Routing for Anonymous Communication

PEARG @ IETF 110

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Joint work with:
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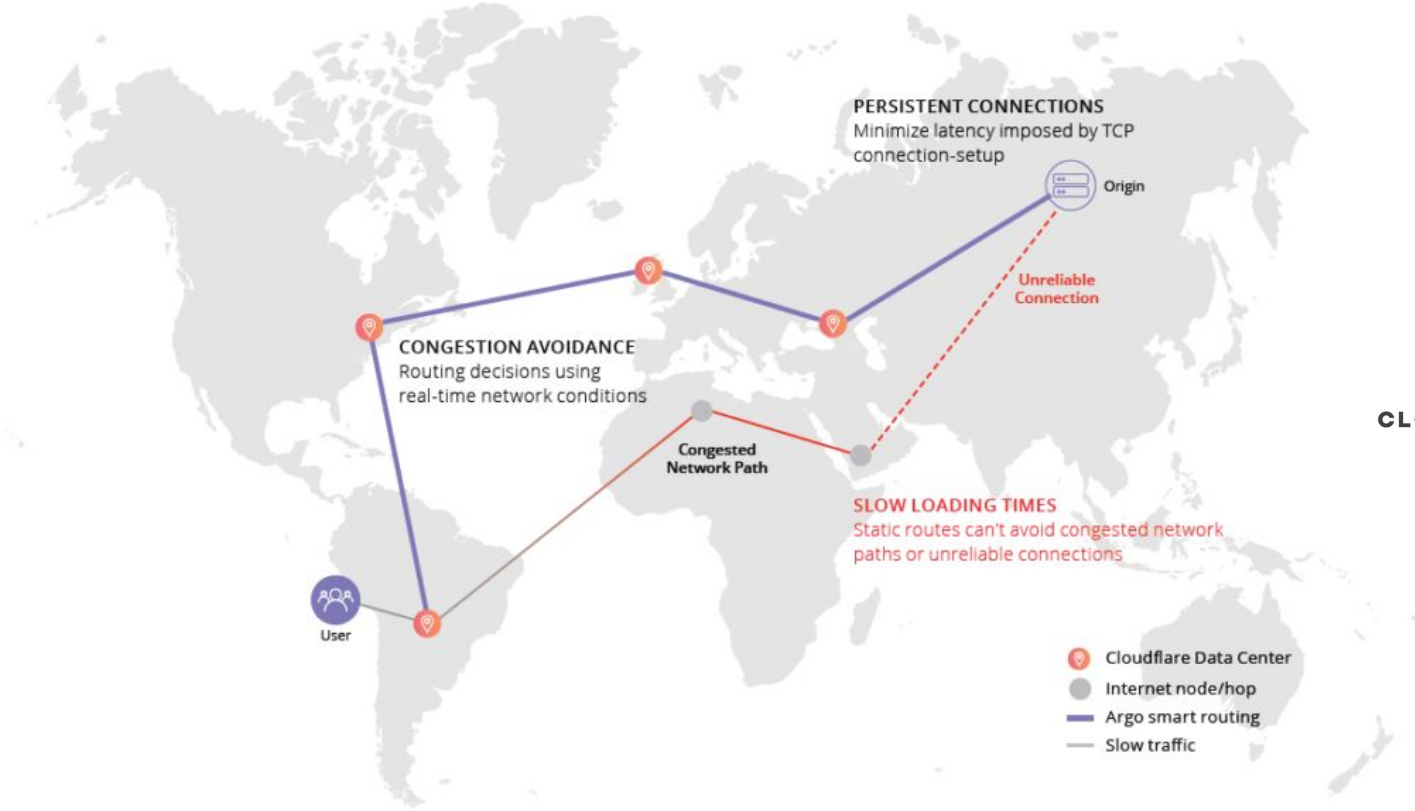
This Talk

Can overlay routing benefit decentralized systems?

- Case study: anonymous communication (i.e., Tor)
  - Must consider application goals (security/privacy)
  - Today: preliminary evidence in favor
  - Future: further evidence, proof-of-concept, analysis, simulations

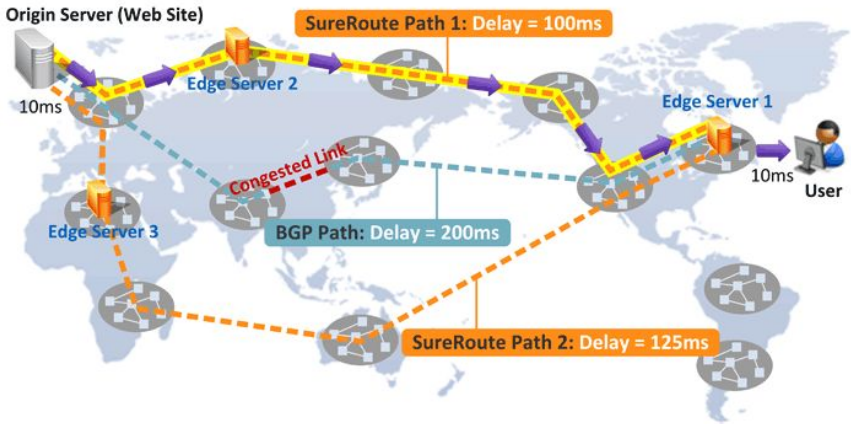
CDNs get faster routes using *overlays*



CLOUDFLARE

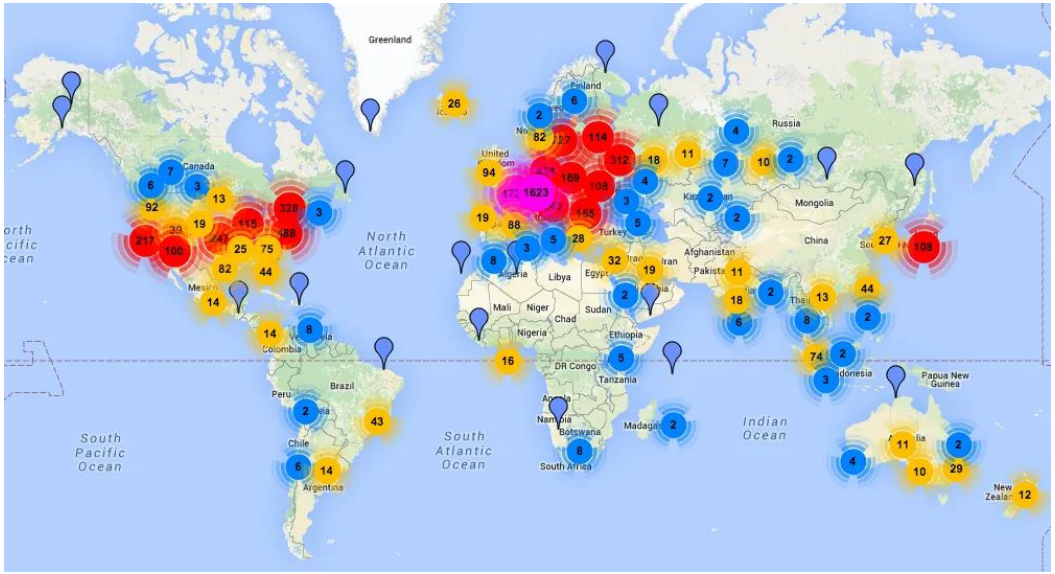
Ideal conditions for overlay routing

- Need to route long paths
  - From many parts of the world
  - And internet
- Use their machines as proxies
  - Wide geographic distribution
  - Wide network distribution
- Global view of the internet



Tor meets those conditions

- Anonymity network
- 2m daily users
- 6,000 "relays"
- Traffic between diverse relays

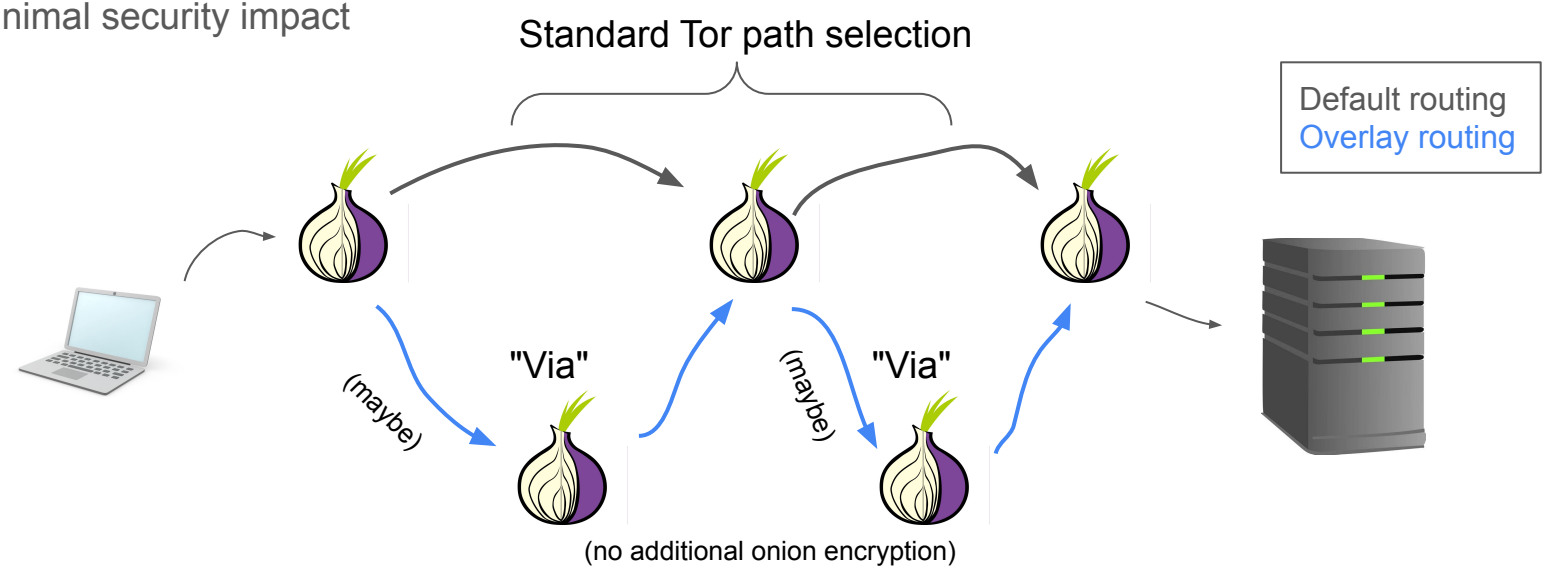


https://www.wired.com/2015/09/mapping-tors-anonymity-network-spread-around-world/

Overlay routing on Tor

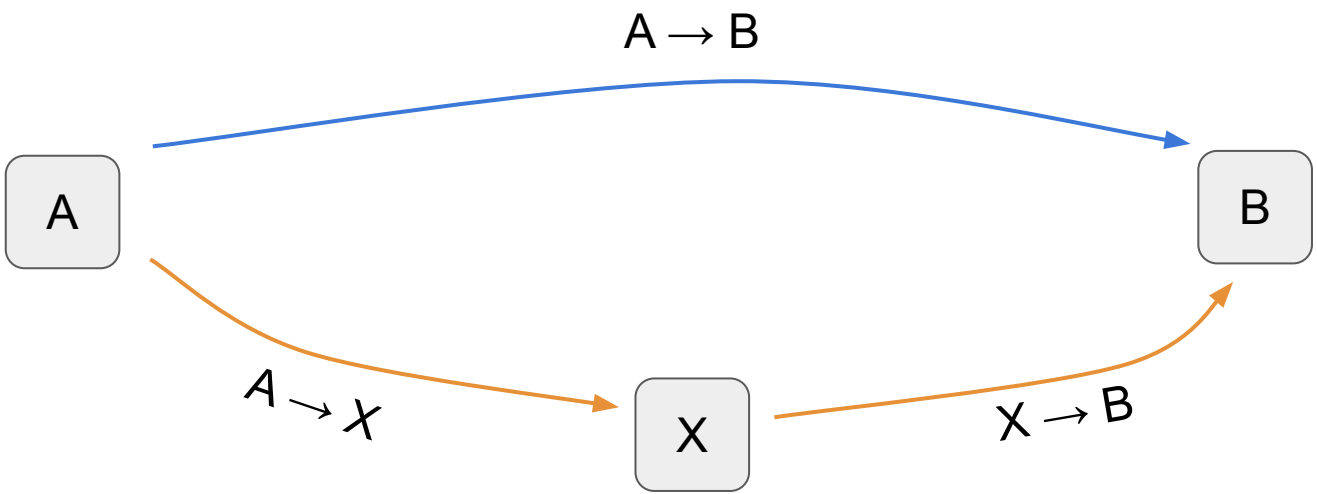
Possible benefits:

- Better performance
- Better reliability
- Minimal security impact

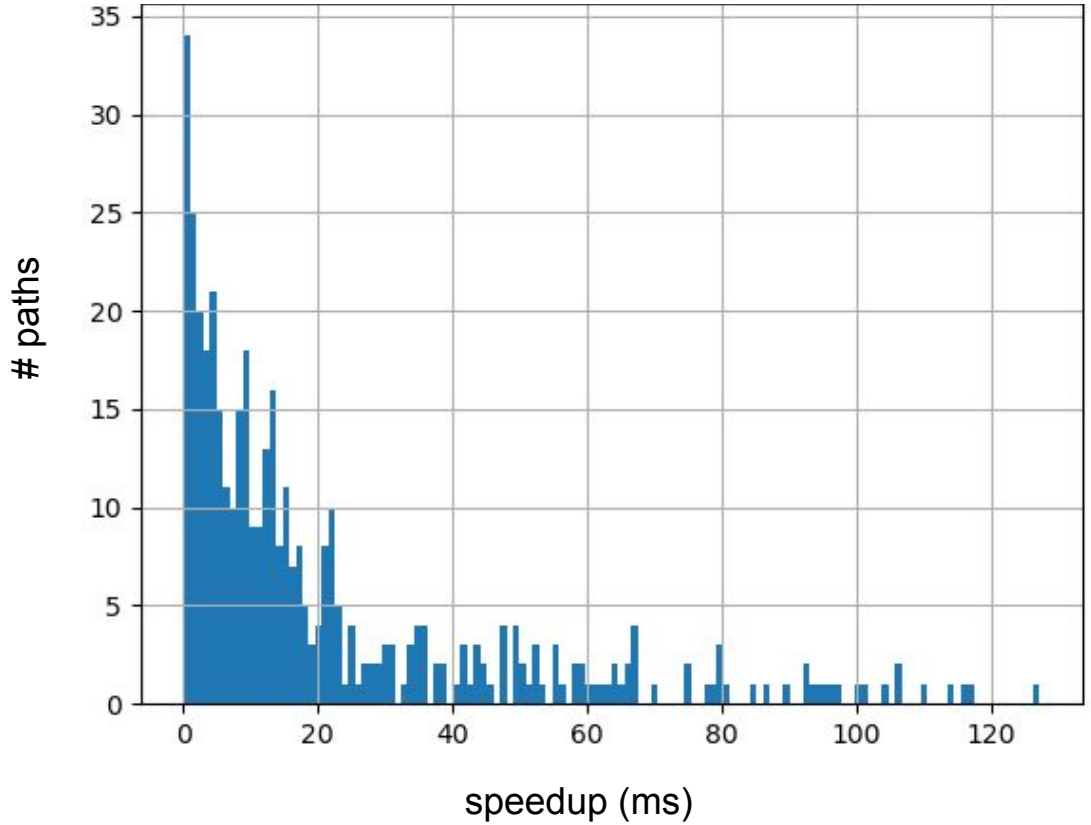


When does latency improve?

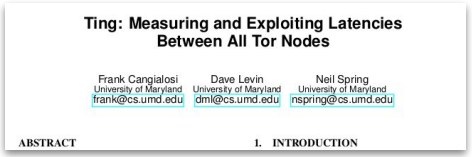
When **A → B** ≫ **A → X + X → B**:



Some paths see >100ms speedups



Using open data from:



Ting: Measuring and Exploiting Latencies Between All Tor Nodes

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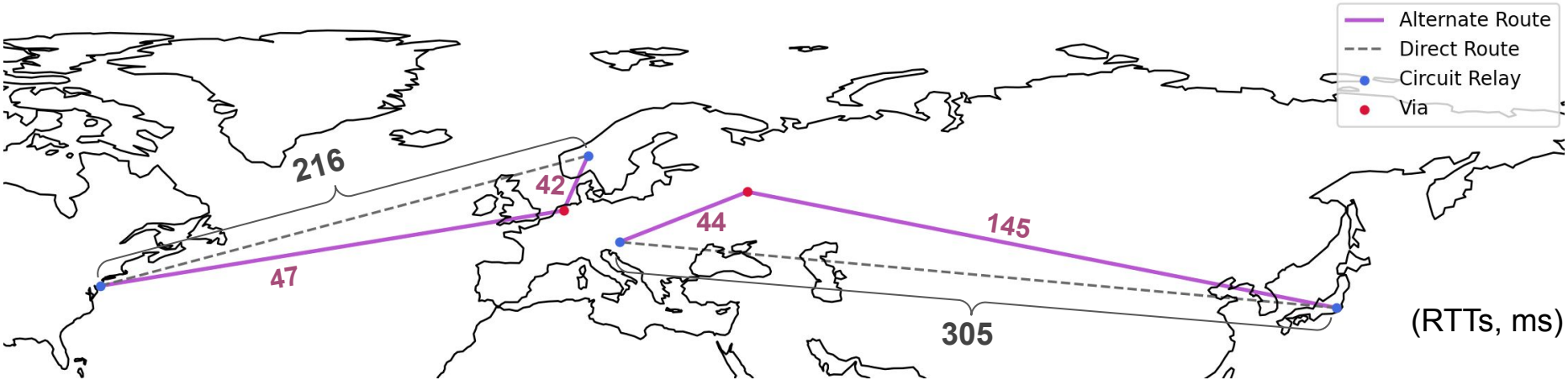
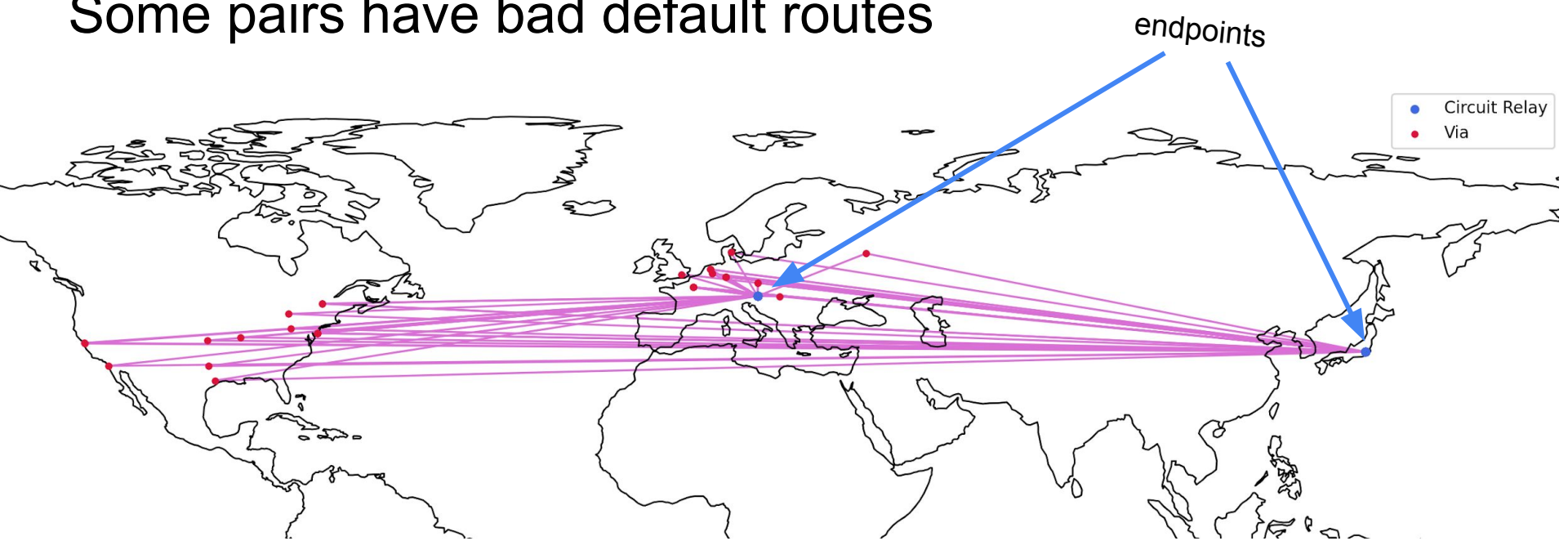
ABSTRACT 1. INTRODUCTION

Sample large speedups



Some pairs have bad default routes



34/50 relays would provide speedup!

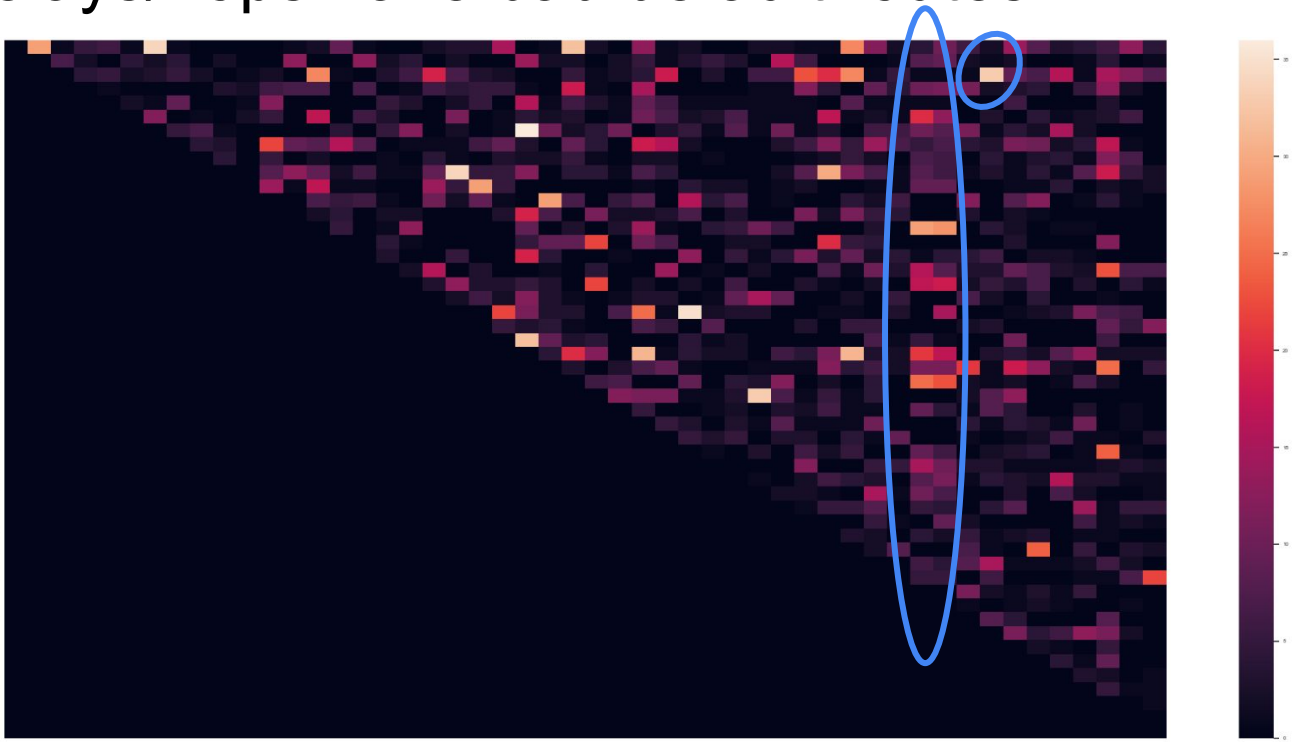
What's next?

- Scale up pair-latency measurements
  - Tor Research Safety Board approved
  - Deploying this month
- Is it secure?
  - Most Tor security metrics unaffected
  - Adapting AnoA, MATor [Backes et al. 13, 14, 16]
- Will it *actually* work?
  - Full design
  - Proof-of-concept
  - Simulations: impact on users? Tor bandwidth?
- And beyond
  - Build it out?
  - Tor measurements of independent interest
  - Hope to see overlay routing used elsewhere

Thank you!

Appendix

Some relays/hops have bad default routes



Some relays are more useful vias than others