Verfploeter: Broad and Load-Aware Anycast Mapping

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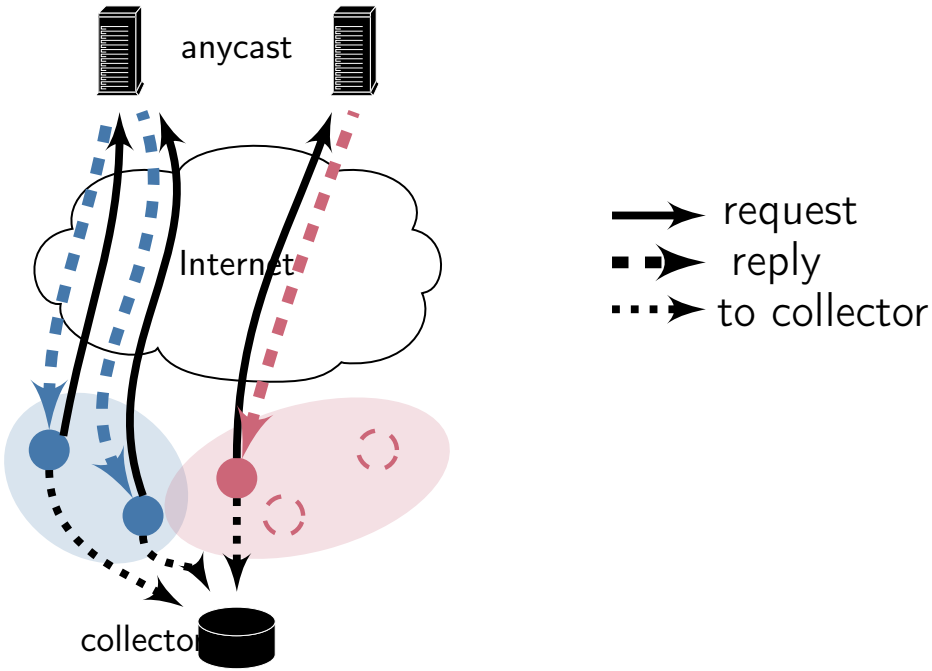
Our Starting Goals:

- Develop a technique to:
  - Accurately map anycast catchments
  - Accurately study B's anycast IPv4 catchments
  - Predict load in advance of changes
  - Study anycast stability over time

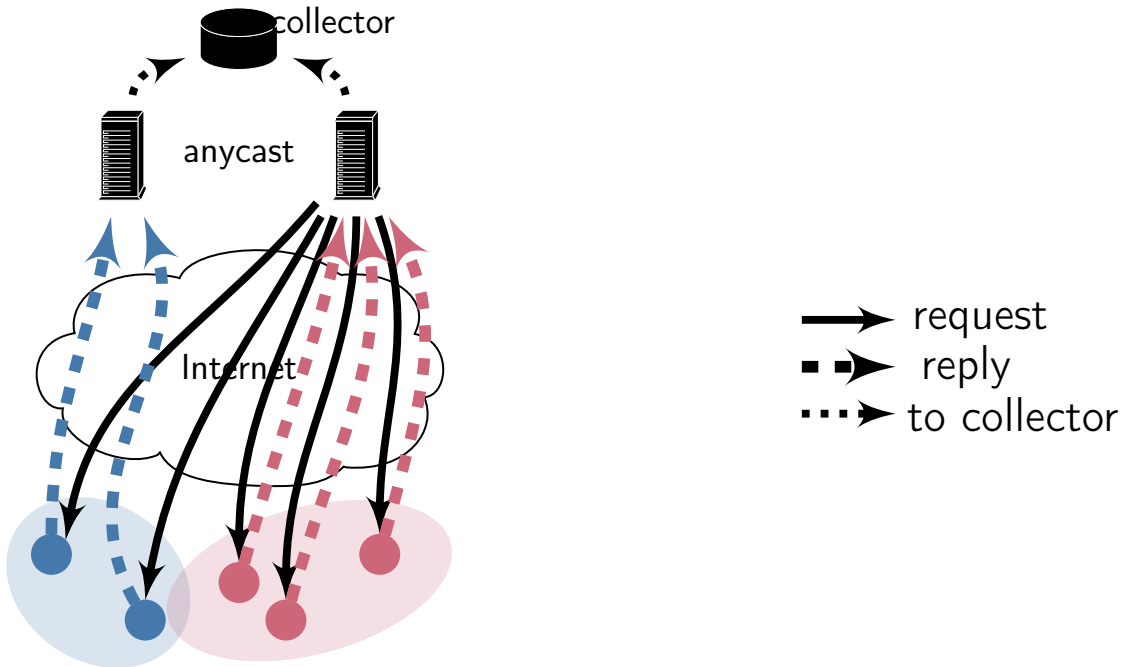
Traditional *"Active"* Anycast Probing

- Traditional techniques require lots of Vantage Points
- e.g. RIPE Atlas



"Verfploeter" uses *"Passive"* Vantage Points

- Verfploeter uses the Internet as its vantage points
- We collect response traffic to ICMP "pings"



Input: An IPv4 Hitlist

- Previous work supplied us with ICMP-responsive IP-addresses in each IPv4 /24 block:

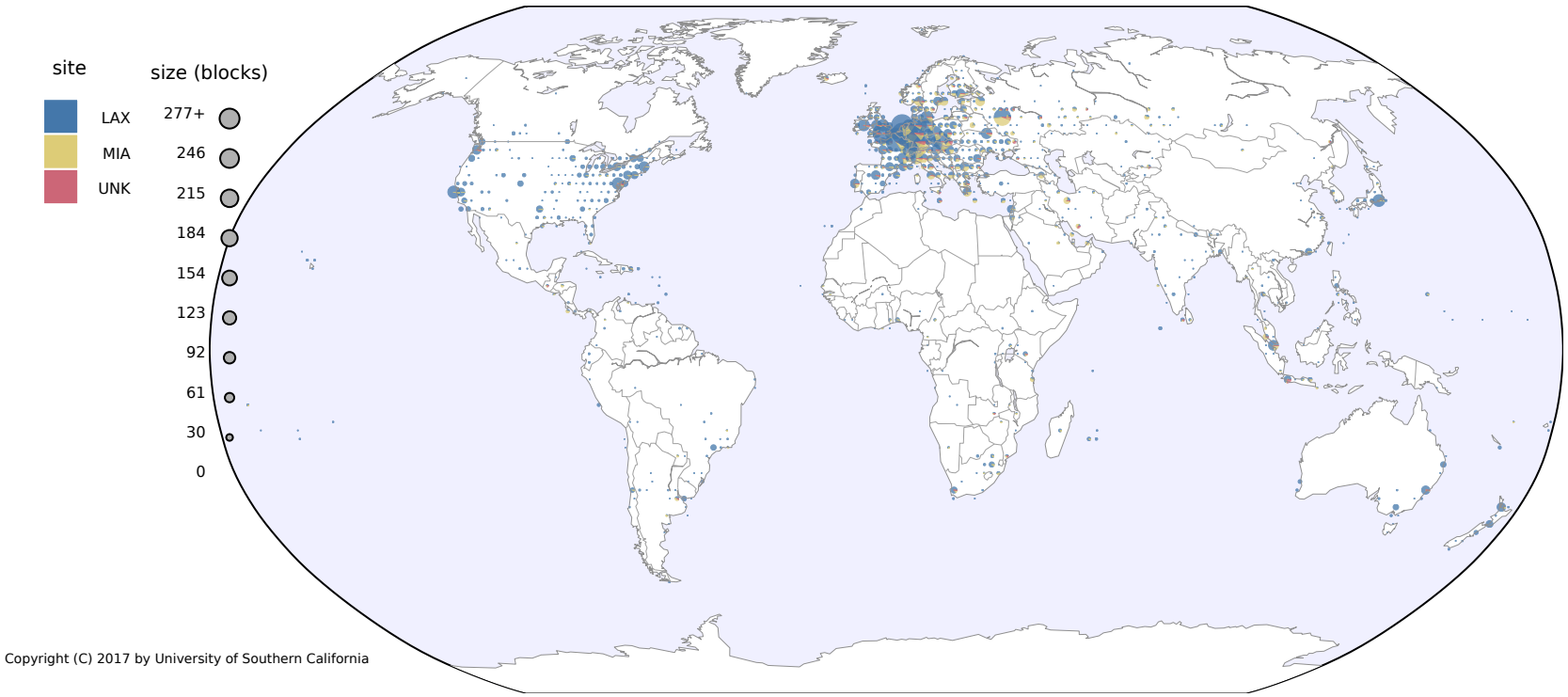
  /Xun Fan and John Heidemann, "Selecting Representative IP Addresses for Internet Topology Studies"/

- `https://ant.isi.edu/datasets/ip_hitlists/`

- Example addresses:

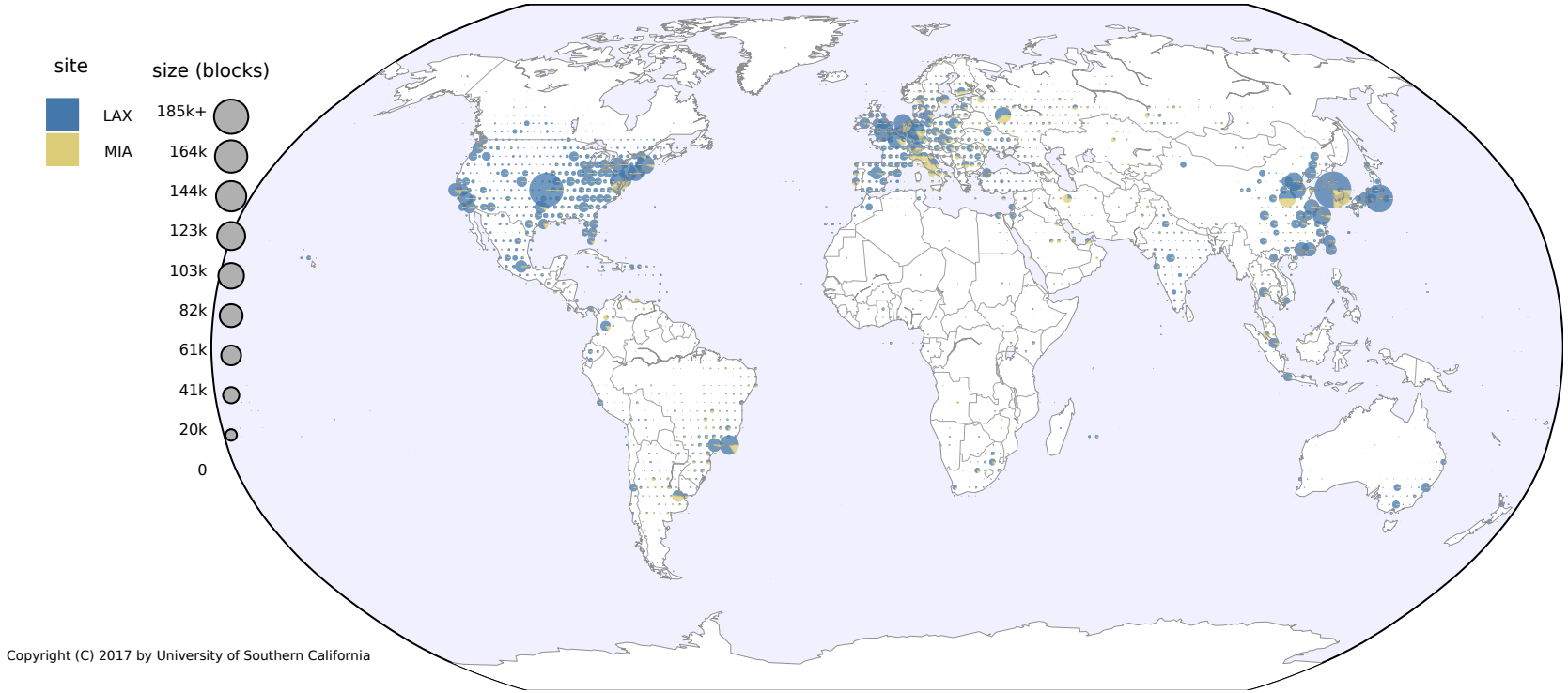
  ```
  1.0.100.37
  1.0.101.100
  1.0.102.123
  1.0.103.1
  1.0.104.1
  1.0.105.106
  1.0.106.123
  ```

RIPE Atlas Coverage of B-Root



(measured 2017/05/15)

Verfploeter Coverage of B-Root



Note: huge scale difference

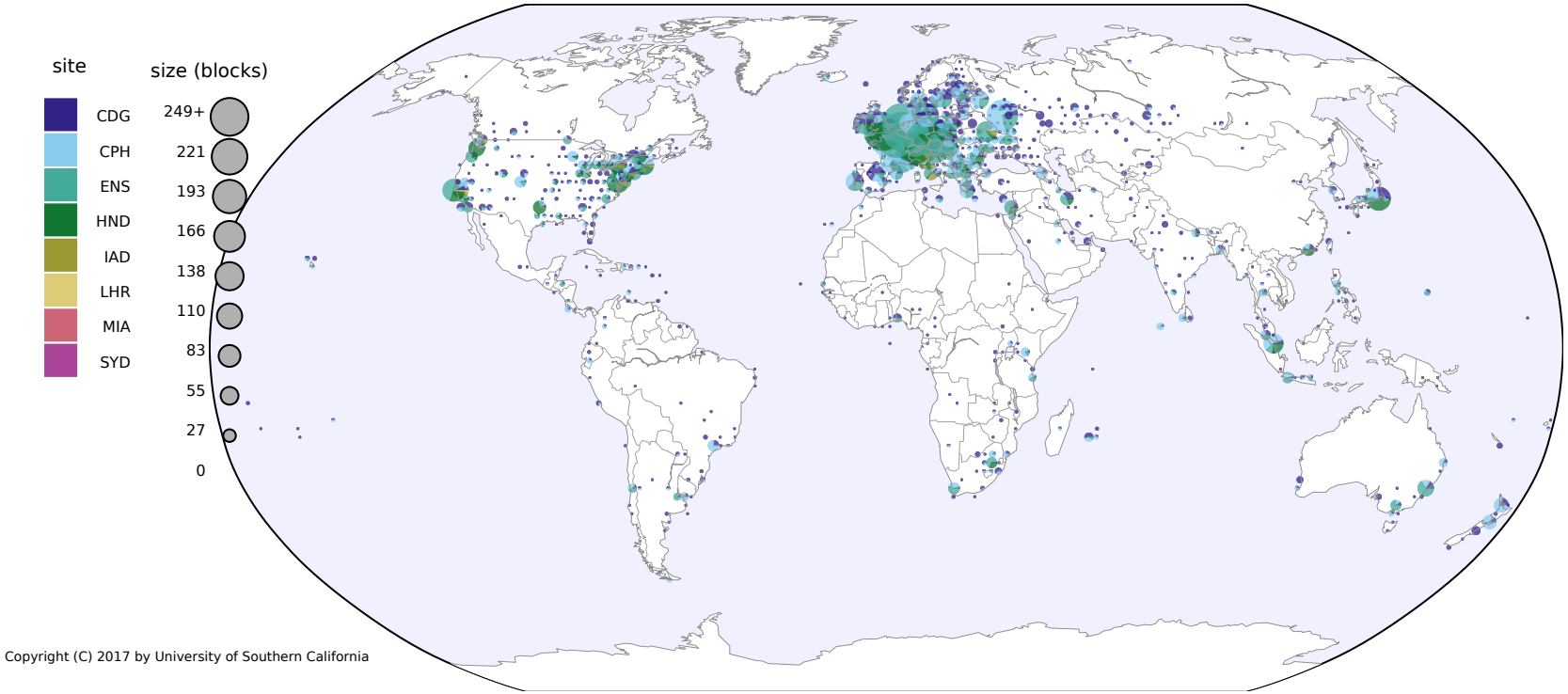
Tangled: Studying A Larger Anycast Testbed

- Tangled: A 9-site anycast testbed University of Twente
- Tangled provides a more complex anycast test framework

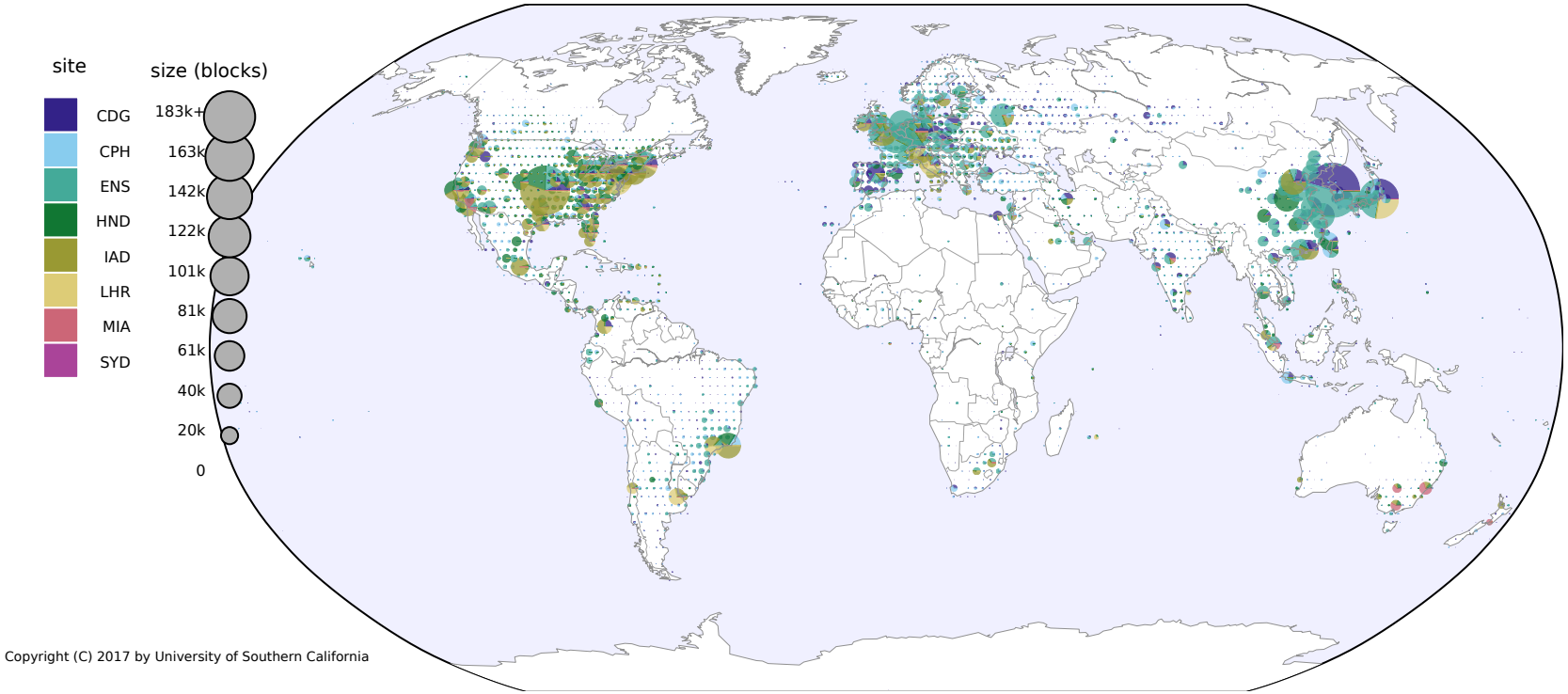
Location		Host	Upstream
AU	Sydney	Vultr	AS20473
FR	Paris	Vultr	AS20473
JP	Tokyo	WIDE	AS2500
NL	Enschede	Univ. of Twente	AS1103
UK	London	Vultr	AS20473
US	Miami	Florida Int. Univ.	AS20080
US	Washington	USC/ISI	AS1972
BR	Sao Paulo	Florida Int. Univ.	AS1251
DK	Copenhagen	DK-Hostmaster	AS39389

- Note: some locations have common upstreams

RIPE Atlas Coverage of Tangled



Verfploeter Coverage of Tangled



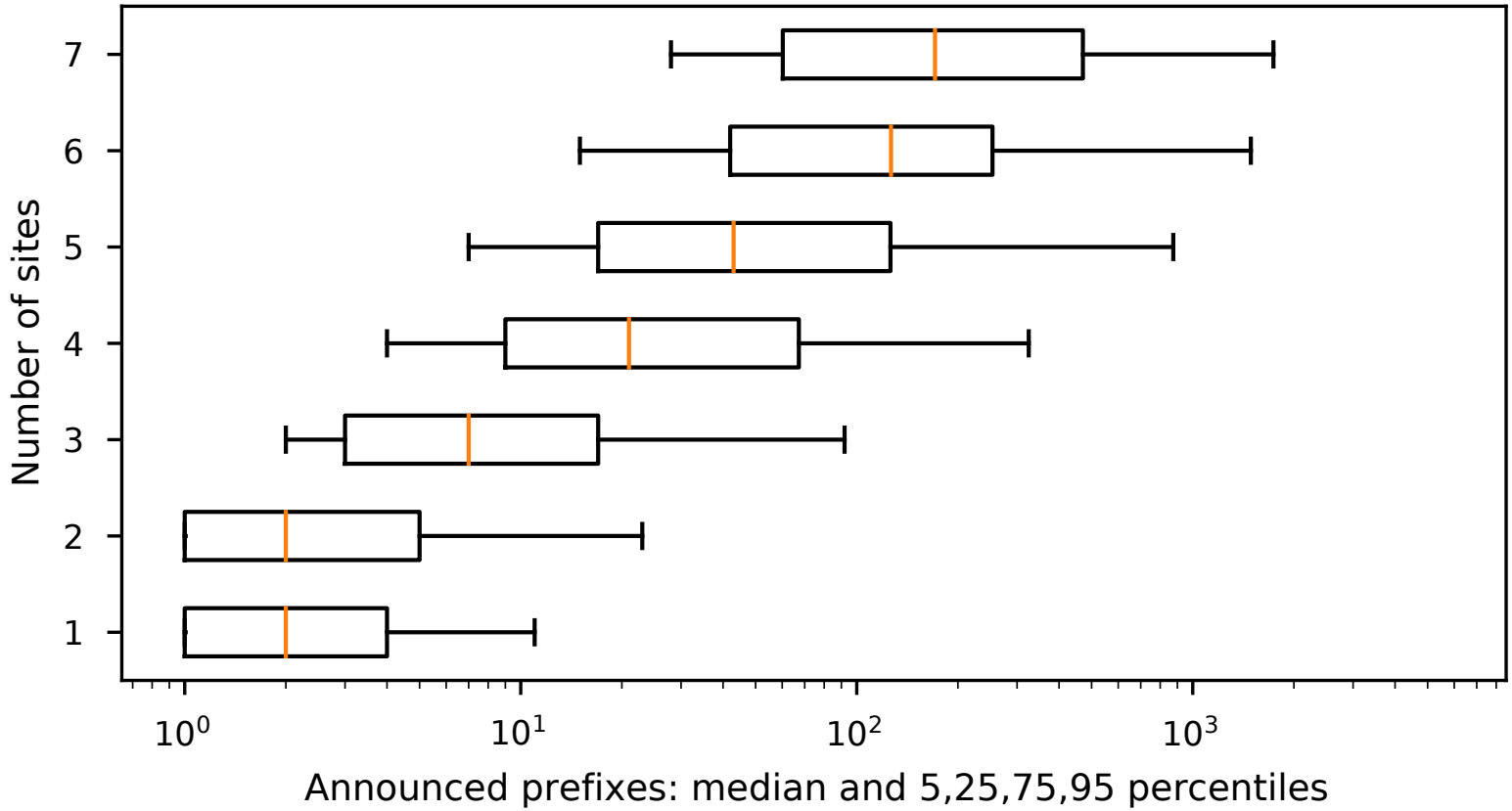
Do We Need To Look Inside ASes?

Given our significant number of new vantage points:

- Can we study traffic catchments within an AS?
- Do the number of sites seen change:
  - with prefix size?
  - with AS size?

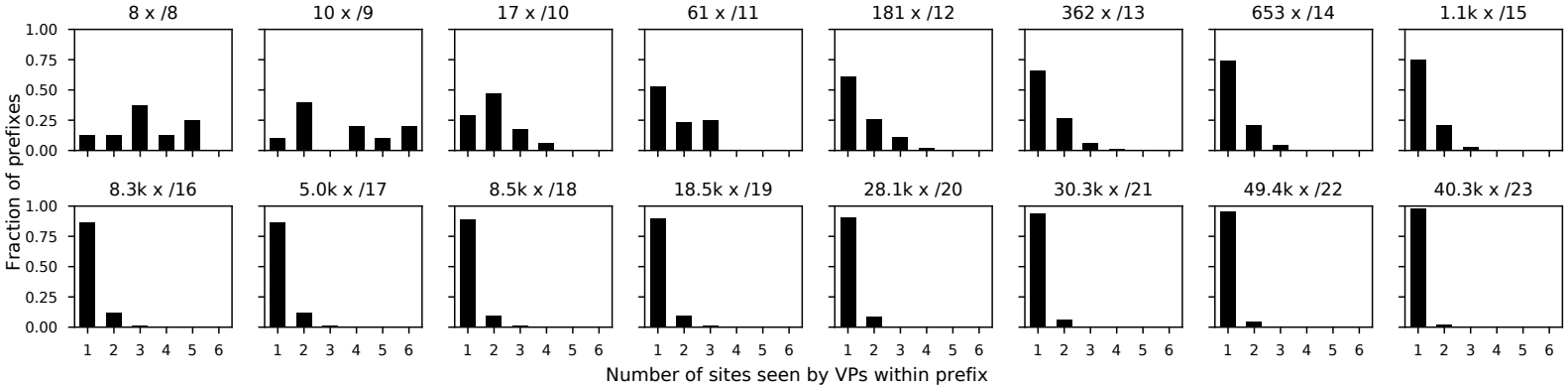
- Can we measure routing stability using Verfploeter?

Sites Seen vs Number of Prefixes Announced



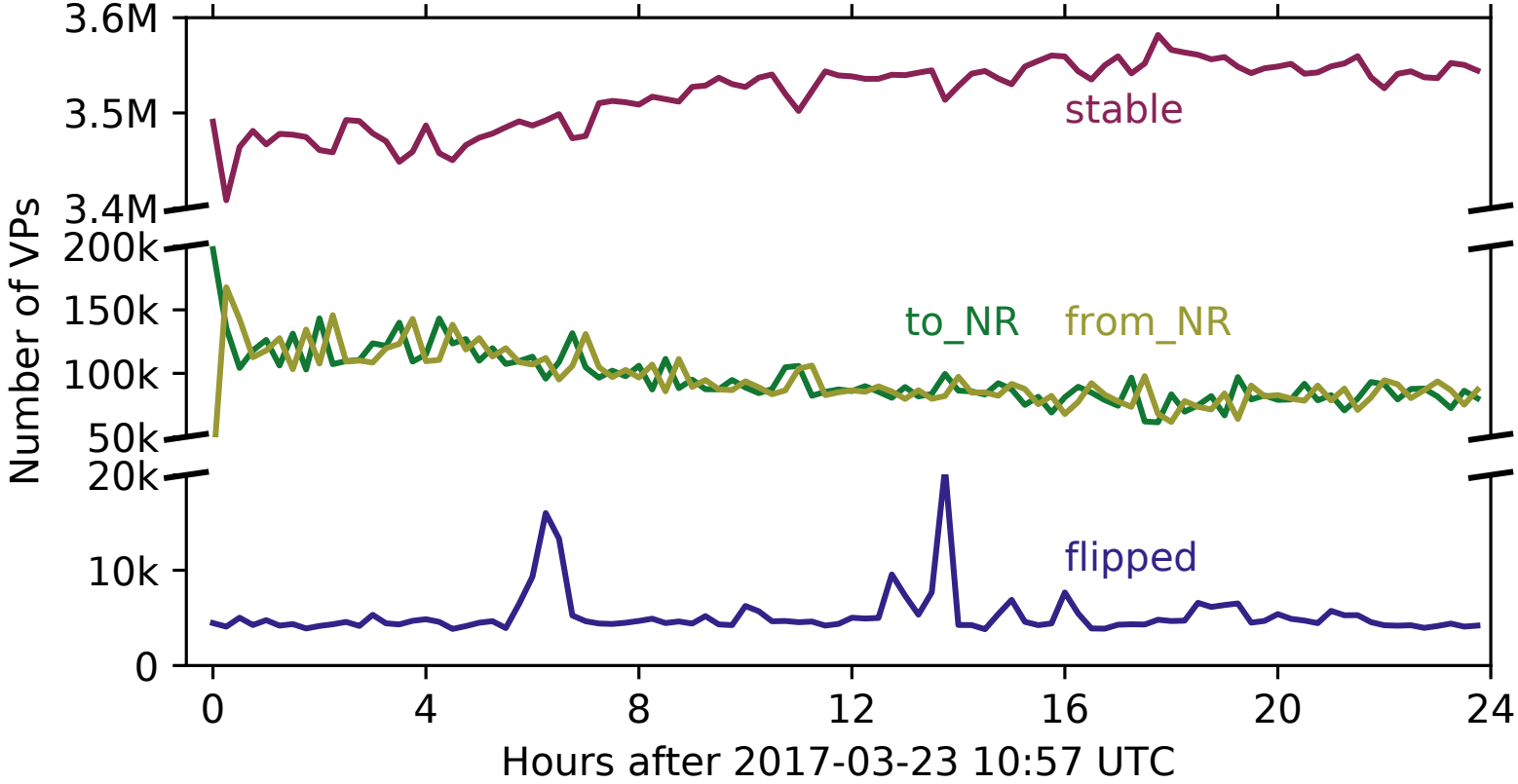
- ASes announcing more prefixes are likely to see more anycast sites

Sites Seen vs Prefix Size



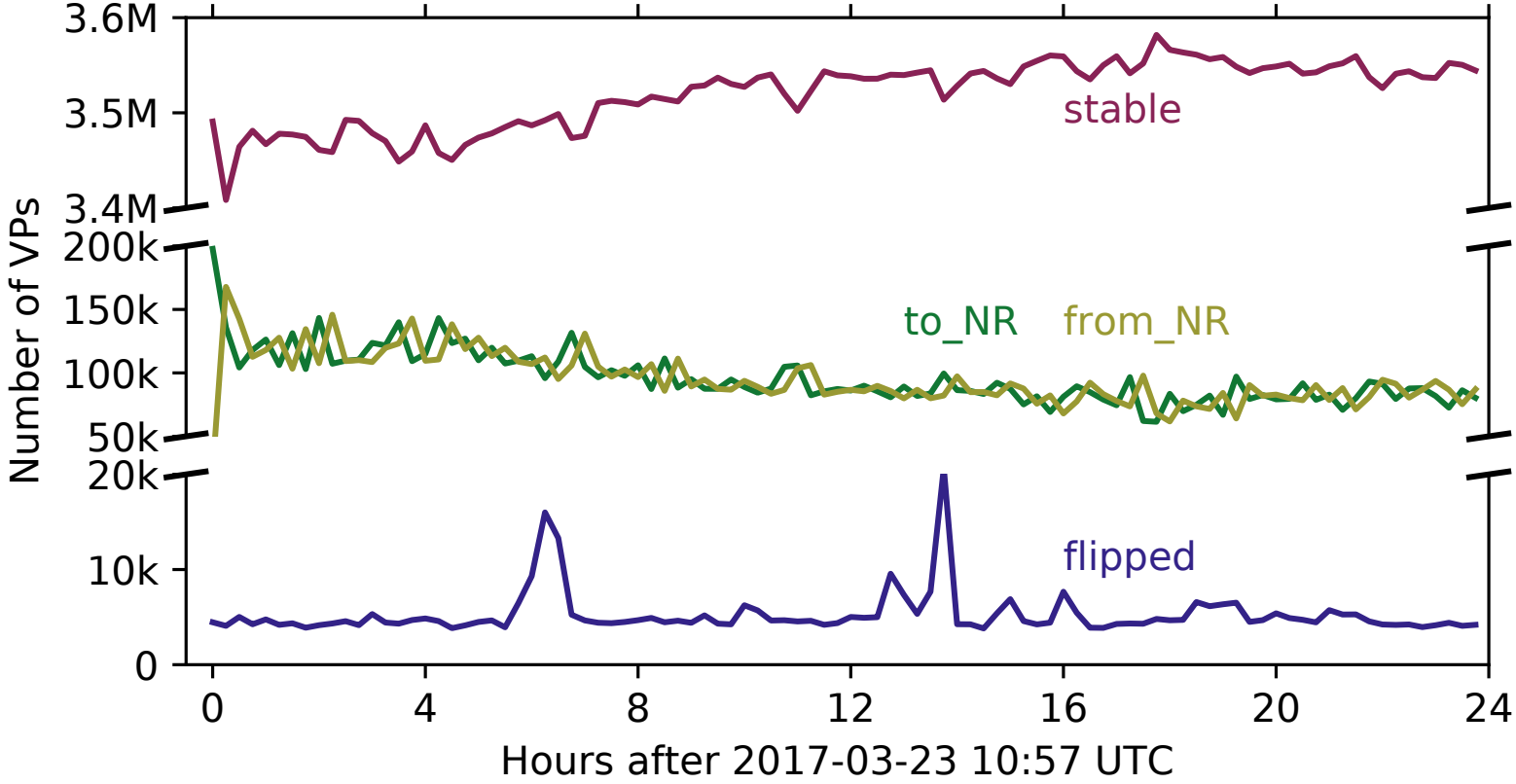
- 80% of prefixes smaller than /16 reach a single site
- Larger prefixes are more likely to see more sites

Anycast Stability Over 24 Hours



- Measurements taken every 15 minutes using Tangled
- *to_NR*: addresses switching to "not reachable"
- *from_NR*: addresses switching from "not reachable"

Anycast Stability Over 24 Hours



- 3.54M (95%) of VPs maintained catchment
- 89k (2.4%) changed from response to non-responsive
- near the same for flipping back
- 4.6k (0.1%) VPs changed catchment within 2809 ASes
- General Conclusion: anycast is quite stable

Network Flips

Networks flipping the most:

	AS	Owner	IPs (/24s)	Flips	Percent
1	4134	CHINANET	47,963	257,915	51%
2	7922	COMCAST	3,933	19,133	04%
3	6983	ITCDELTA	1,372	15,403	03%
4	6739	ONO-AS	849	13,347	03%
5	37963	ALIBABA	2,493	10,988	02%
		Other	43,388	188,630	37%
		Total	108,493	505,416	

Notes:

- 63% of the flipping are in these 5 ASes
- CHINANET accounts for 51% of the flips alone
- All the flips recorded are located in 2809 ASes

Verfploeter Sizing Summary

- Verfploeter sees ~430x more network blocks than Atlas
  - Atlas has some unique blocks though
- Difference in /24s seen by Verfploeter and Atlas:

	Atlas	Verfploeter
/24 blocks seen	8677	3,786,907
geolocatable	8677	3,786,229
unique	2079	3,606,300

Verfploeter: Ready For Use

Verfploeter provides a novel mechanism for studying anycast

- Paper:
  - `https://www.isi.edu/~johnh/PAPERS/Vries17a.pdf`
- Datasets:
  - `https://ant.isi.edu/datasets/anycast/index.html#verfploeter`
- Software:
  - `https://ant.isi.edu/software/verfploeter/index.html`

Please feel free to contact us for help or to share your results