Applied Networking Research Workshop

An Empirical Characterization of Anycast Convergence Time

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BGP convergence

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Goal Empirically establish BGP convergence times in an anycast setting

Methodology

Experiment overview

Incrementally announce anycast VPs and measure routing changes

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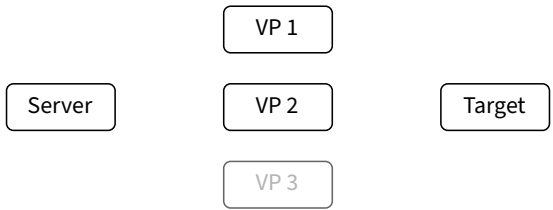
Catchment mapping methods used

Forward Internet-wide probing

Reverse probing VPs from Ark

Catchment mapping

Forward probing



Catchment mapping

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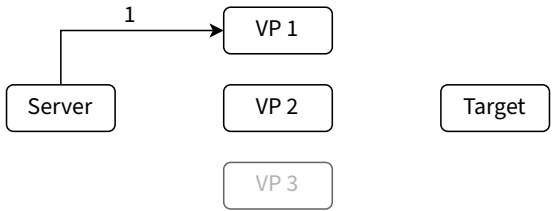

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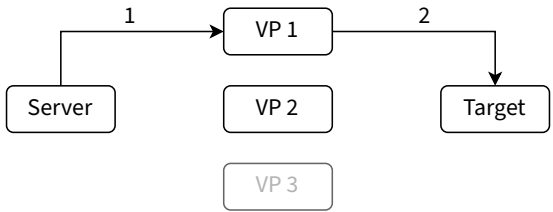

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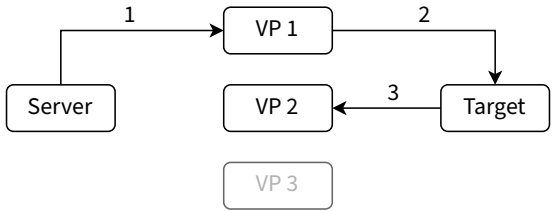

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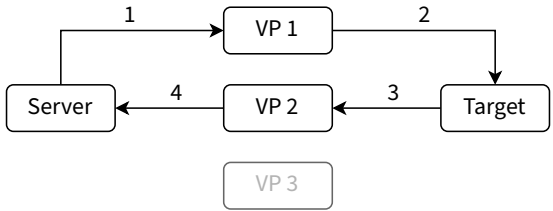

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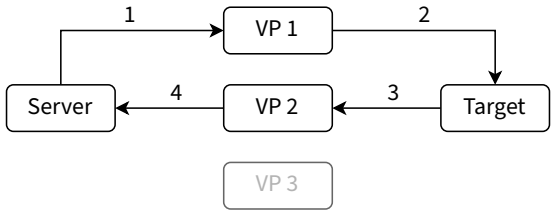

Result fine-grained catchment mapping at /24 level

Catchment mapping

Reverse probing

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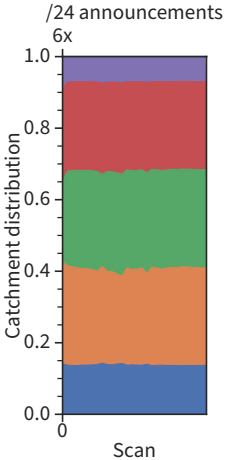
Catchment mapping

Reverse probing

- In parallel to forward probing
- Ark nodes query VPs via DNS
- We assign a different A record to each VP (like `id.server`)
- Less granularity: 149 Ark nodes vs. 3.92M hitlist targets

Results

Resulting catchments



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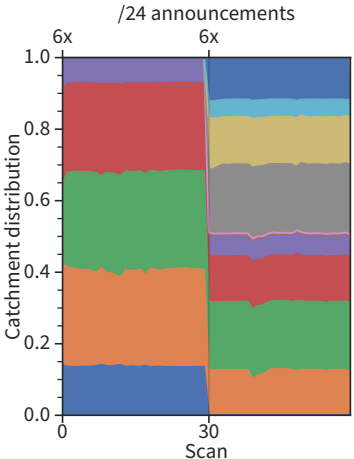

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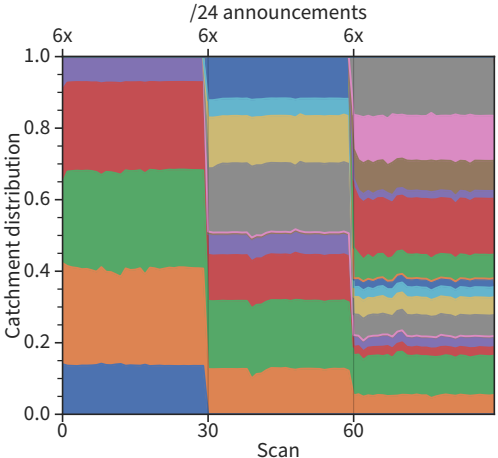

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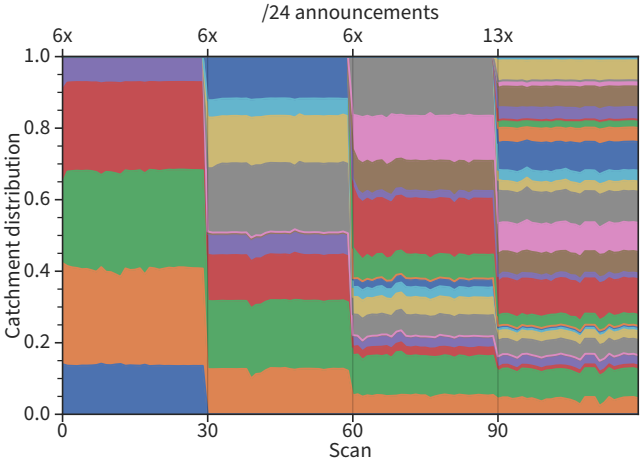

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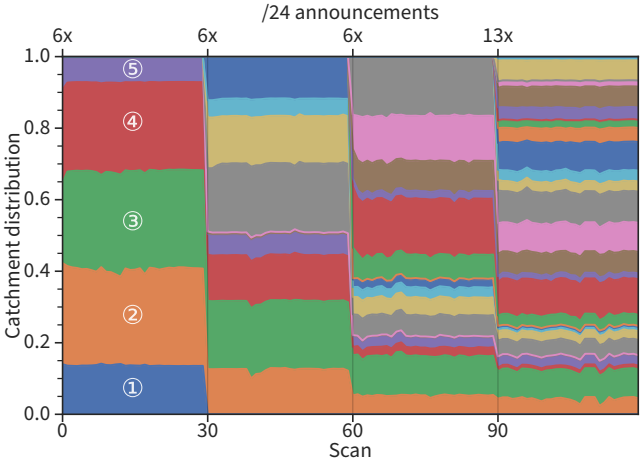

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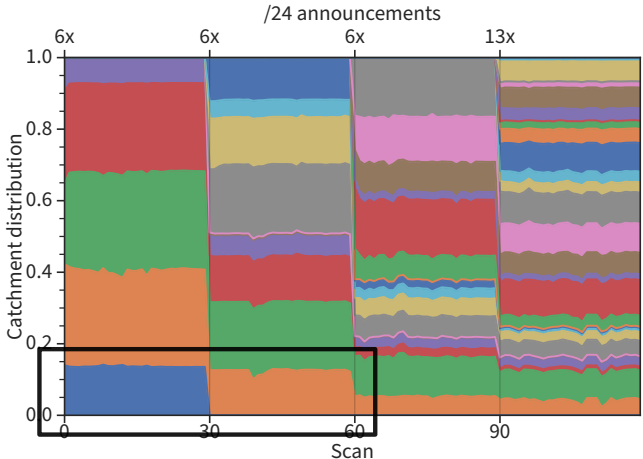
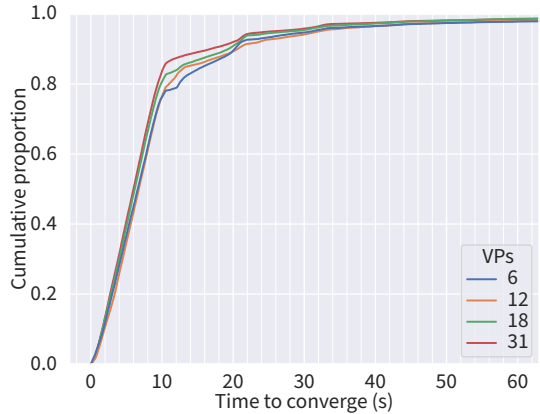
Resulting catchments



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

Convergence times

VPs	50%		80%		95%	
	P_{50}	σ	P_{80}	σ	P_{95}	σ
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



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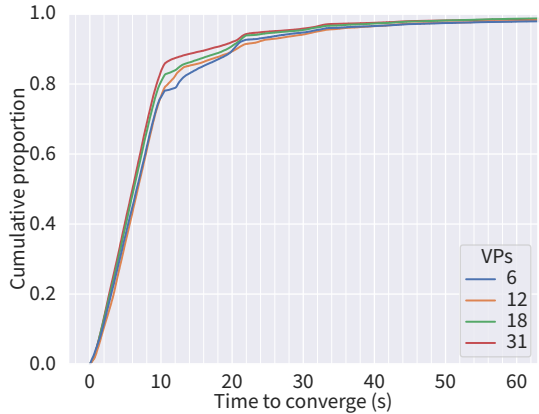

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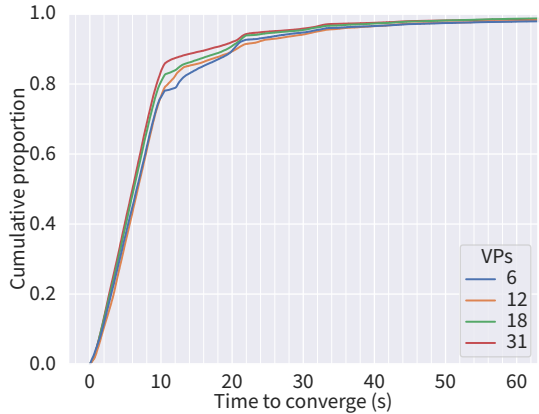
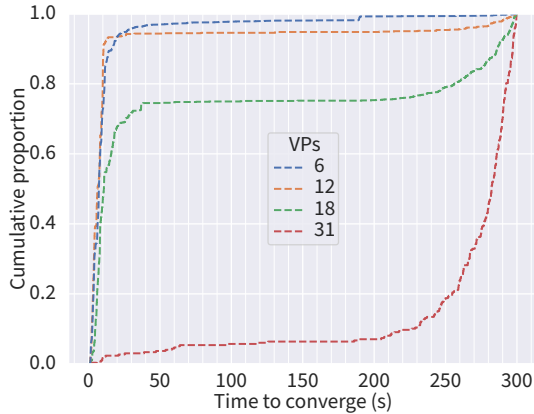
- 80% converged within scan duration
- Noticeable decrease in convergence time with more active VPs



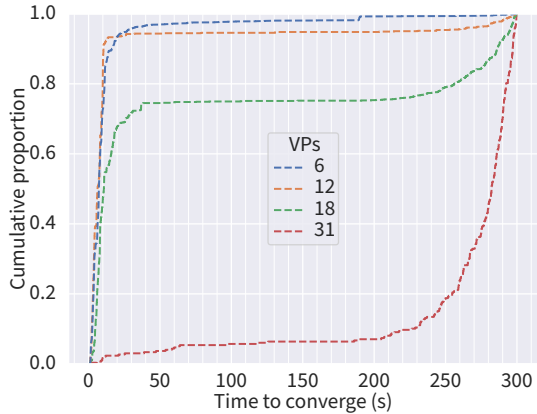
Reverse probing

- Convergence seems delayed



Reverse probing

- Convergence seems delayed …since 11 nodes across all configurations did not converge at all!



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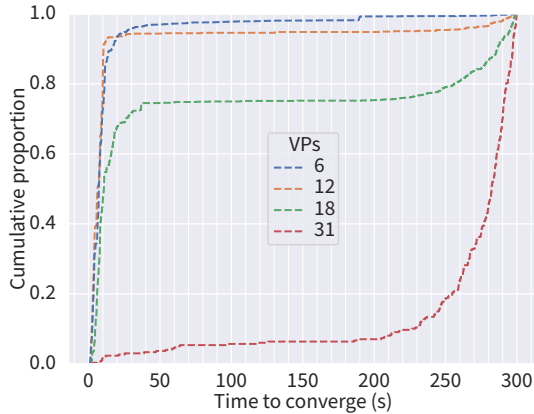

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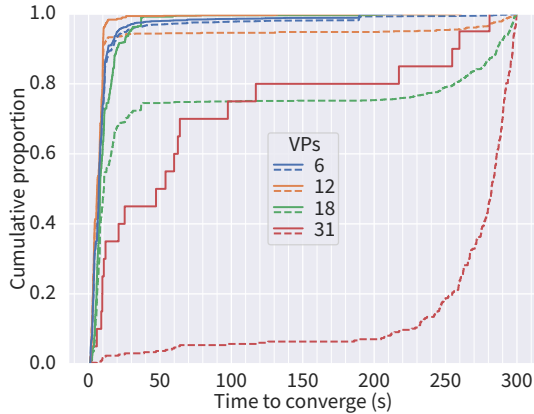
- After excluding alternating nodes, it supports our results



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- 80% of the Internet converges within $\sim$ 10 s
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Further ideas

- Increase measurement resolution
- Zoom in on regional differences
- IPv6?

An Empirical Characterization of Anycast Convergence Time

Paper doi.org/m8bx
Dataset doi.org/m44z
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