

Internet Path Transparency Measurements using RIPE Atlas

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measurement and architecture for a middleboxed internet

measurement

architecture

experimentation



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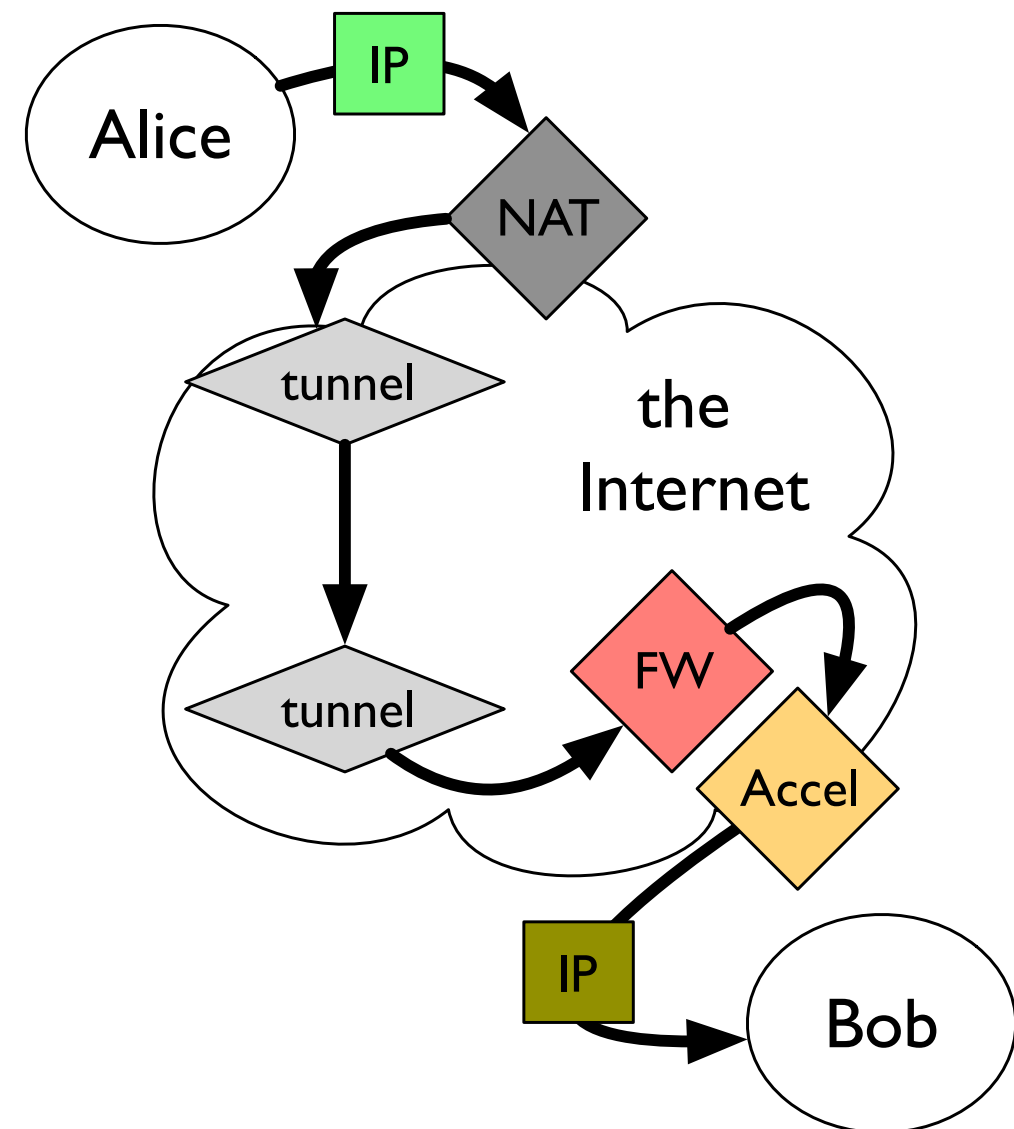
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path transparency (in one slide)

(From MAT at RIPE 71)

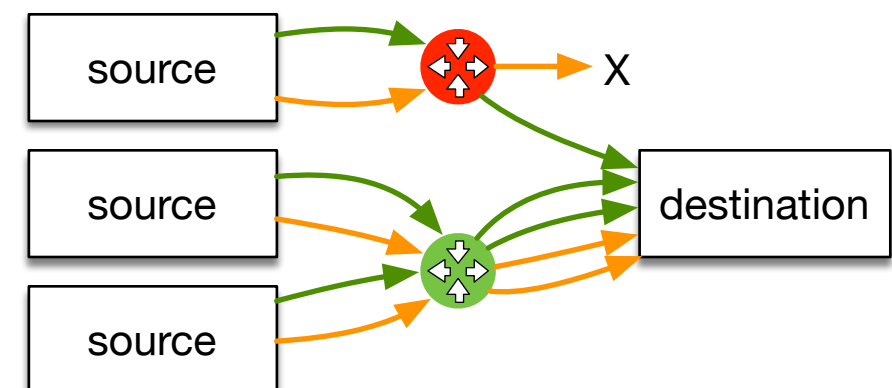
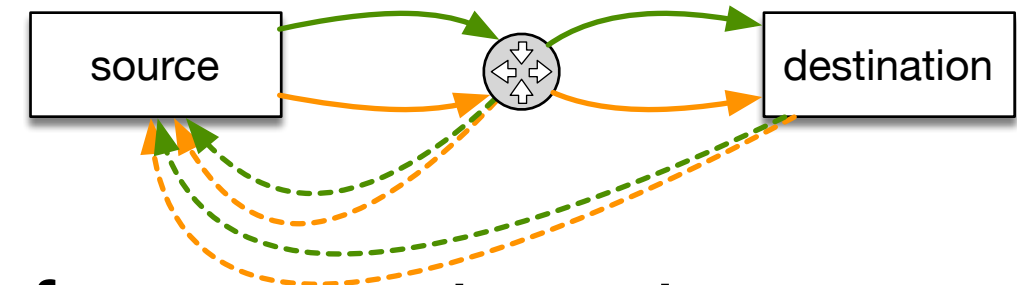
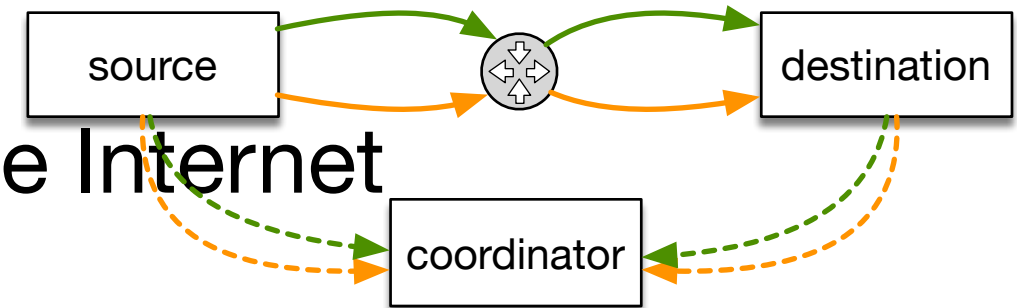
- The Internet is not end-to-end...
 - some of this is policy, but a lot of it is accident
 - deployment of new protocols over IP, transport extensions difficult or impossible
- ...but some paths are worse than others.
 - Goal: data on "how bad" and "where" to guide future protocol design
 - In operations: another tool for troubleshooting connectivity dependency for unusual traffic





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





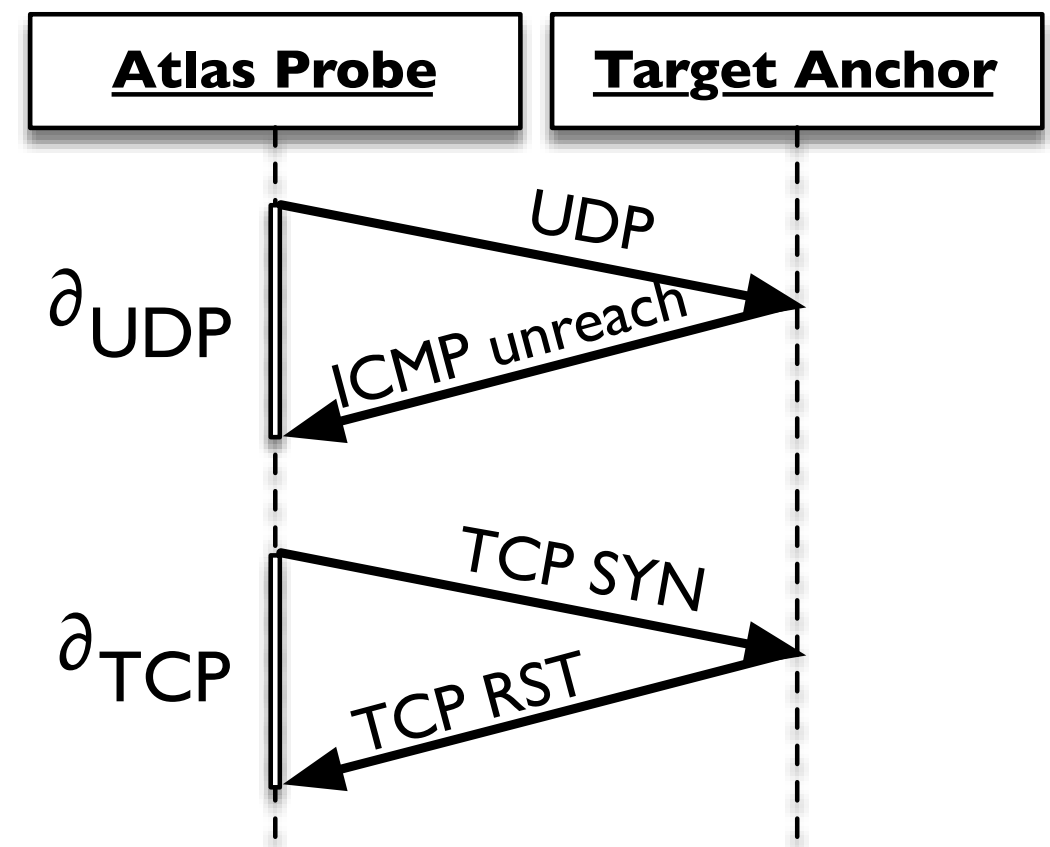
“Can we run the Internet over UDP?”

- 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



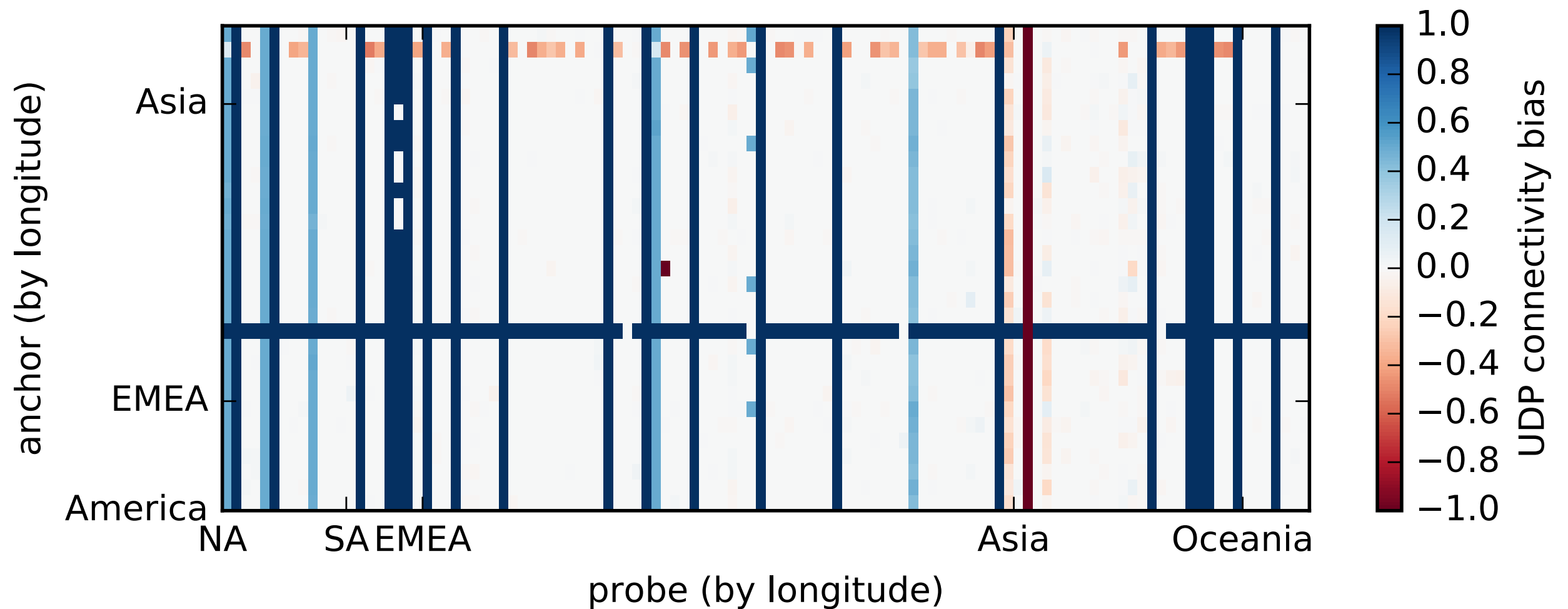
RIPE Atlas to the rescue

- 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?





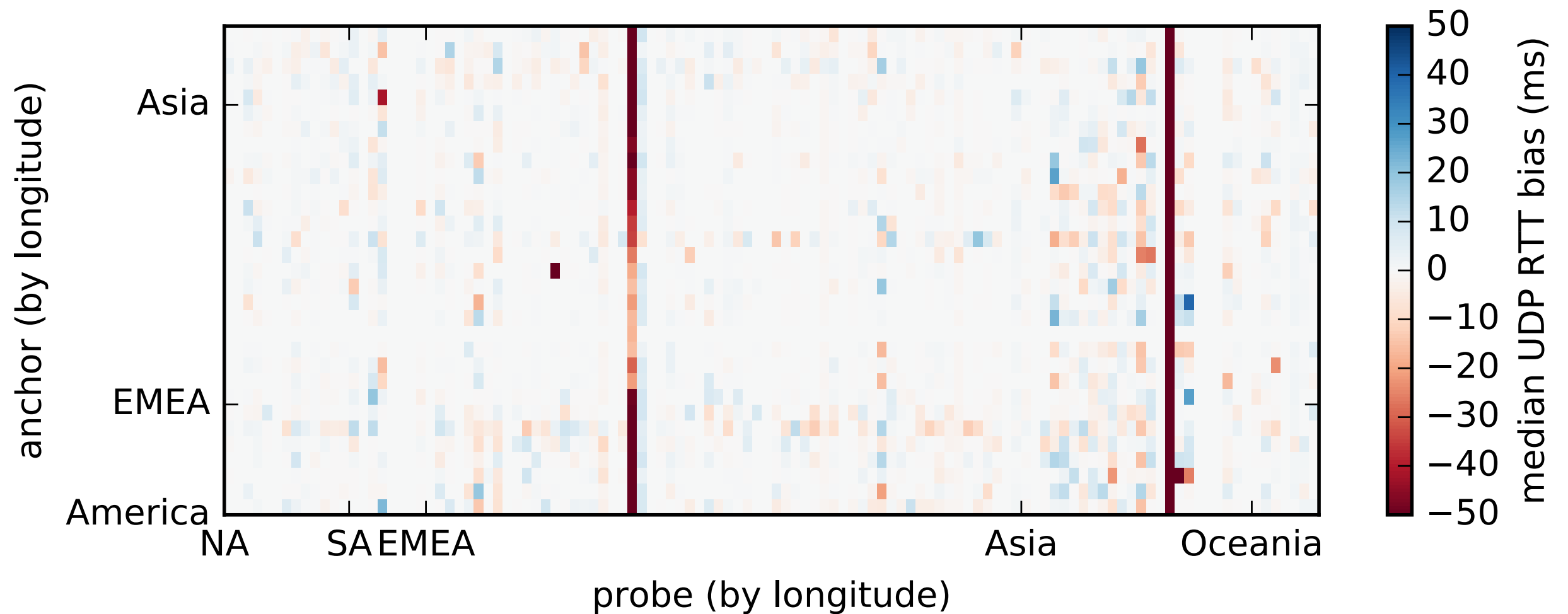
TCP appears more impaired than UDP



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



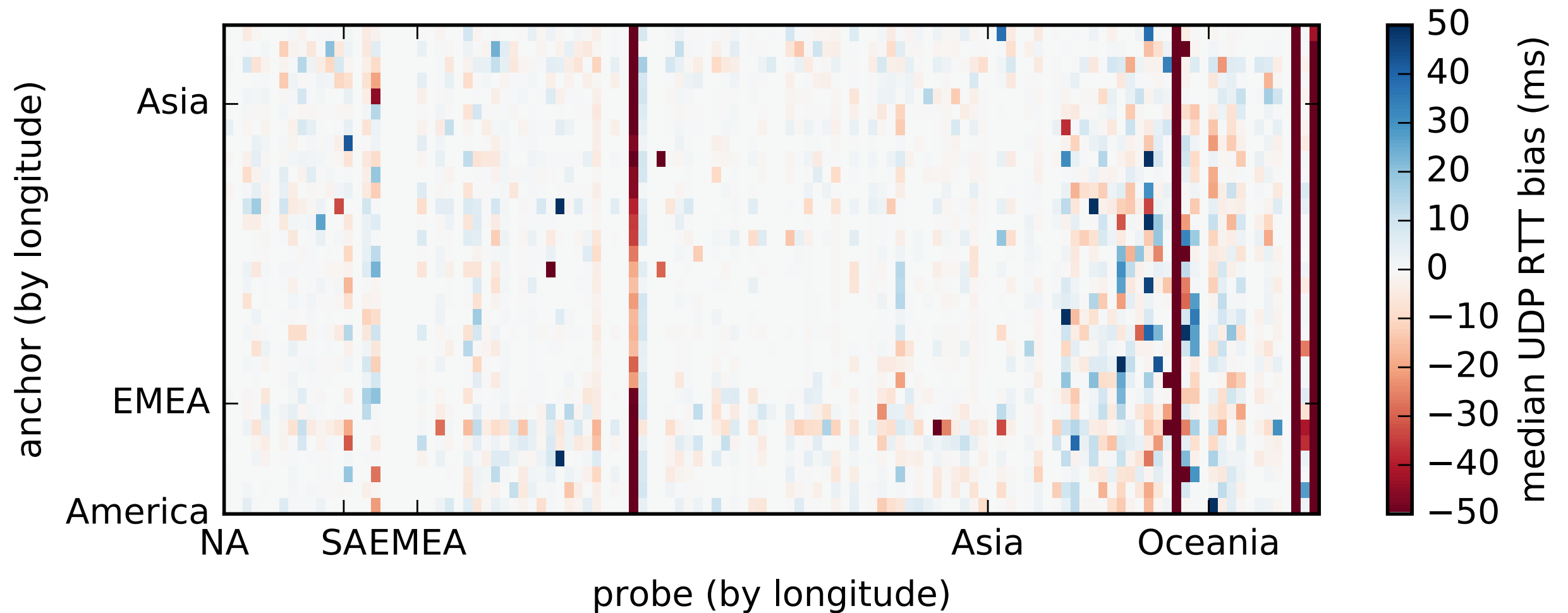
RTT bias mostly probe-dependent



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

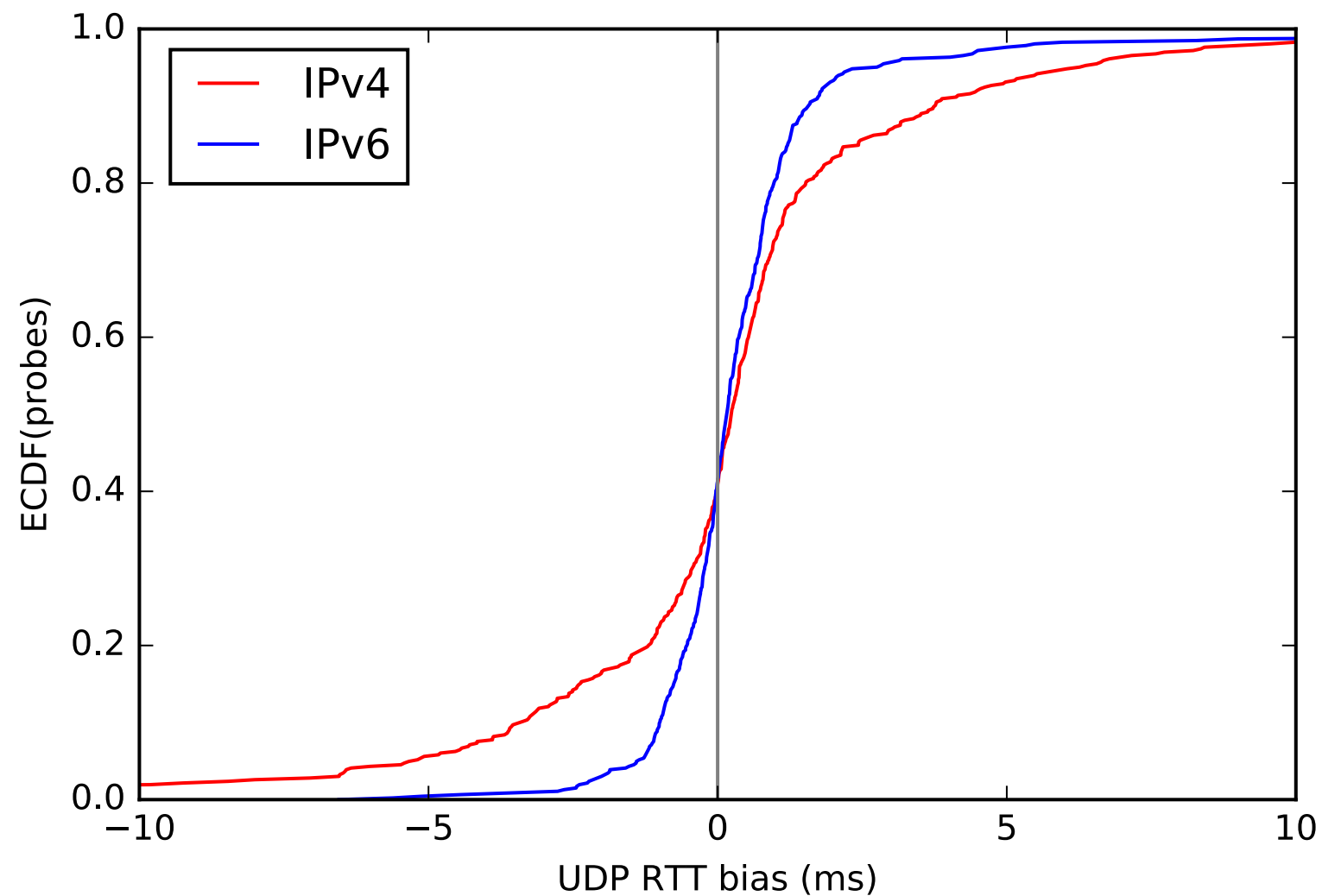


More interference with TCP/80



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

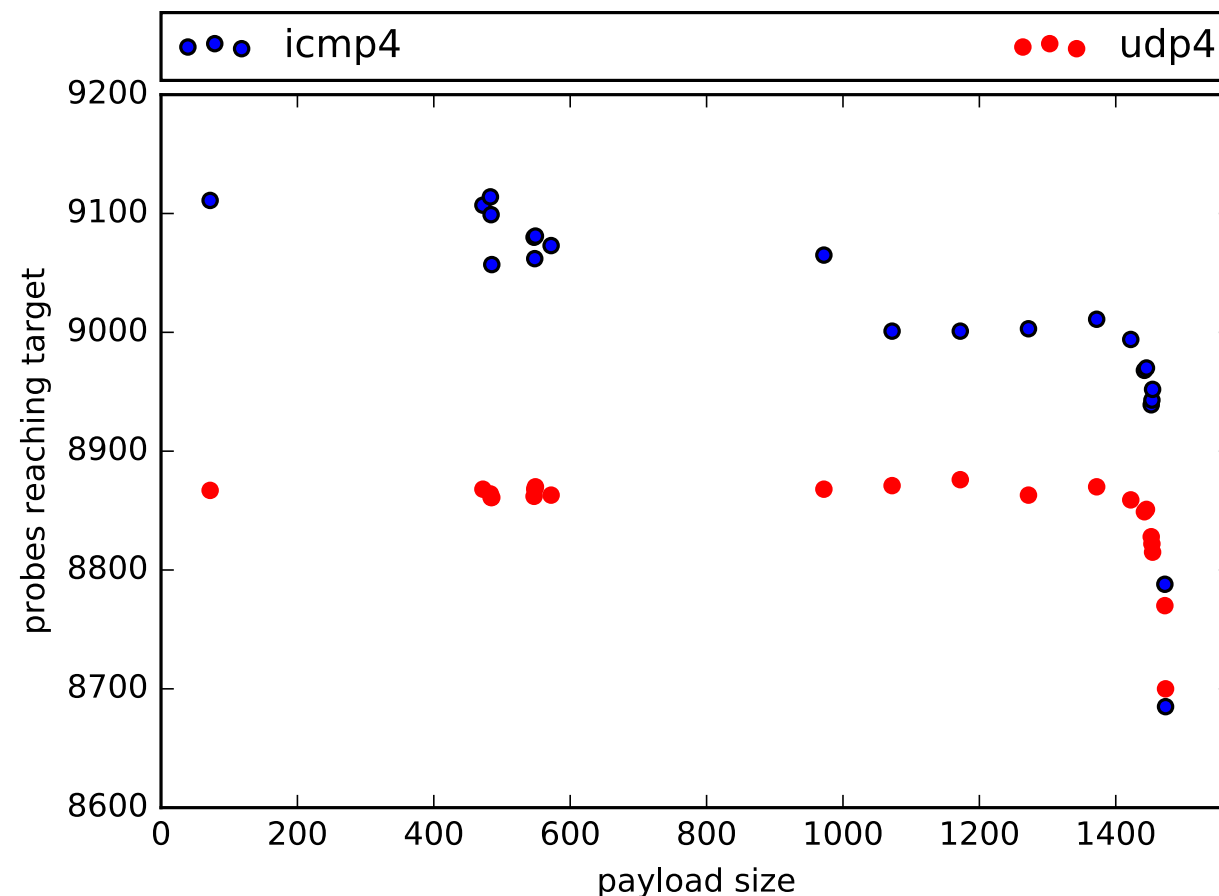


...not so fast: UDP blocked on one in thirty Atlas probe networks

- 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)



Are larger UDP packets blocked?

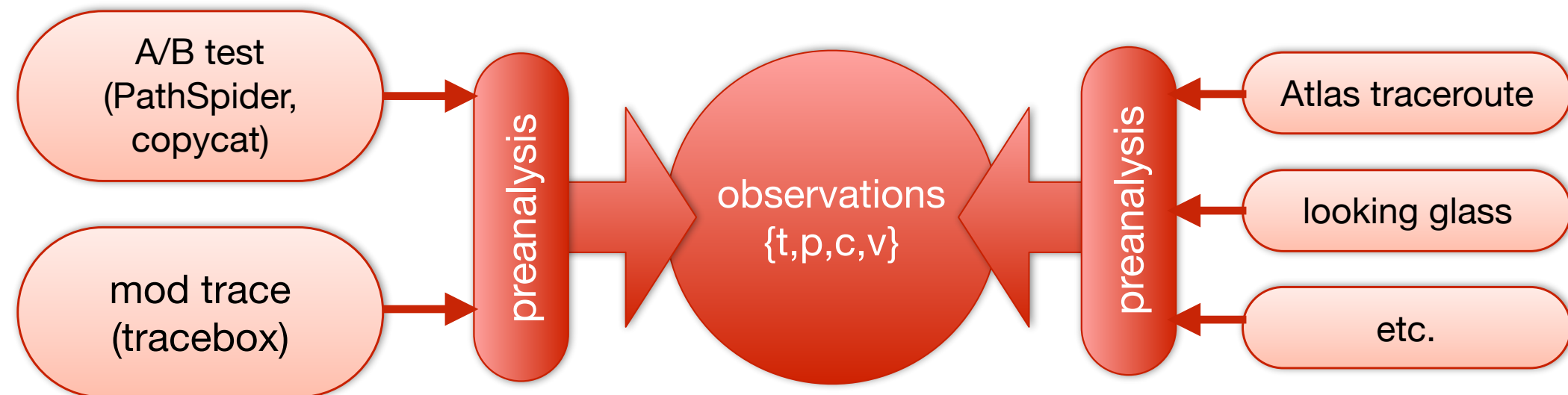


- Apparently not
 - one-off measurement, Mar '16, 9396 probes to one anchor
- No additional blocking after 512, 1024 for IPv4
- (In this short campaign, **296 of 9262** probes (3.2%) may block UDP)



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>