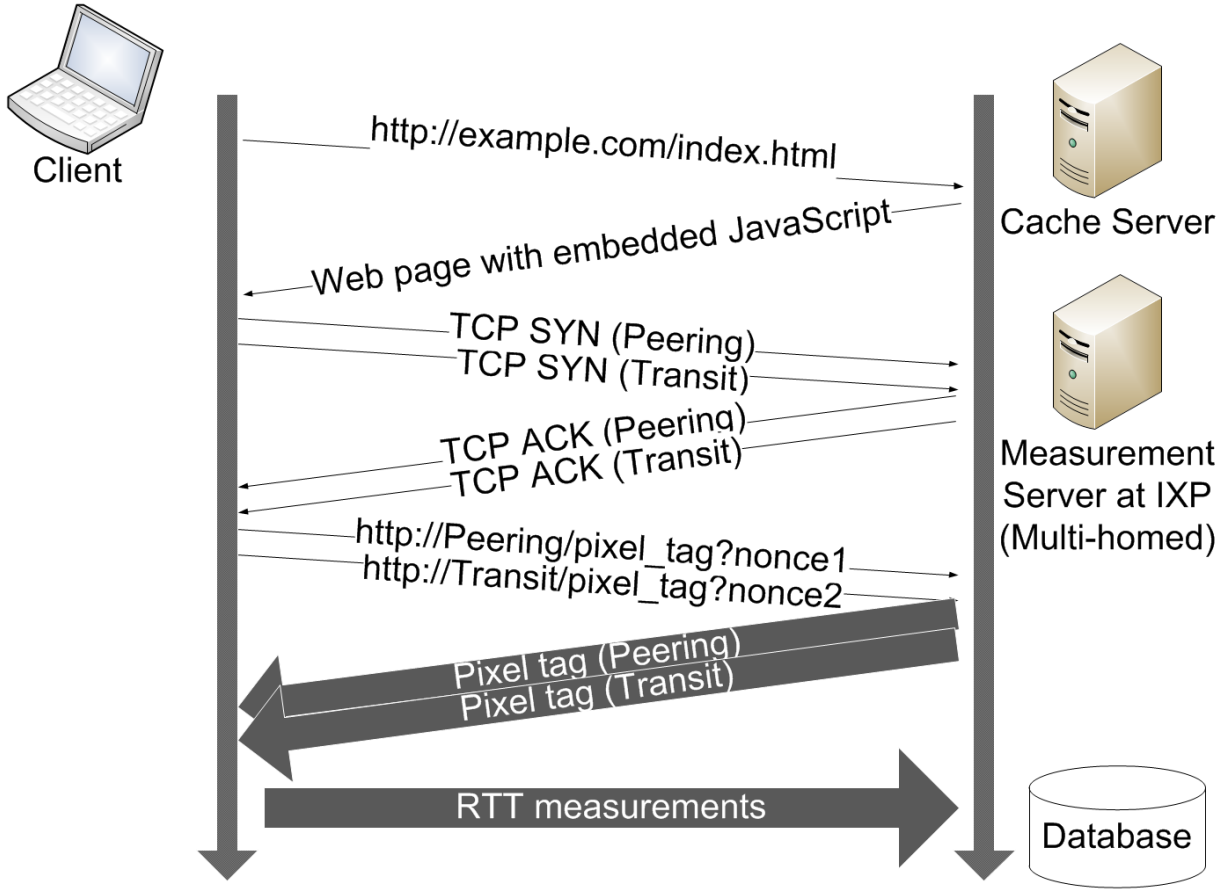
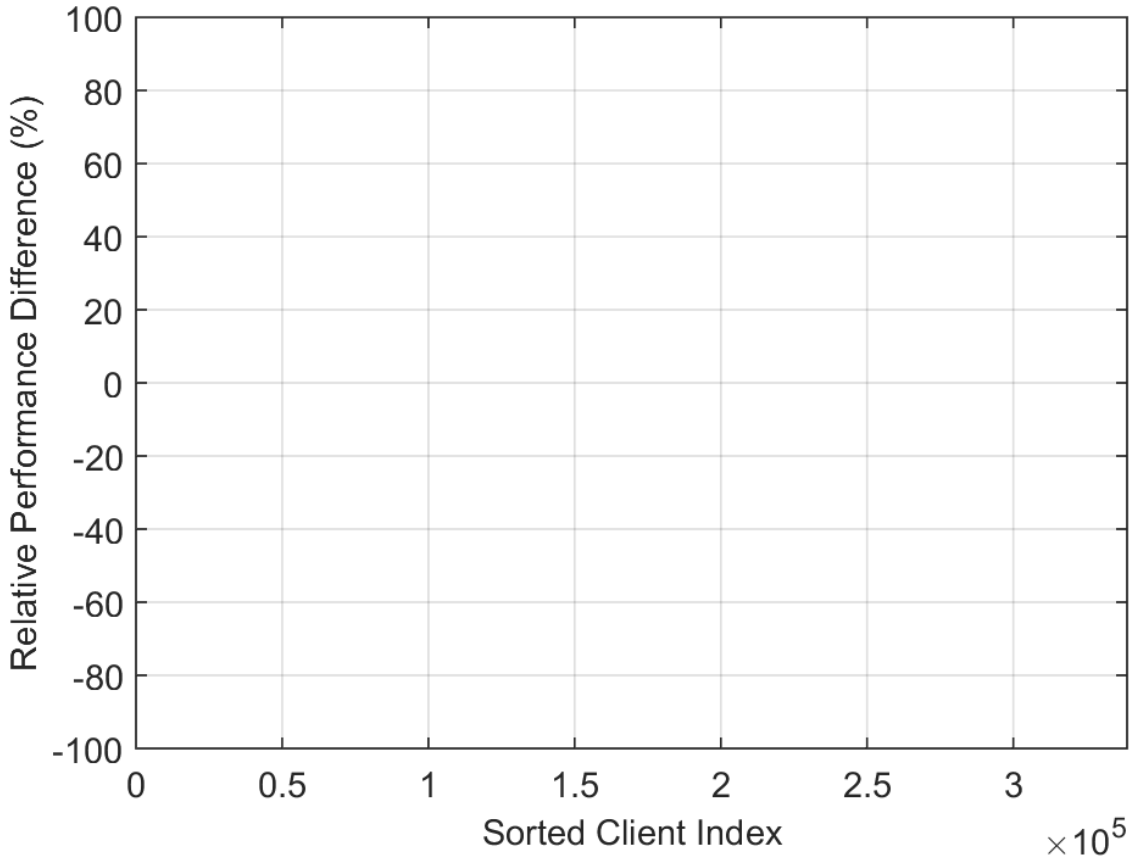


Data collection

- A commercial CDN
- Collected across PoPs at 19 IXPs
- 1M measurements
  - ~350K clients
  - 360 Autonomous systems

Peering vs Transit



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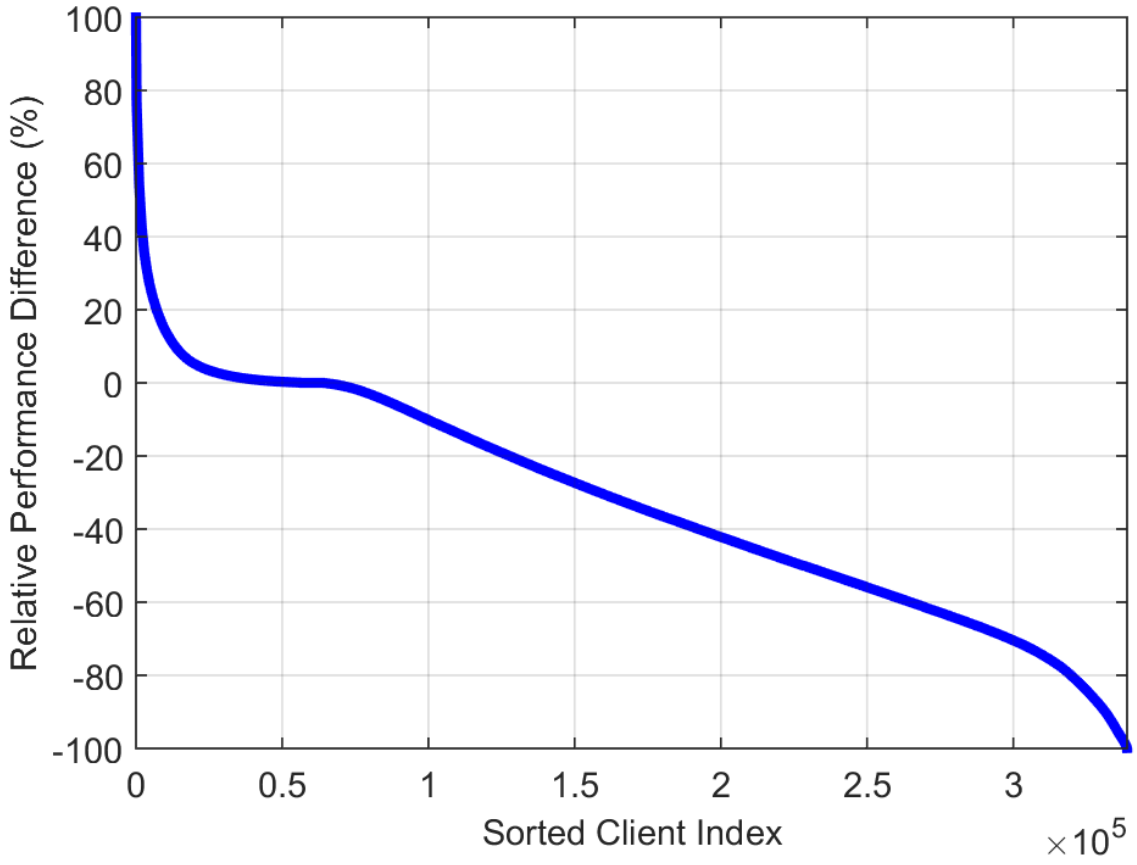

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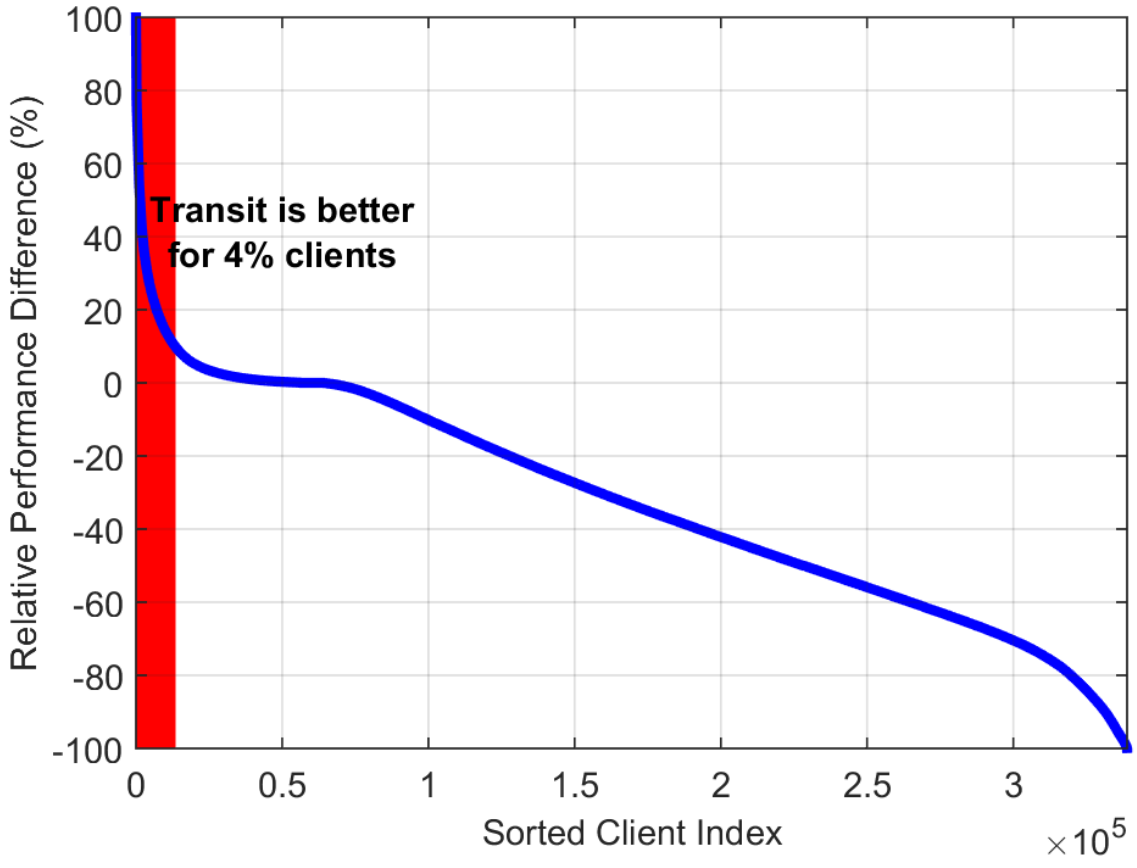

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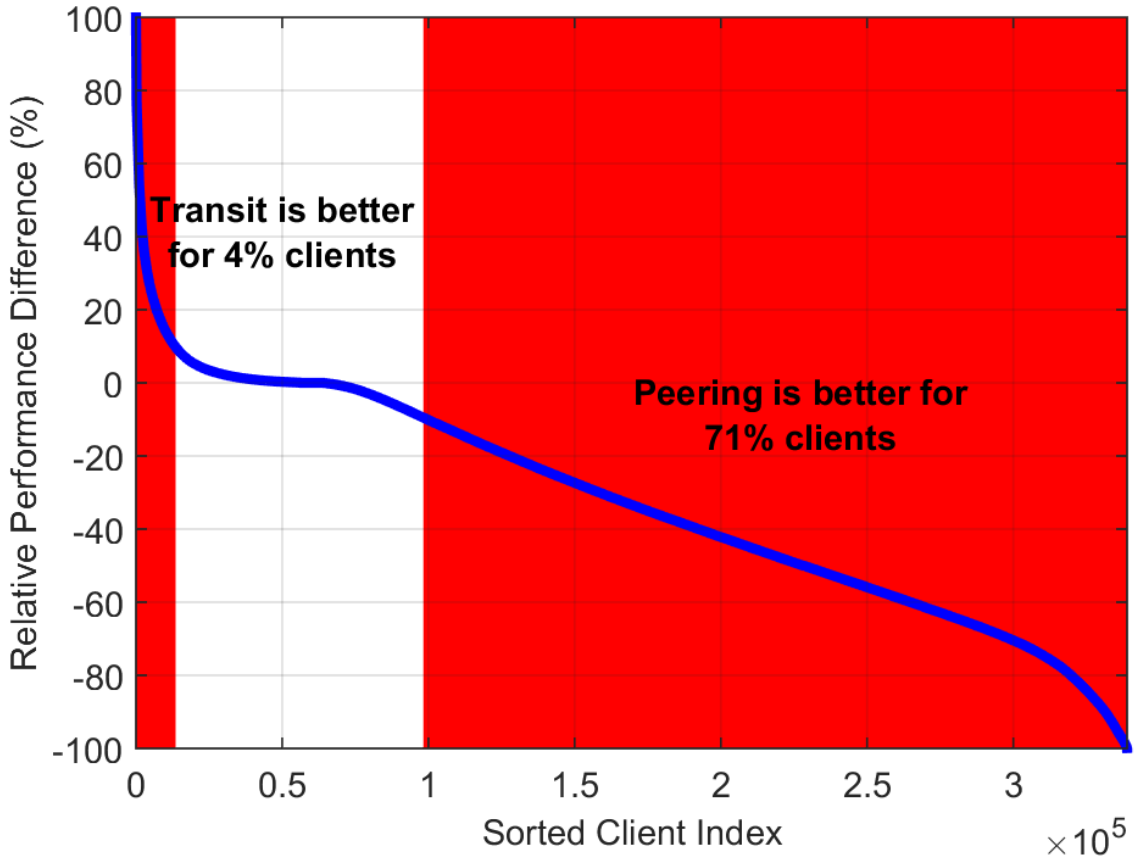
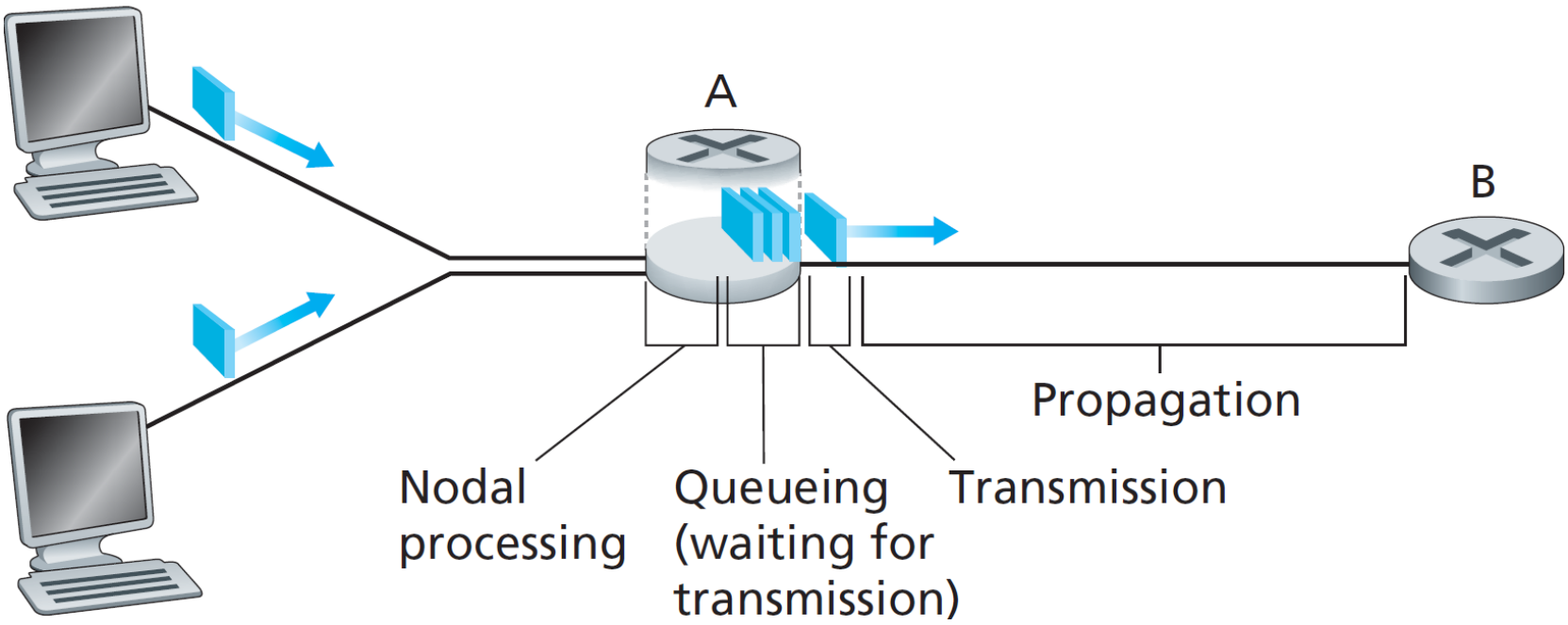


RTT components



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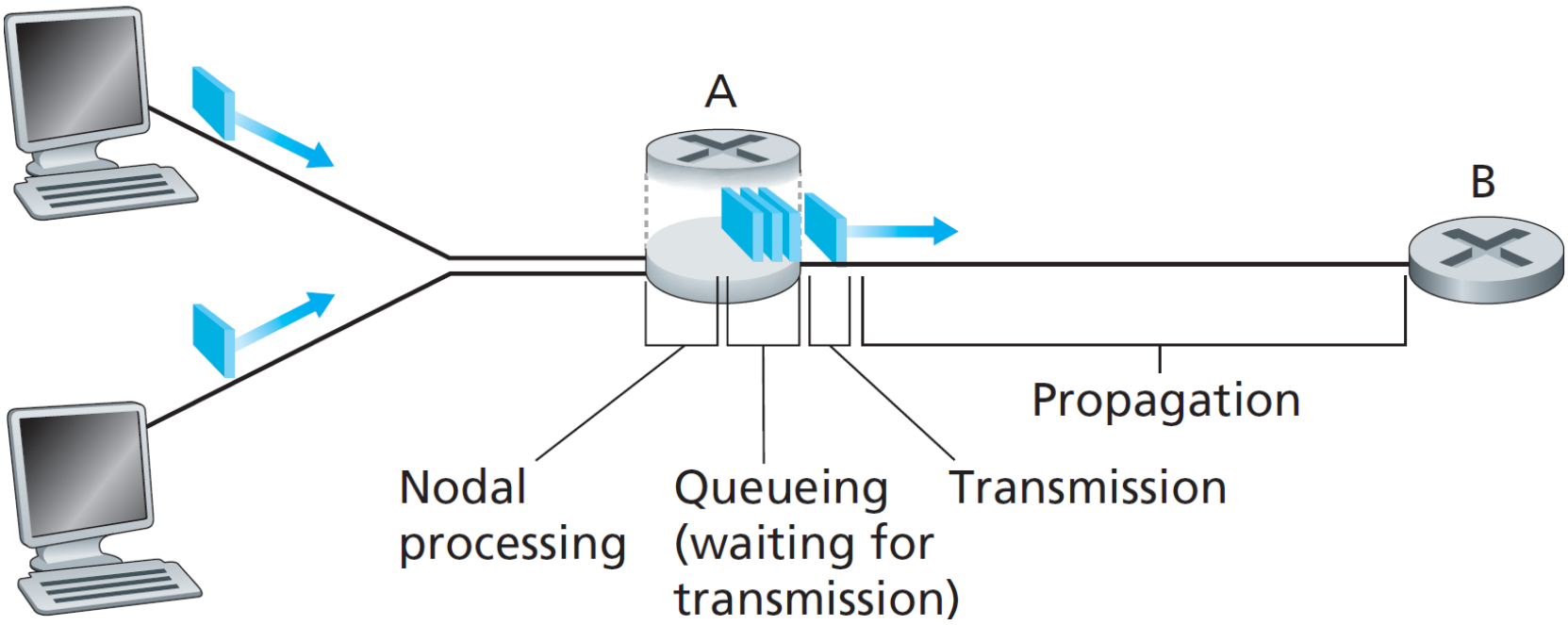
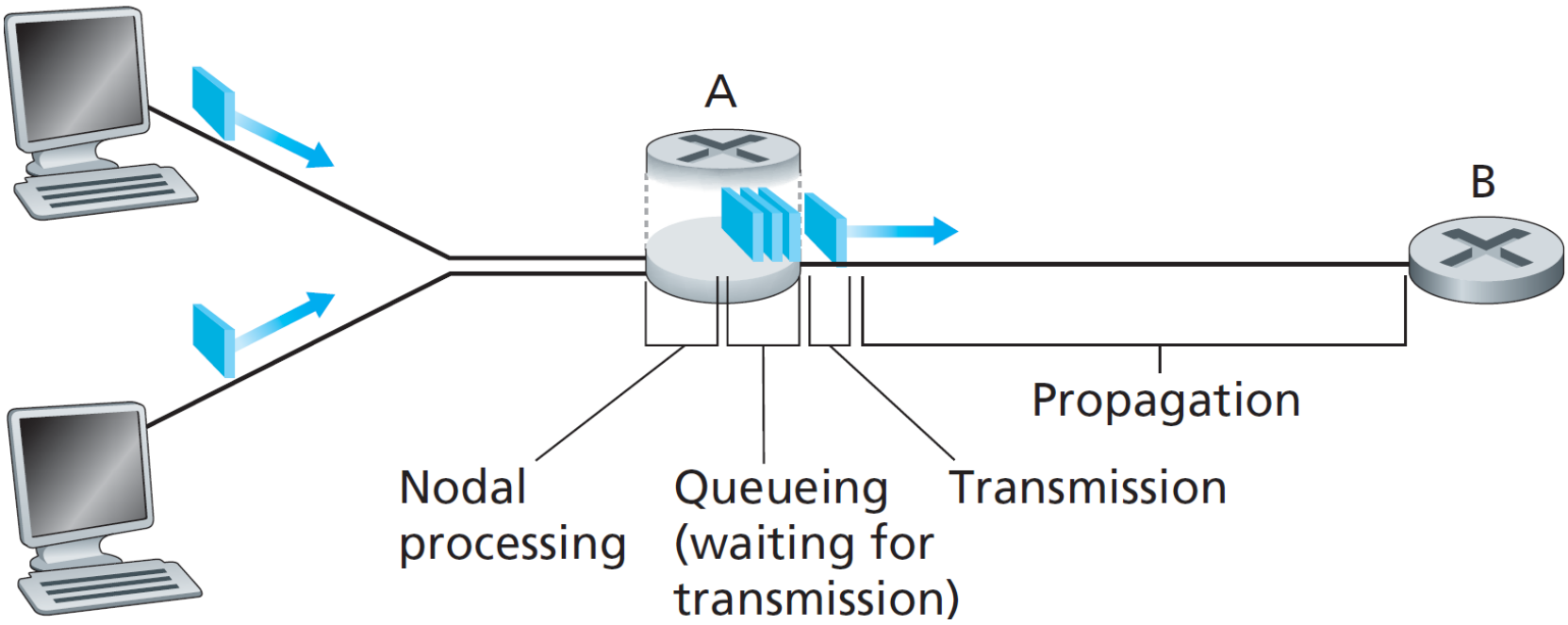


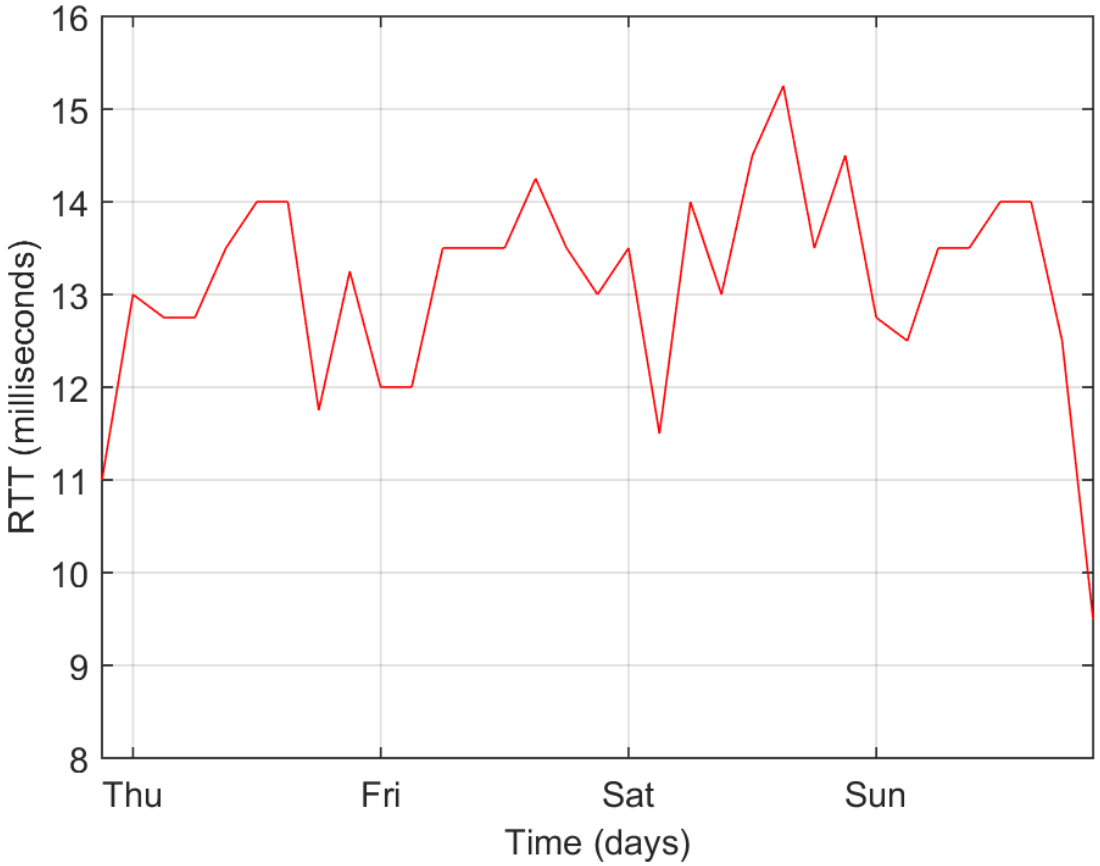
- Transmission ~ 0
  - small size of pixel tag

RTT components



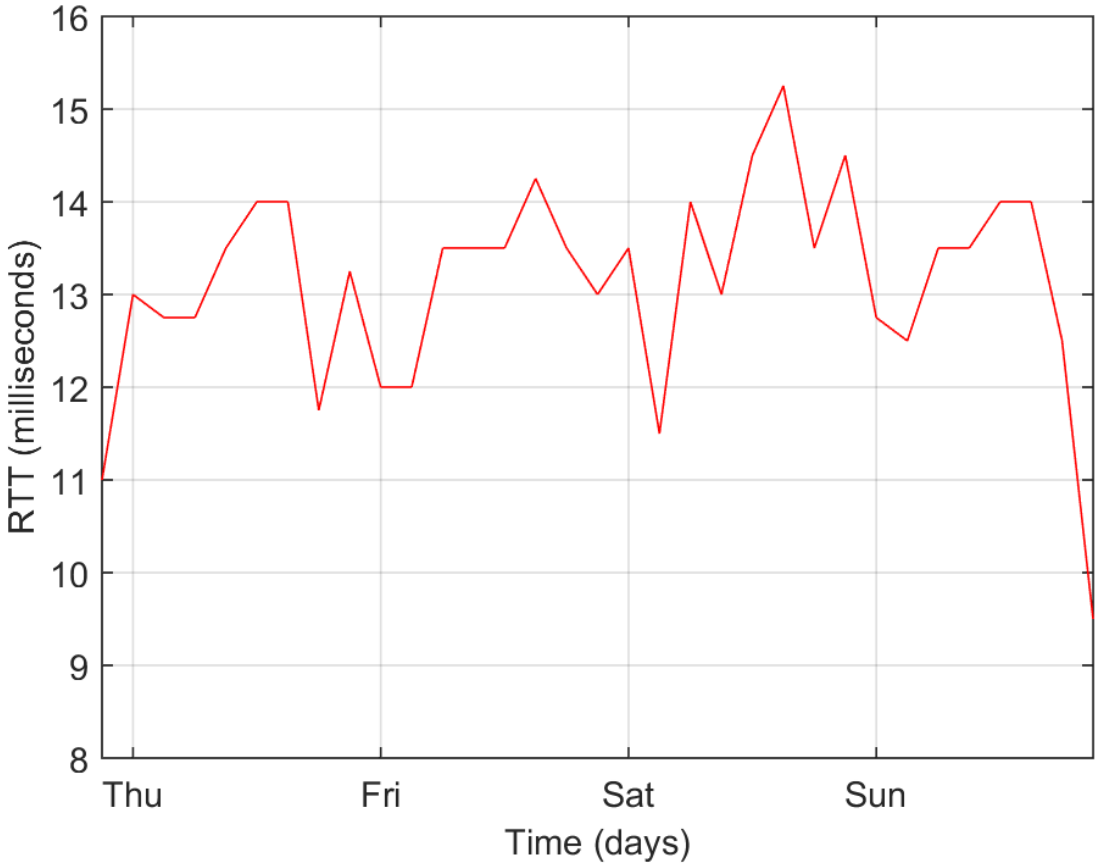
- Transmission ~ 0
  - small size of pixel tag
- RTT ~ Propagation delay + Queueing delay

RTT components



RTT measurements over time

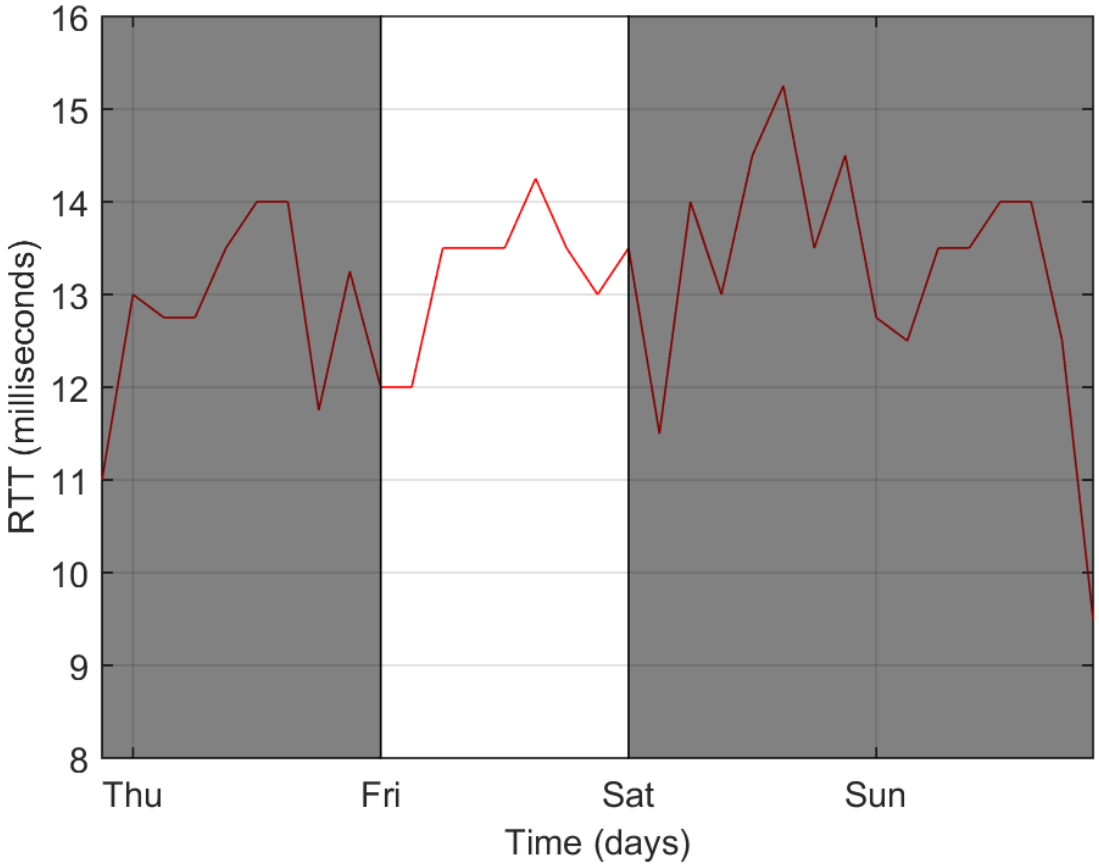
RTT components



RTT measurements over time

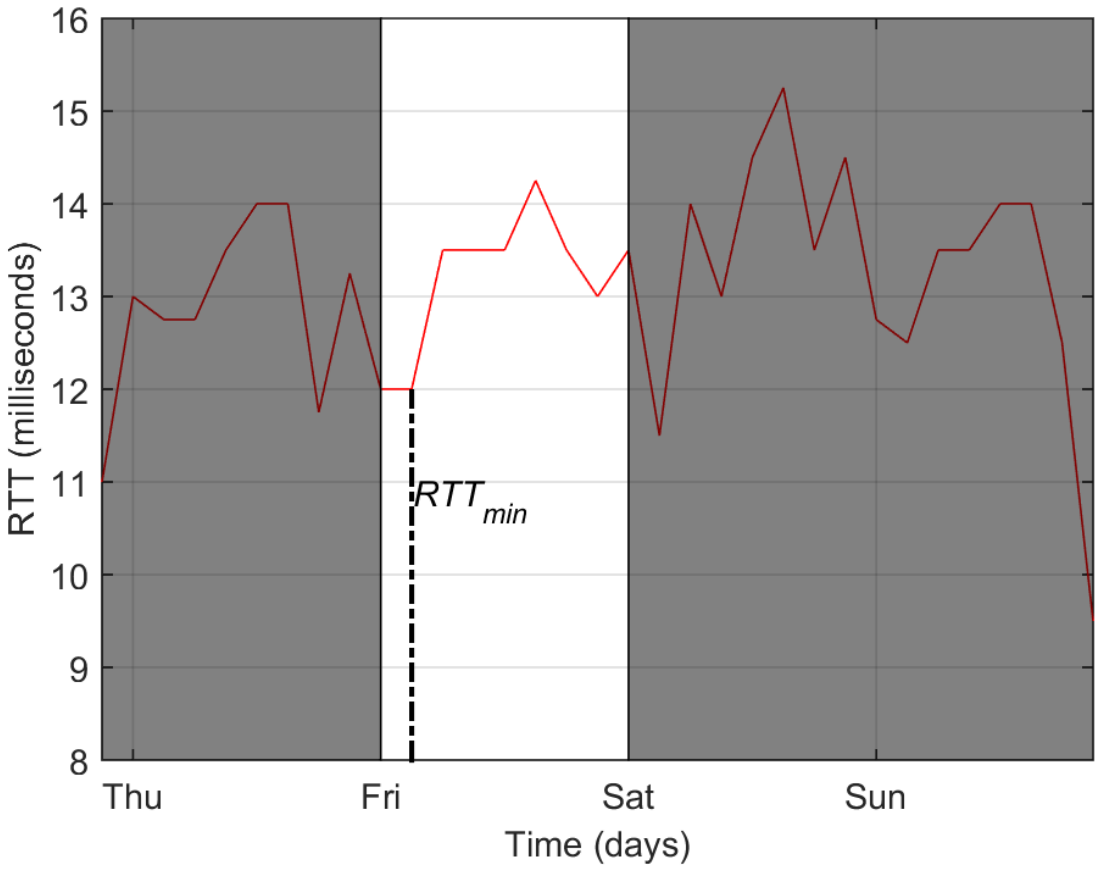
- Diurnal pattern

RTT components



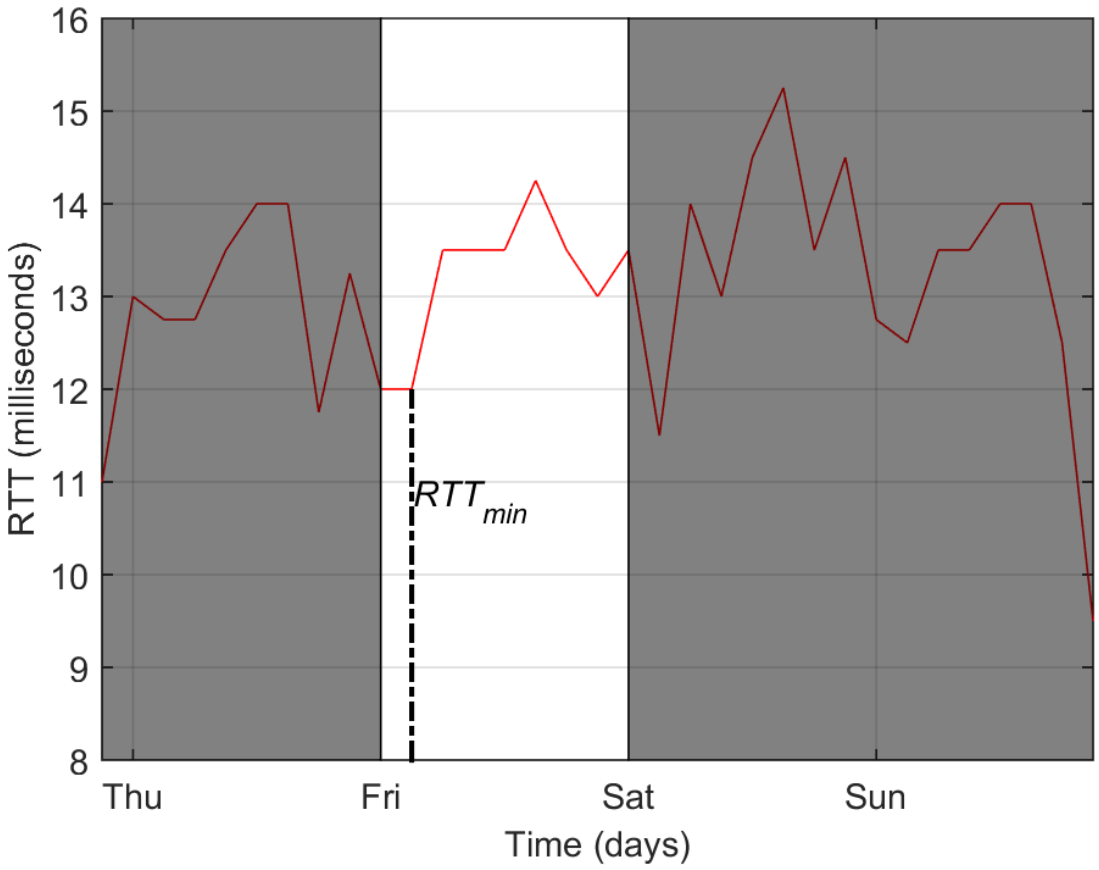
- Diurnal pattern
- Time series latency pings

RTT components



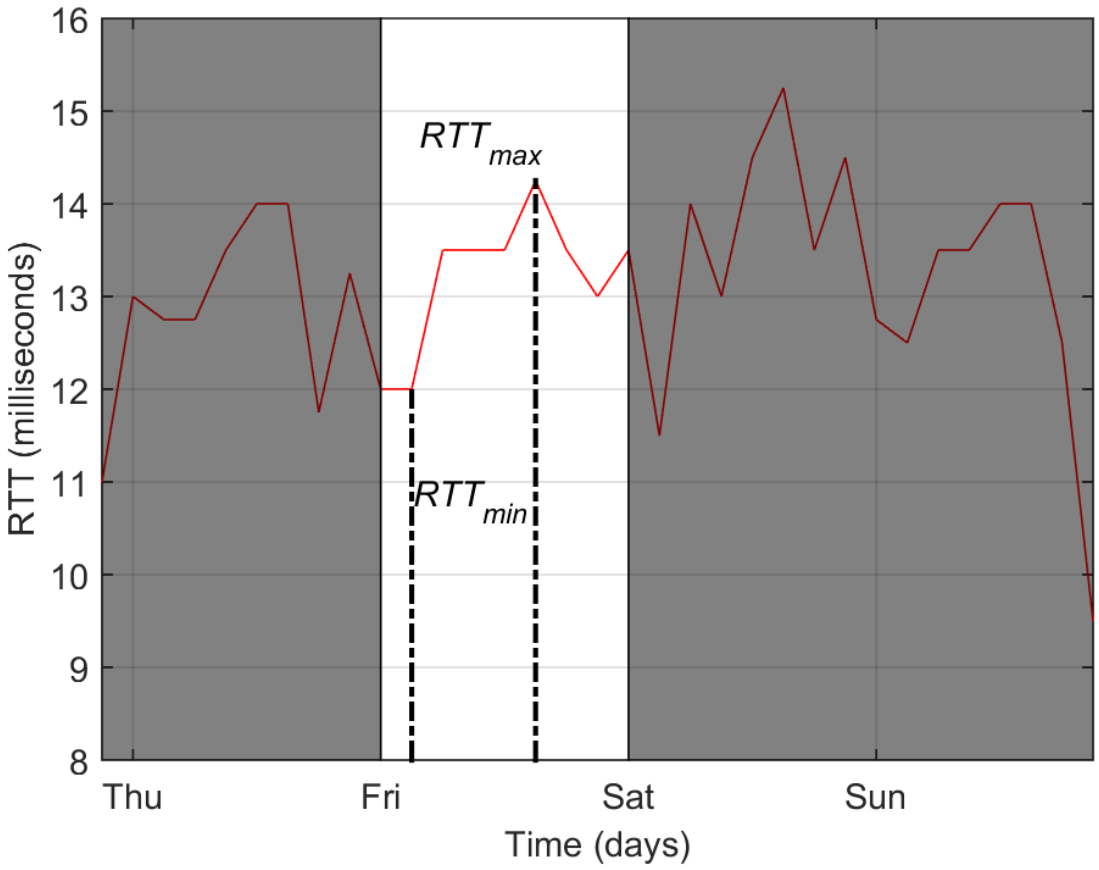
- Diurnal pattern
- Time series latency pings

RTT components



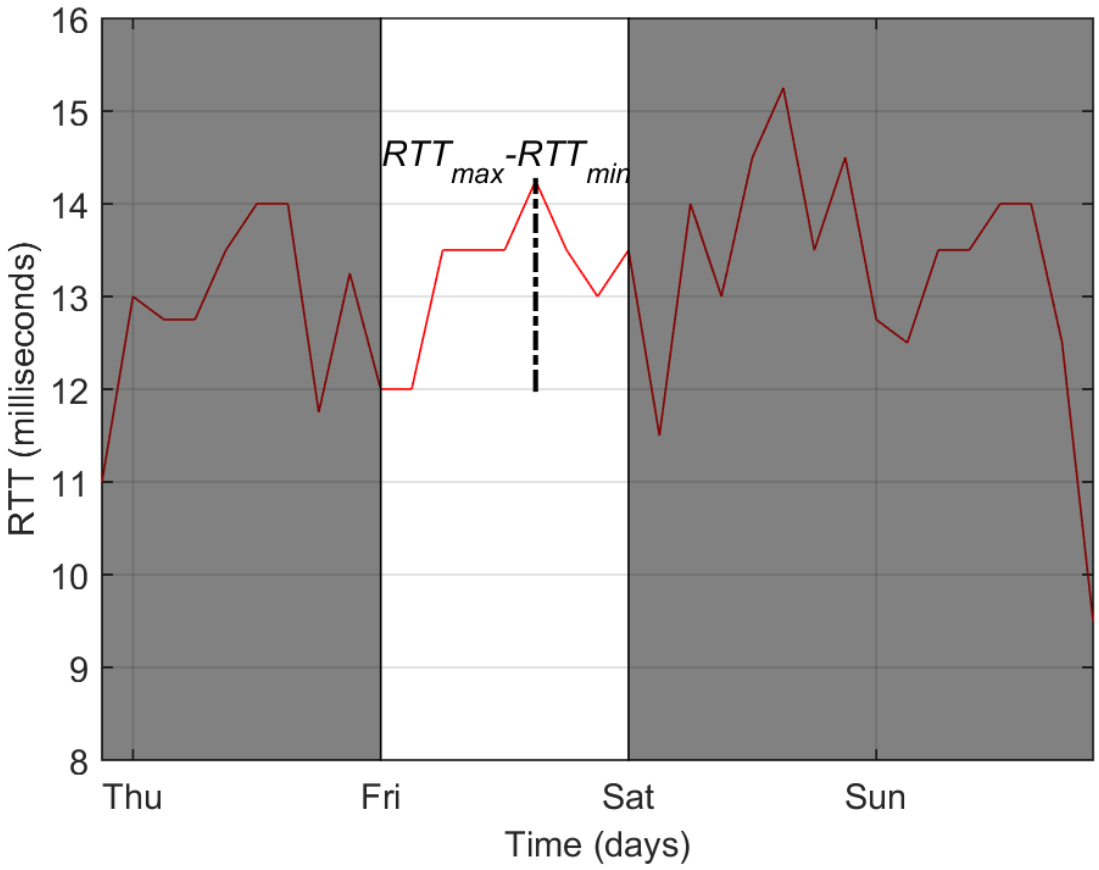
- Diurnal pattern
- Time series latency pings
- Propagation delay < RTT_{min}

RTT components



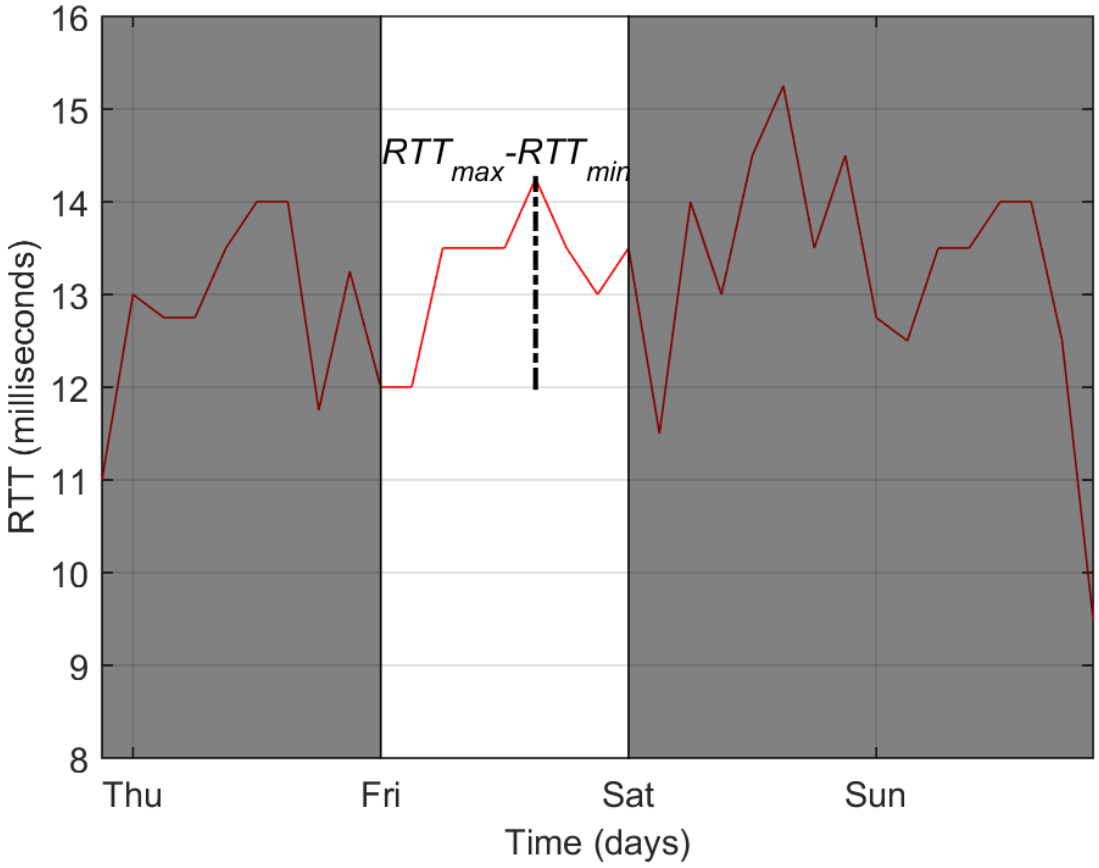
- Diurnal pattern
- Time series latency pings
- Propagation delay < RTT_{min}

RTT components



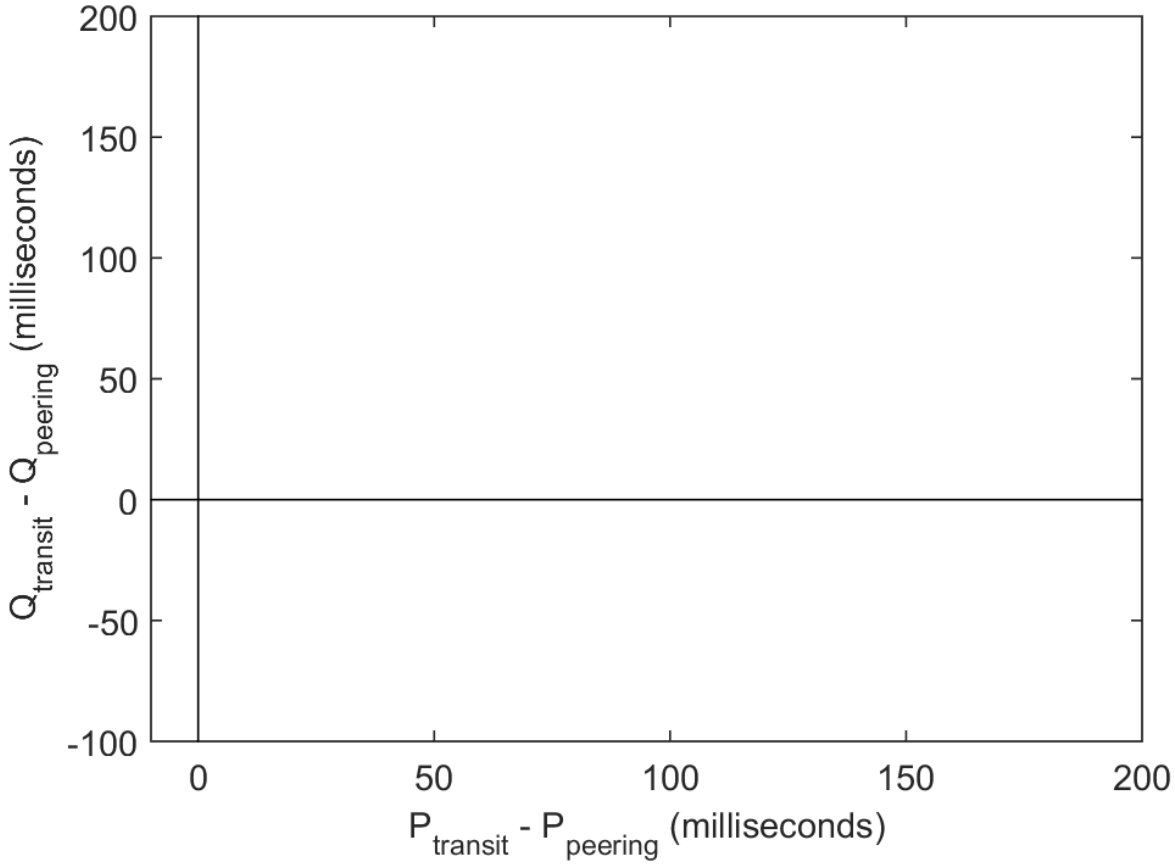
- Diurnal pattern
- Time series latency pings
- Propagation delay < RTT_{min}

RTT components



- Diurnal pattern
- Time series latency pings
- Propagation delay < RTT_{min}
- Maximum queueing delay ~ RTT_{max} - RTT_{min}

Propagation and Queueing delays



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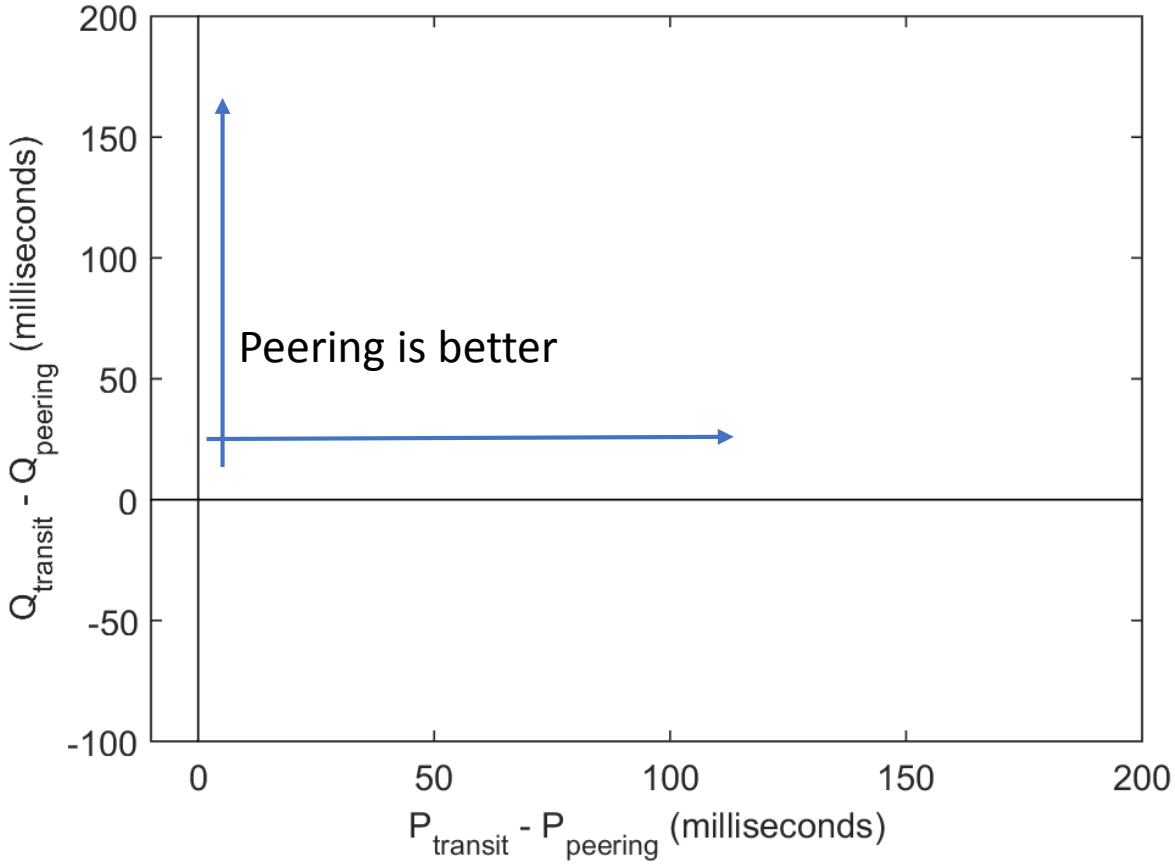

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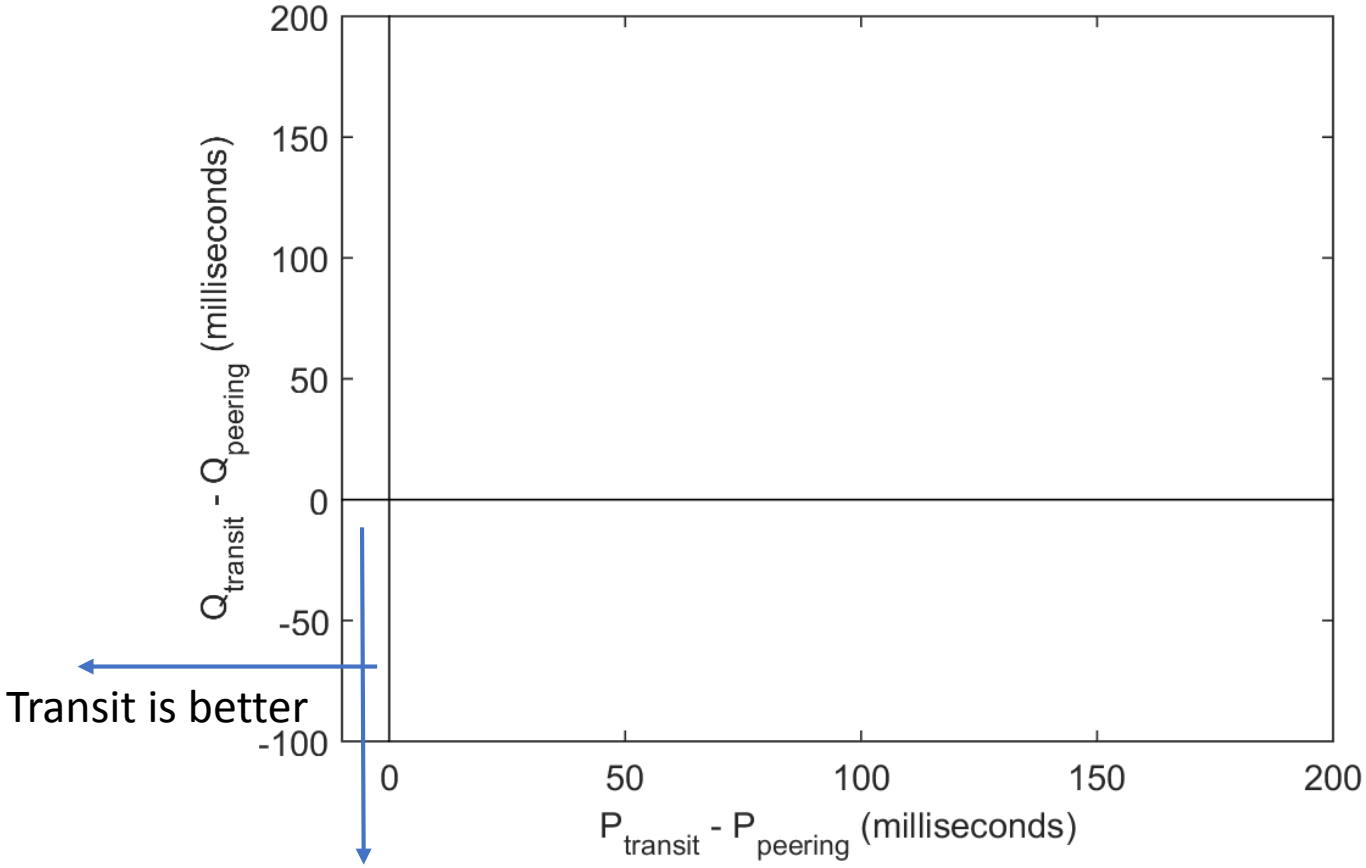

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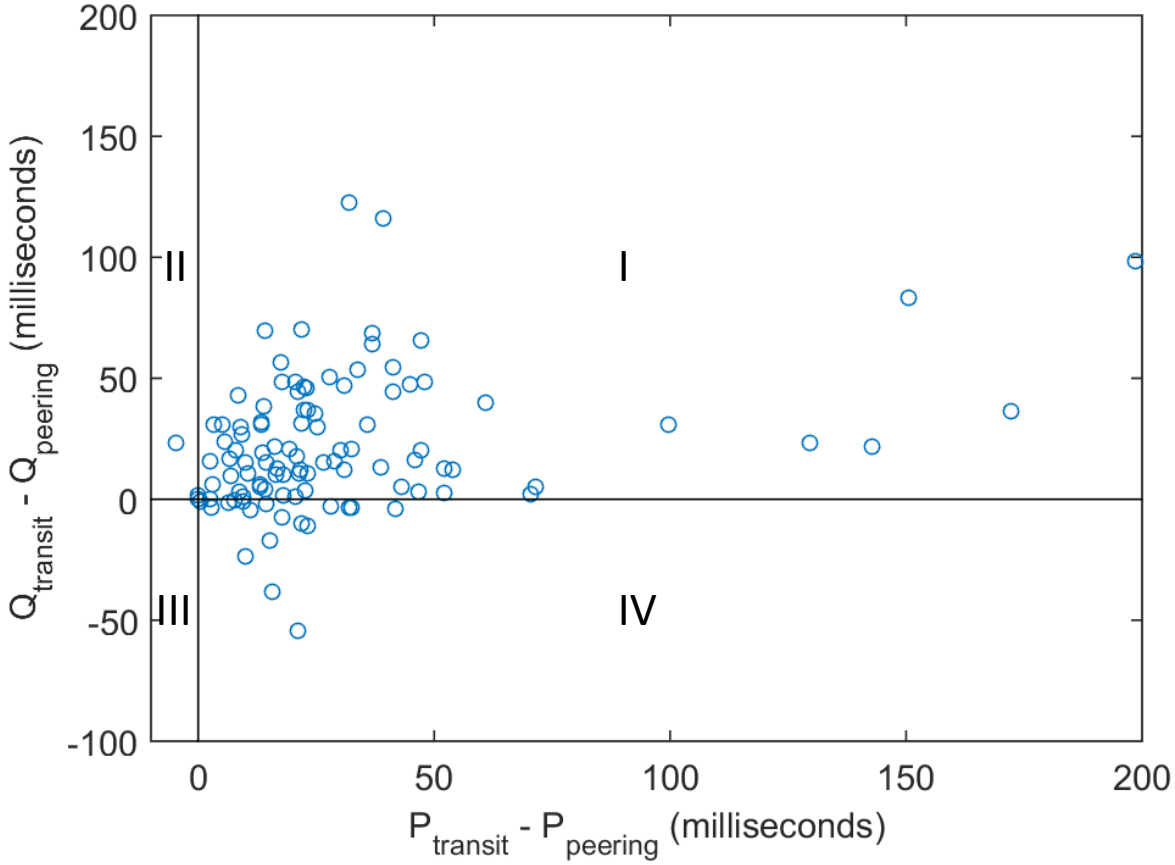

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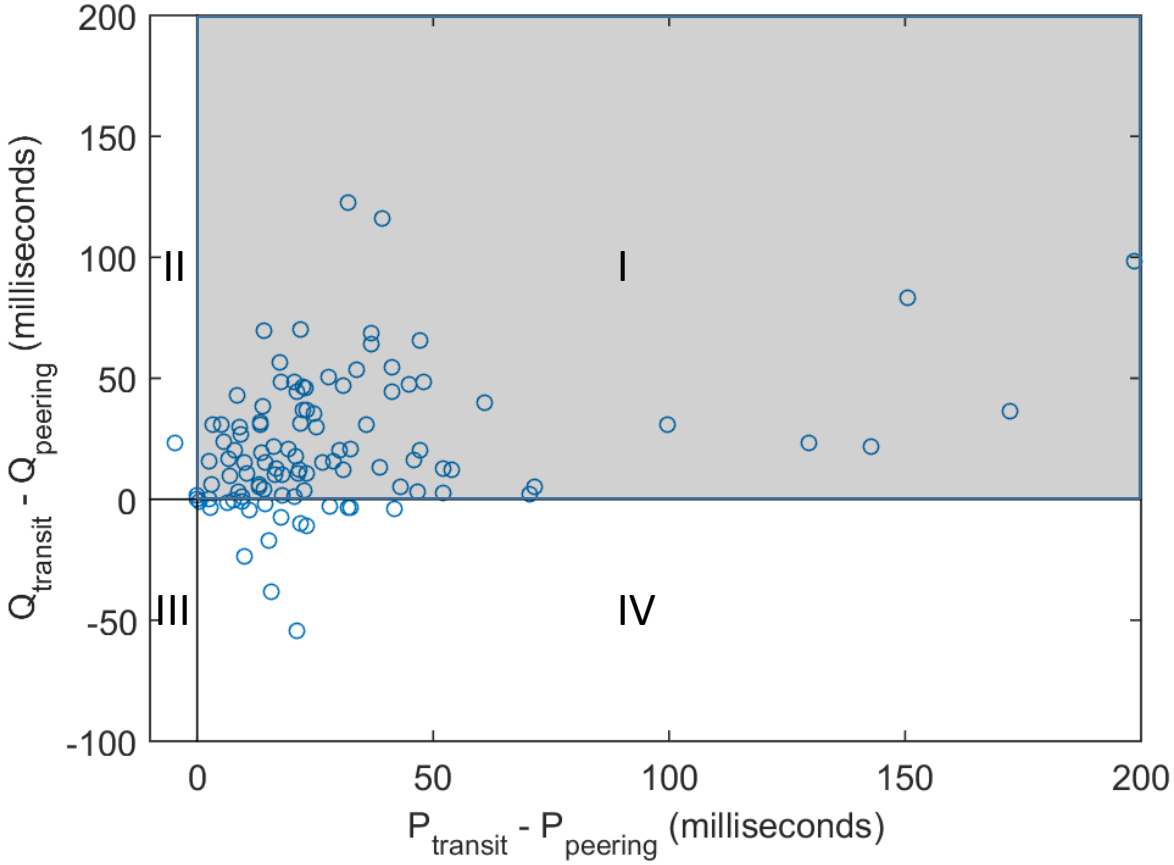

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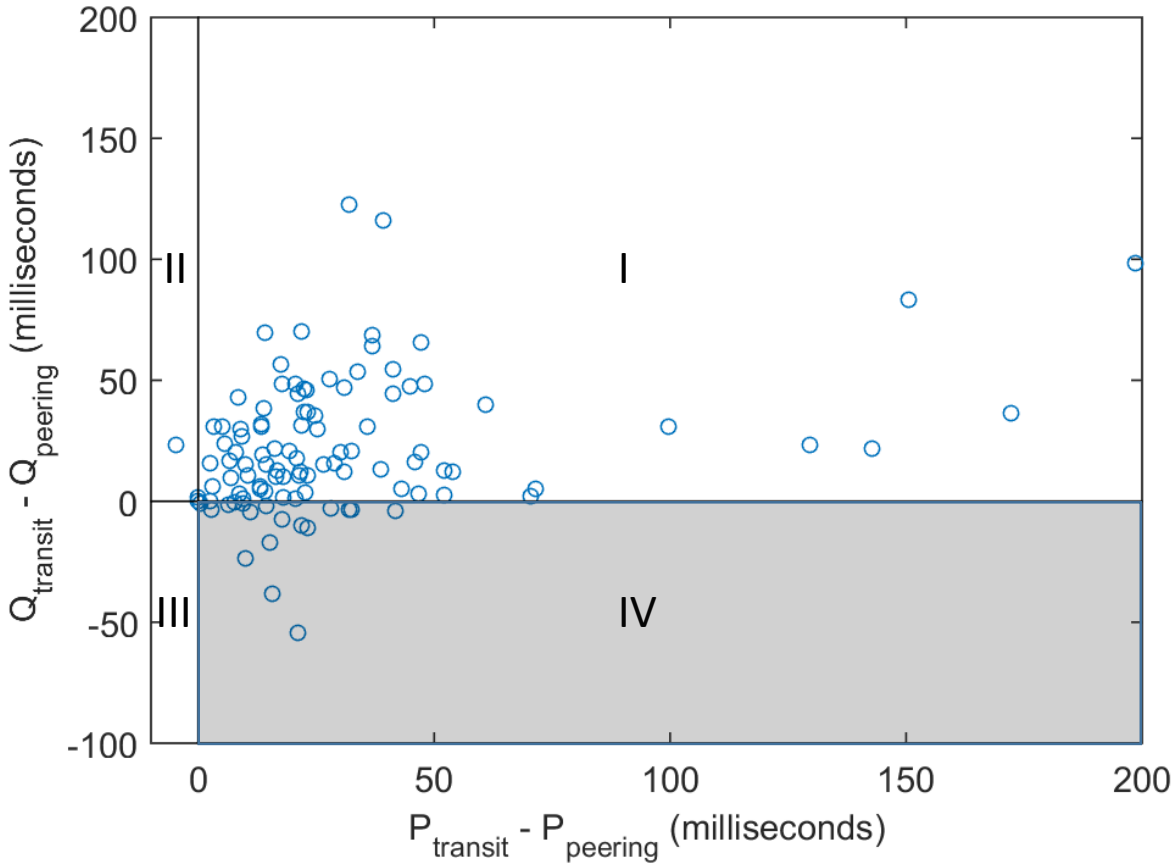
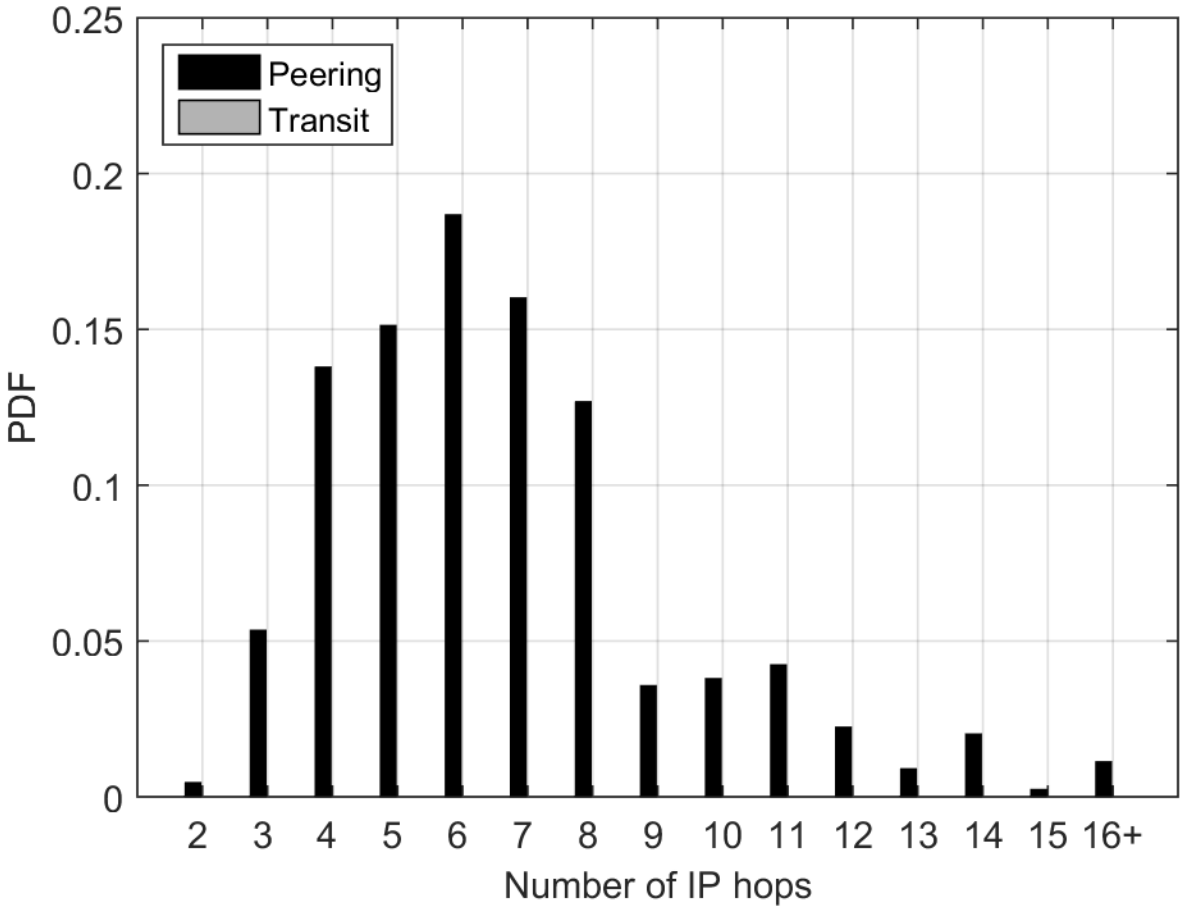


Path length comparison



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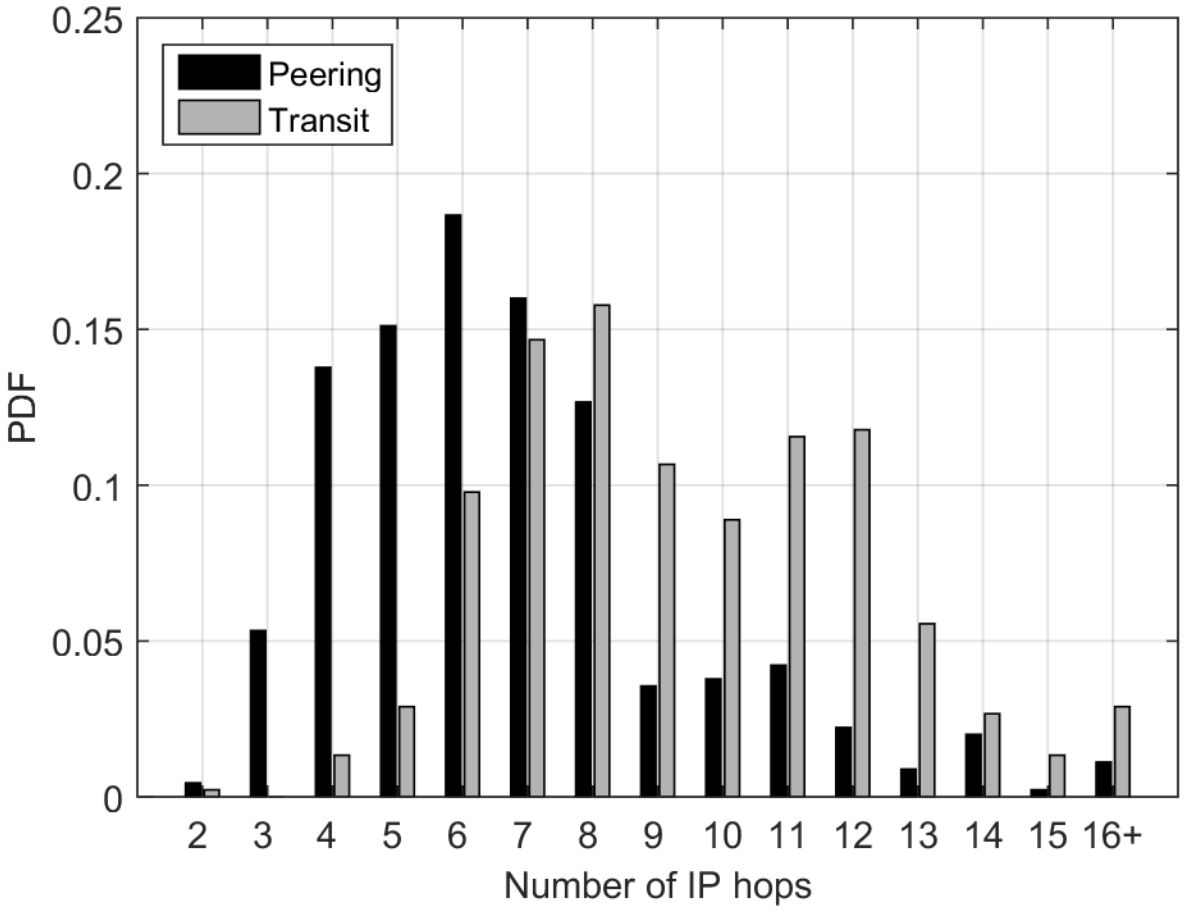

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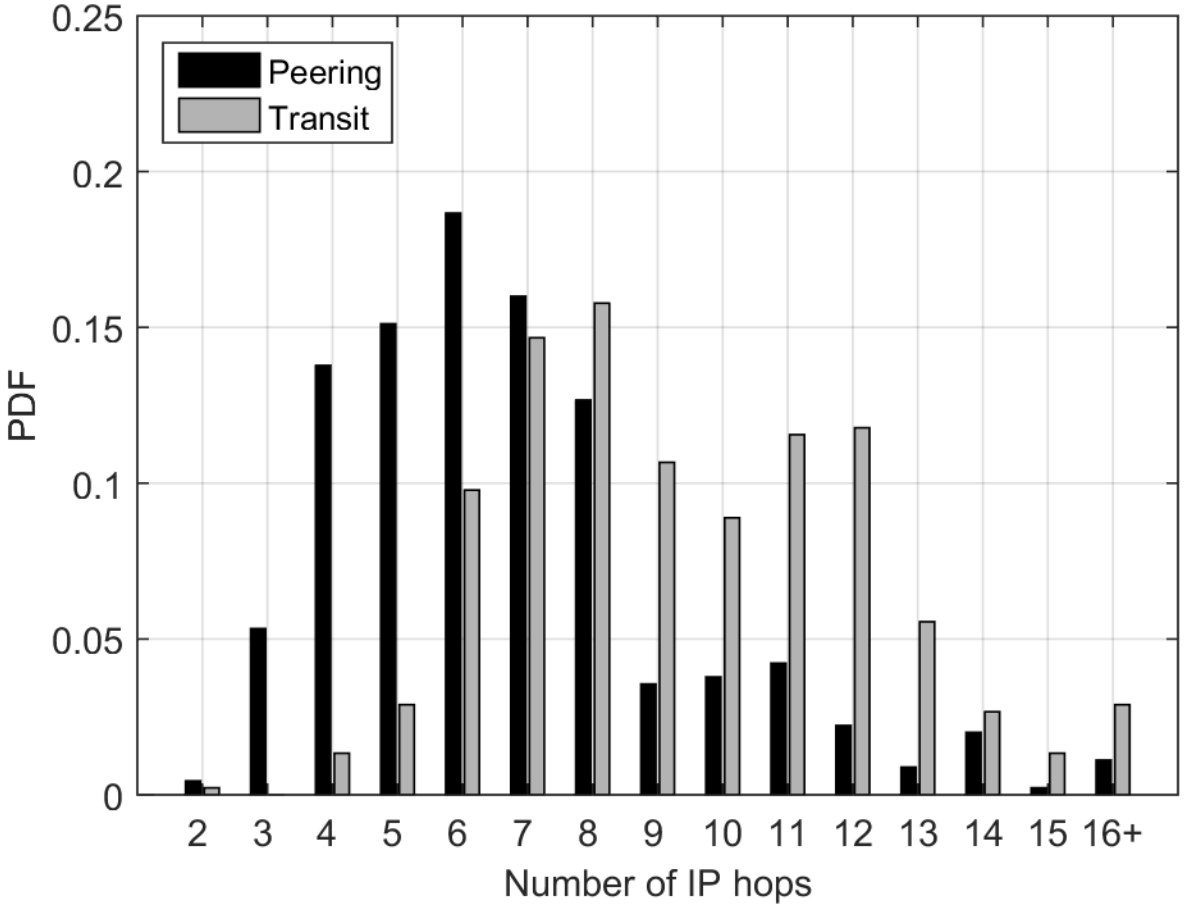

Shorter path length via peering

Conclusion

- Peering generally outperforms transit for a majority of clients
- Peering almost always has better propagation delays
  - Shorter path lengths for peering
- Transit sometimes has better queueing delays
  - Under-provisioned peering paths