Internet Path Transparency Measurements using RIPE Atlas

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mami

measurement and architecture for a middleboxed internet

| measurement | architecture | experimentation |

"Can we run the Internet over UDP?"

- UDP encapsulation attractive for new transport protocols
  - (mostly) NAT- and middlebox-compatible header
  - wide availability of APIs in userland
- Lots of current work:
  - WebRTC data channel: SCTP/DTLS/UDP
  - QUIC: new HTTP/2 new transport over UDP
  - SPUD: universal shim for explicit cooperation
- ***Is this safe?***
  - Widespread operational practice may hinder UDP

Background: Active Measurement of Path Transparency

- Basic methodology:

  1. throw a bunch of packets at the Internet

  2. see what happens.

- Ideal: two-ended A/B testing

- Scalable: one-ended A/B testing

- Multiple sources: isolate on-path from near-target impairment
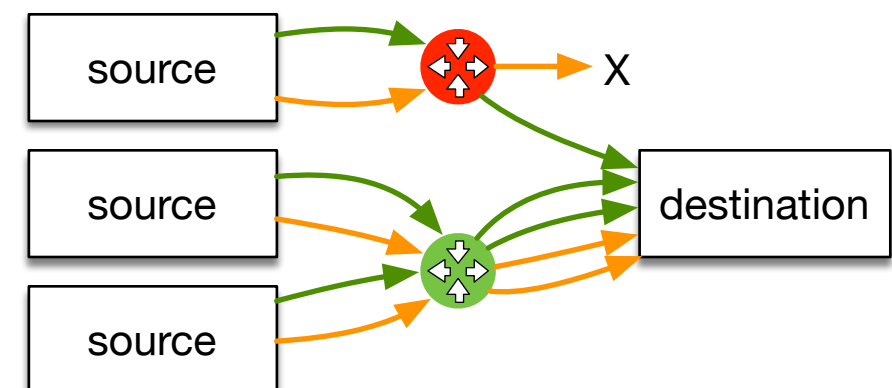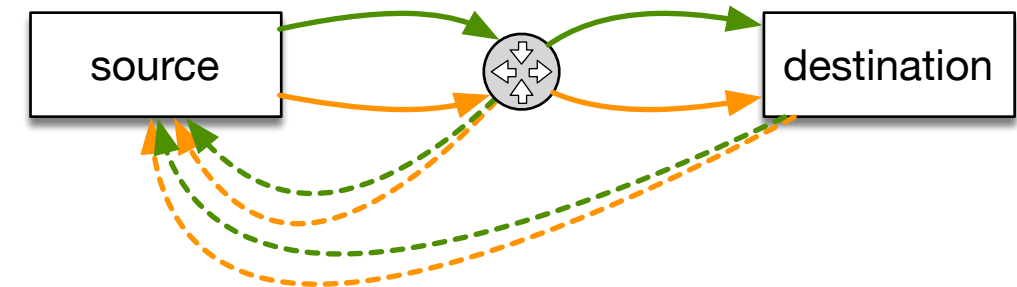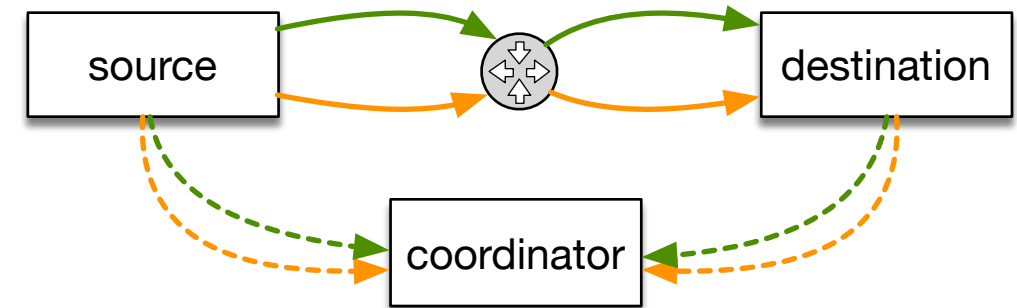
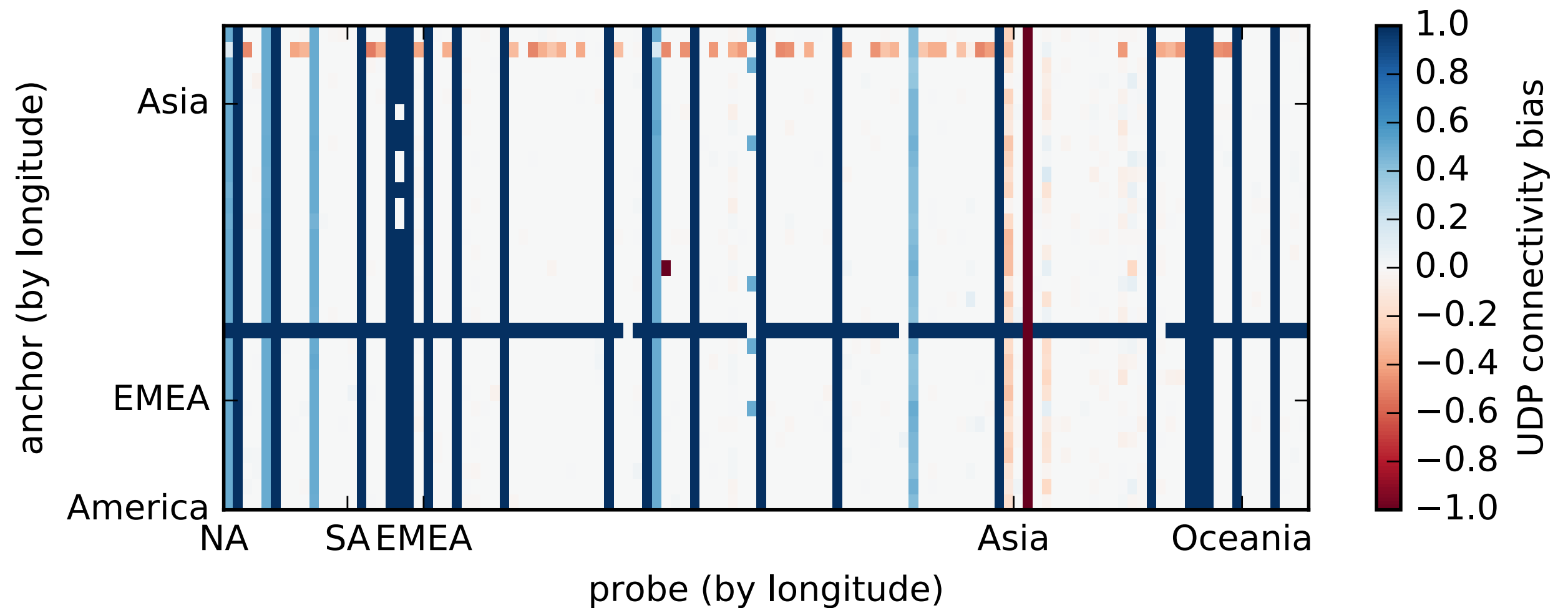# RIPE Atlas to the rescue

- No arbitrary TCP/UDP on Atlas…

- …but: traceroute!
  - basic connectivity and first-packet latency with high TTL

- Many probes to many anchors
  - How many probes on UDP blocked networks?
  - Is blocking path- or access-network dependent?

Atlas Probe	Target Anchor

∂_{UDP} — UDP → / ICMP unreach ←
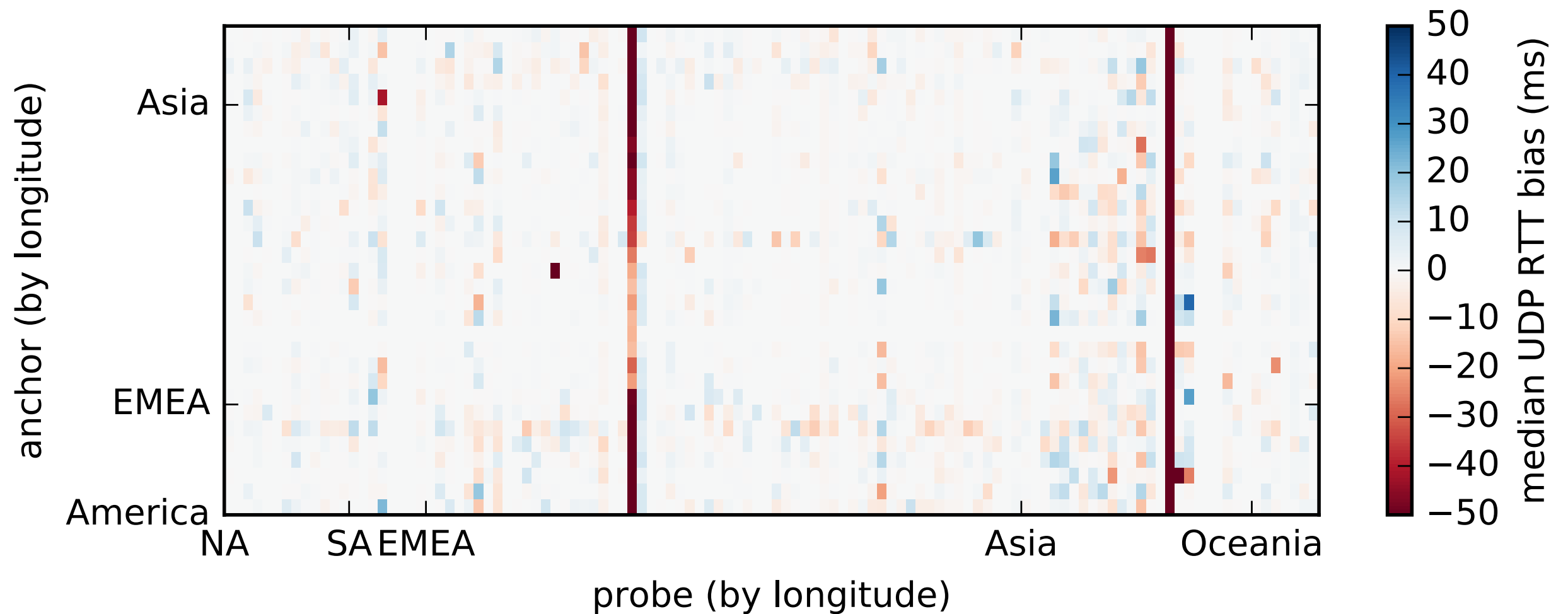
∂_{TCP} — TCP SYN → / TCP RST ←
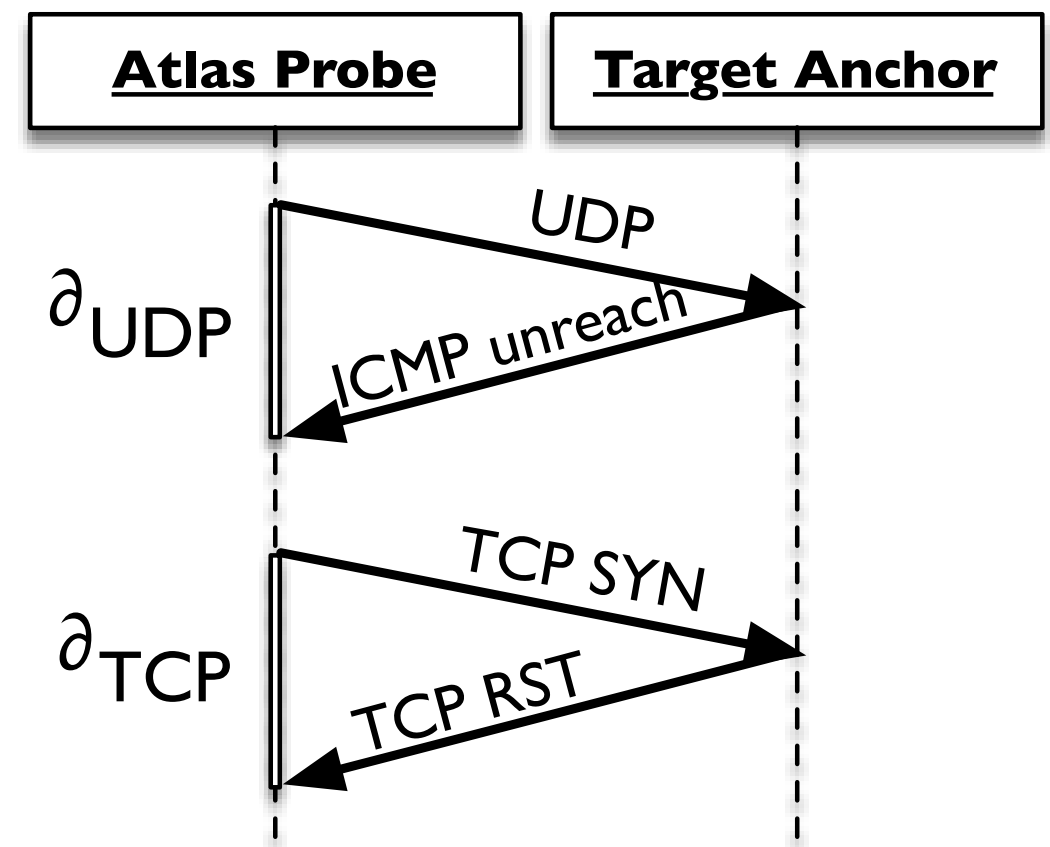
TCP appears more impaired than UDP

Connectivity, UDP/33435 vs TCP/33435, <= 19 trials, 128 probes to 32 anchors
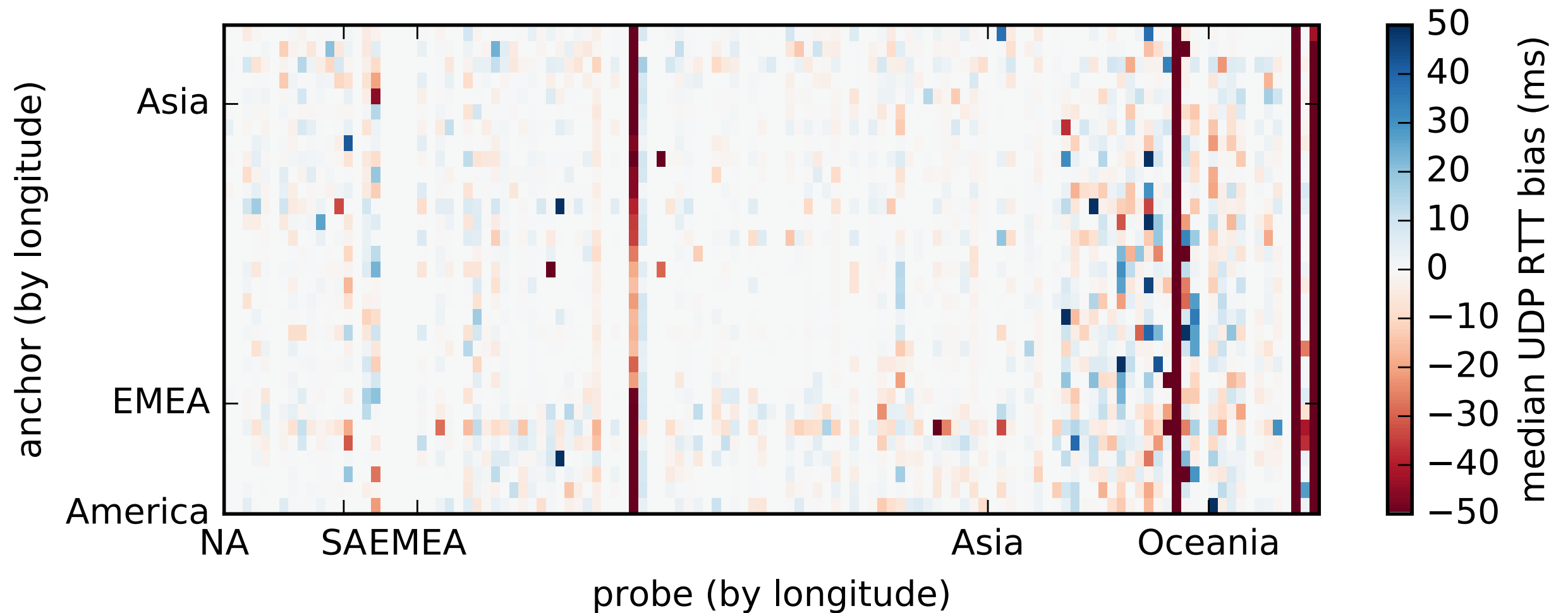September 2015

RTT bias mostly probe-dependent

Median RTT bias, UDP/33435 vs TCP/33435, <= 19 trials, 128 probes to 32 anchors
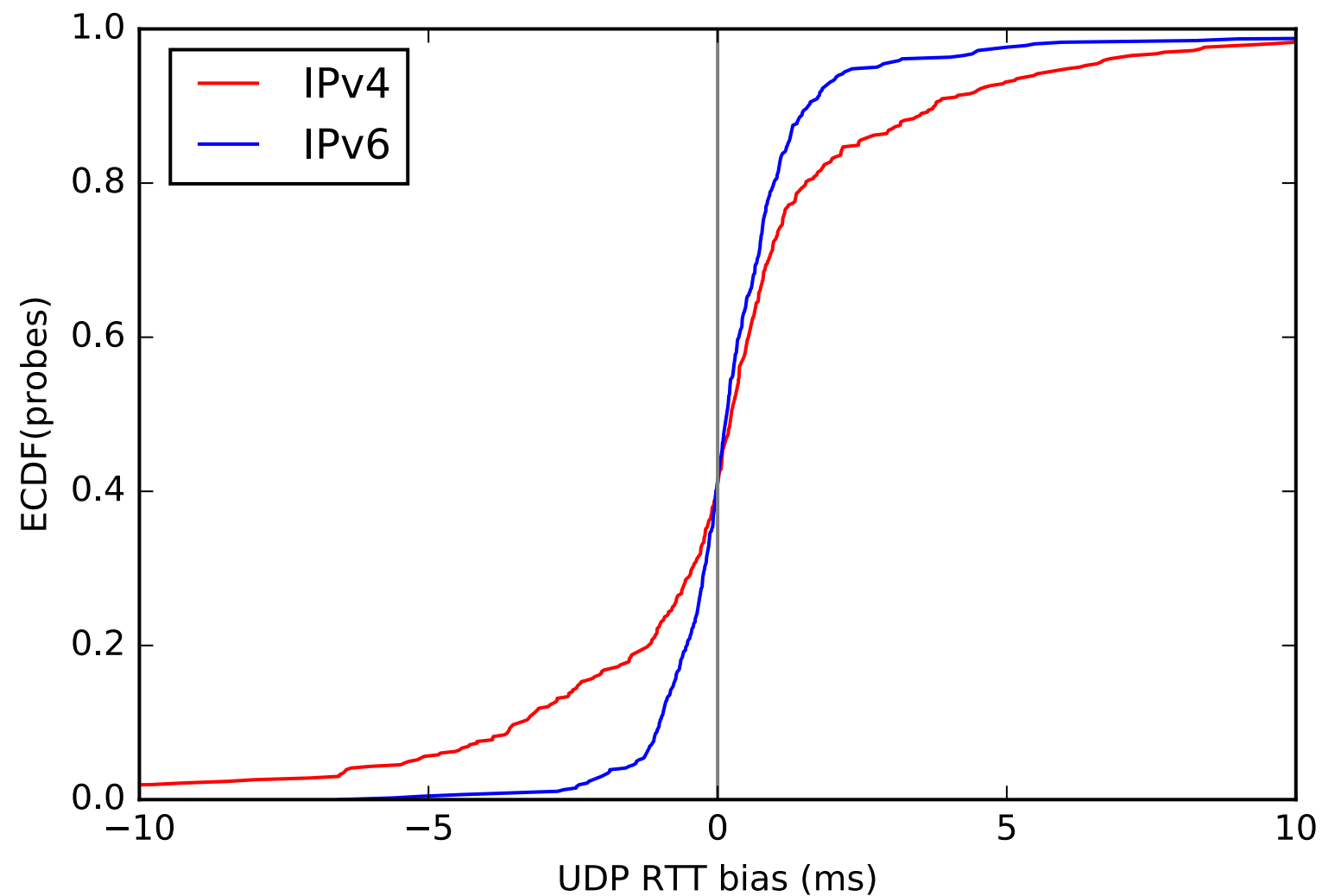September 2015

More interference with TCP/80

Median RTT bias, UDP/33435 vs TCP/80, <= 19 trials, 128 probes to 32 anchors
September 2015

RTT bias spread tighter on IPv6 than IPv4

Median RTT bias, UDP/33435 vs TCP/33435, 464 probes to APNIC anchor
Feburary 2016

…not so fast: UDP blocked on one in thirty Atlas probe networks

- Methodology: find all probes
  - that tried to do at least 9 UDP traceroutes in 2015
  - to targets that were up at the time
  - and that showed connectivity via TCP or ICMP
- **2240** probes meet this criterion
  - How many of these never succeeded via UDP?
- **82** probes, largely on networks with marginal connectivity

- Running the Internet over UDP needs a backup for this 3.6%
  - (In line with a 6-7% "QUIC doesn't work" reported in HOPSRG)

A Path Transparency Observatory

- Atlas traceroute gives us a small part of the picture

  - copycat: differential bandwidth/loss test for UDP encapsulation

  - PathSpider: generalized protocol-dependent connectivity testing

- We need to integrate measurements from these different tools

- Observatory (public release end 2016) to derive common *observations* about *conditions* on a given *path* at a given *time*

- *Watch this space*: https://mami-project.eu
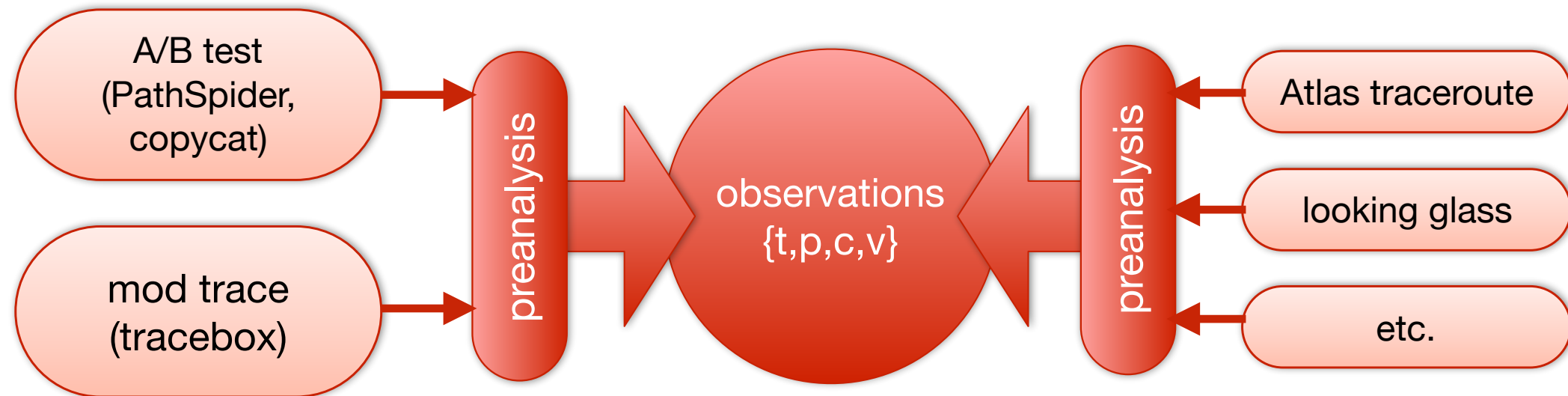
Conclusions

- Atlas useful for estimating UDP/TCP connectivity

    - it's a hack, but it's a nice one

- UDP not as broken as we'd thought

    - still not universal enough to run the Internet over it

- Like all measurement people, ***we need more data***

    - And are building an observatory to aggregate and analyze path transparency info at Internet scale

- Questions? <{trammell, mirja.kuehlewind}@tik.ee.ehz.ch>