#### An Empirical Characterization of Anycast Convergence Time

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## Introduction & methodology

#### Motivation

- Active BGP measurements to study routing policies, asymmetry, DDoS resilience
- Little is known about (anycast) convergence times
- How long should we wait after an announcement before its effect can be observed? 2 minutes? 10 minutes? 50 minutes?

# Methodology

A high-level overview

#### Using a commercial testbed, gradually announce anycast VPs and measure routing changes

- 1. Shuffle and partition /24 hitlist
- 2. For each partition:
  - 2.1 Announce prefix from a set of VPs
  - 2.2 Probe partition of hitlist every 10 seconds for 5 minutes
  - 2.3 Repeat these two steps for 3 more sets of VPs

## Experimental setup

Forward probing

Verfploeter-style measurements

- 1. Server distributes task to arbitrary VP
- 2. That VP probes address from their location
- 3. Another (or same) VP receives the reply
- 4. The receiving VP relays the reply to server

#### Result: fine-grained catchment mapping at /24 level



#### Validation experiment

**Reverse probing** 

- ▶ In parallel to forward probing, we perform another catchment mapping
- DNS queries from Ark nodes to VP
- VPs answer with an identifier (like id.server)
- Less granularity: 149 vs. 3.92M end hosts



#### Catchment development



- Catchments vary vastly in size
- Some VPs take preference over others

## Forward probing

VPs	50%		80%		95%	
	P <sub>50</sub>	$\sigma$	P <sub>80</sub>	$\sigma$	$P_{95}$	$\sigma$
6	6.64	0.26	12.36	4.61	31.12	26.73
12	6.70	0.09	10.84	2.78	32.48	13.84
18	6.18	0.07	9.90	1.27	27.80	5.49
31	5.99	0.06	9.40	0.44	25.02	4.49

- 80% converged within scan duration
- Noticeable decrease in convergence time with more active VPs, especially from 12 to 18



### **Reverse probing**

- Why did nodes seem to converge so late? (dashed lines)
- 11 nodes did not converge at all!
- We exclude the nodes that keep alternating (solid lines)



## Conclusion

### Conclusion

Convergence is much faster than is commonly assumed in the literature

- 80% of Internet converges within  $\approx$  10 seconds
- Faster convergence with every additional anycast site

#### Further ideas

- Regional differences
- IPv6
- Different topologies
- Combinations of VPs

Paper (link in meeting agenda) Dataset doi.org/m44z