IETF Hackathon:
Measurement and Analysis for Protocols (MAP) - Live

IETF 104
23-24 March, 2019
Prague

Hackathon Plan (Project 1)

- Analysis tool development and measurement results for Internet Draft on **Privacy & Security Issues in IPv6 Deployment**
  - Preparing I-D to share anonymized, aggregate results
  - Goal is to inform v6 address assignment in engineering and operations and inform measurement practice
- Compare, and contrast, results of independent (TU-Munich & Akamai), worldwide IPv6 traceroute surveys January 2019 having shared analysis tools: be sure we're comparing *apples to apples*

What got done

- Consider best current practice for privacy & security in “hitlists” and repositories, *e.g.,* Passive DNS databases
- Public measurements: https://ipv6hitlist.github.io/
- Shared analysis tools: http://www.cs.wisc.edu/~plonka/ipv6toolkit/, http://www.cs.wisc.edu/~plonka/mac2vendor/
- We analyzed and compared the largest public and “private” IPv6 traceroute survey results known

What we learned

- **>1.2 million EUI-64 IPv6 router addresses found** in traceroute surveys and campaigns performed by industry and academia
  - This **discovery was *accidental;*** a side-effect of reachability and topology studies
  - **Public and "private" results are *complementary***, each revealing unique details in different parts of the active IPv6 address space

- Surprisingly, **older "hitlists"** (seed addresses used to synthesize traceroute targets) can ***sometimes*** **yield more results!**

- There is likely some **follow-on BCP** work for 6man and/or v6ops working groups

- Hackathon **results** will be **reported in MAPRG meeting this week** with a new draft to be proposed as work for the research group

Top 10 ASNs by EUI-64 Device Count

```
$ make -s 20190104_combined_v6_eui64_bgp_top
          (0.00,1.00]  284243  (23.54) *********
          (1.00,2.00]  187259  (15.51) ******
          (2.00,3.00]  155841  (12.90) *****
          (3.00,4.00]  144464  (11.96) ****
          (4.00,5.00]  111061   (9.20) ***
          (5.00,6.00]  100878   (8.35) ***
          (6.00,7.00]   44505   (3.69) *
          (7.00,8.00]   31118   (2.58) *
          (8.00,9.00]   23787   (1.97)
         (9.00,10.00]   16389   (1.36)
```

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          (3             144464  (11.96) ****
```

571 unique ASNs in which EUI-64 addressed routers were discovered.

Top 10 Vendors by EUI-64 Device Count

```
$ make -s 20190104_combined_v6_eui64_mac2vendor_top
          (0.00,1.00]  354902  (31.67) ************
          (1.00,2.00]  284190  (25.36) **********
          (2.00,3.00]  124608  (11.12) ****
          (3.00,4.00]   86725   (7.74) ***
          (4.00,5.00]   67661   (6.04) **
          (5.00,6.00]   37189   (3.32) *
          (6.00,7.00]   26887   (2.40)
          (7.00,8.00]   19786   (1.77)
          (8.00,9.00]   14707   (1.31)
         (9.00,10.00]   14169   (1.26)
```

Top 10 Vendors by EUI-64 Device Count

```
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00,1.00]  354902  (31.67) ***********
0,2.00]  284190  (25.36) **********
3.00]  124608  (11.12) ****
00]   86725   (7.74) ***
```

235 unique vendors from EUI-64 router addresses in public and "private" trace surveys, combined.

Portion	Anon. Vendor (of MAC from EUI-64)	Anon. ASN
23.53%	Wonka Industries	AS-A
15.50%	Acme Corp.	AS-B
8.74%	Acme Corp.	AS-C
8.21%	Stark Industries	AS-D
7.06%	Ollivander's Wand Shop	AS-E
5.58%	Gekko & Co	AS-F
3.68%	Acme Corp.	AS-G
1.77%	Wayne Enterprises	AS-C
1.52%	Cyberdyne Systems	AS-F
1.47%	Cheers	AS-H

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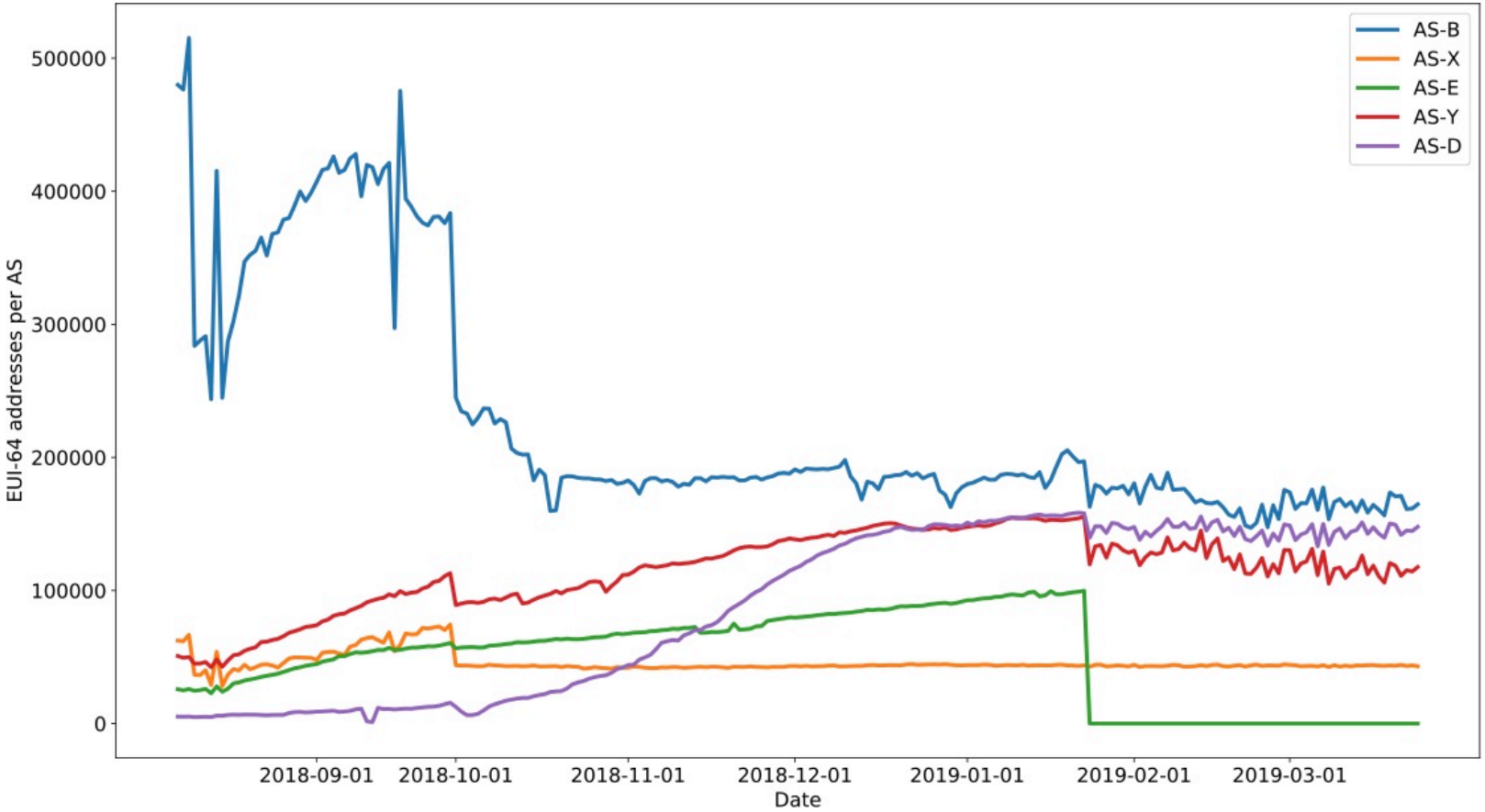
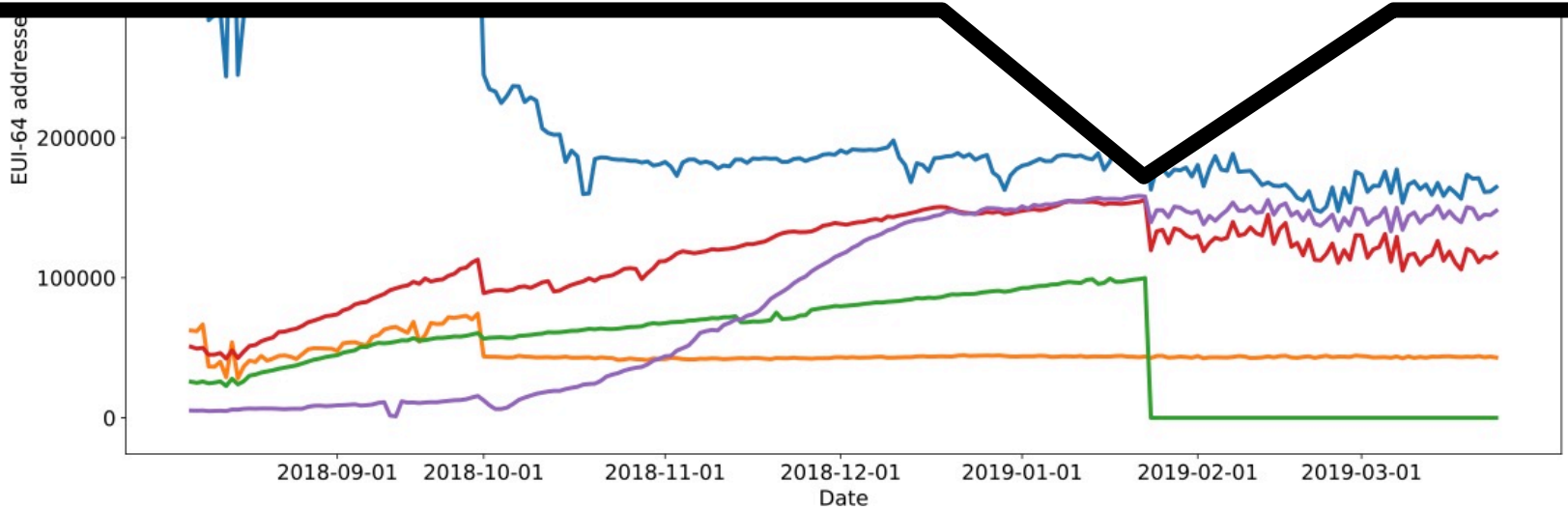
Portion	Anonymized Vendor (of MAC from EUI-64)	Anonymized ASN
23.53%	Wonka Industries	AS-A
15.50%	Acme Corp.	AS-B
8.74%	Acme Corp.	AS-C
8.21%	Stark Industries	AS-D
7.06%	Ollivander's Wand Shop	AS-E
5.58%	Gekko & Co	AS-F
3.68%	Acme Corp.	AS-G
1.77%	Wayne Enterprises	AS-C
1.52%	Cyberdyne Systems	AS-F
1.47%	Cheers	AS-H
1.27%	Stark Industries	AS-I
1.16%	Genco Pura Olive Oil Company	AS-F
0.97%	The New York Inquirer	AS-J
0.84%	Duff Beer	AS-E
0.81%	Acme Corp.	AS-K
0.76%	Cheers	AS-L
0.67%	Bubba Gump	AS-M

Top 5 ASNs by EUI-64 count: TU-M data

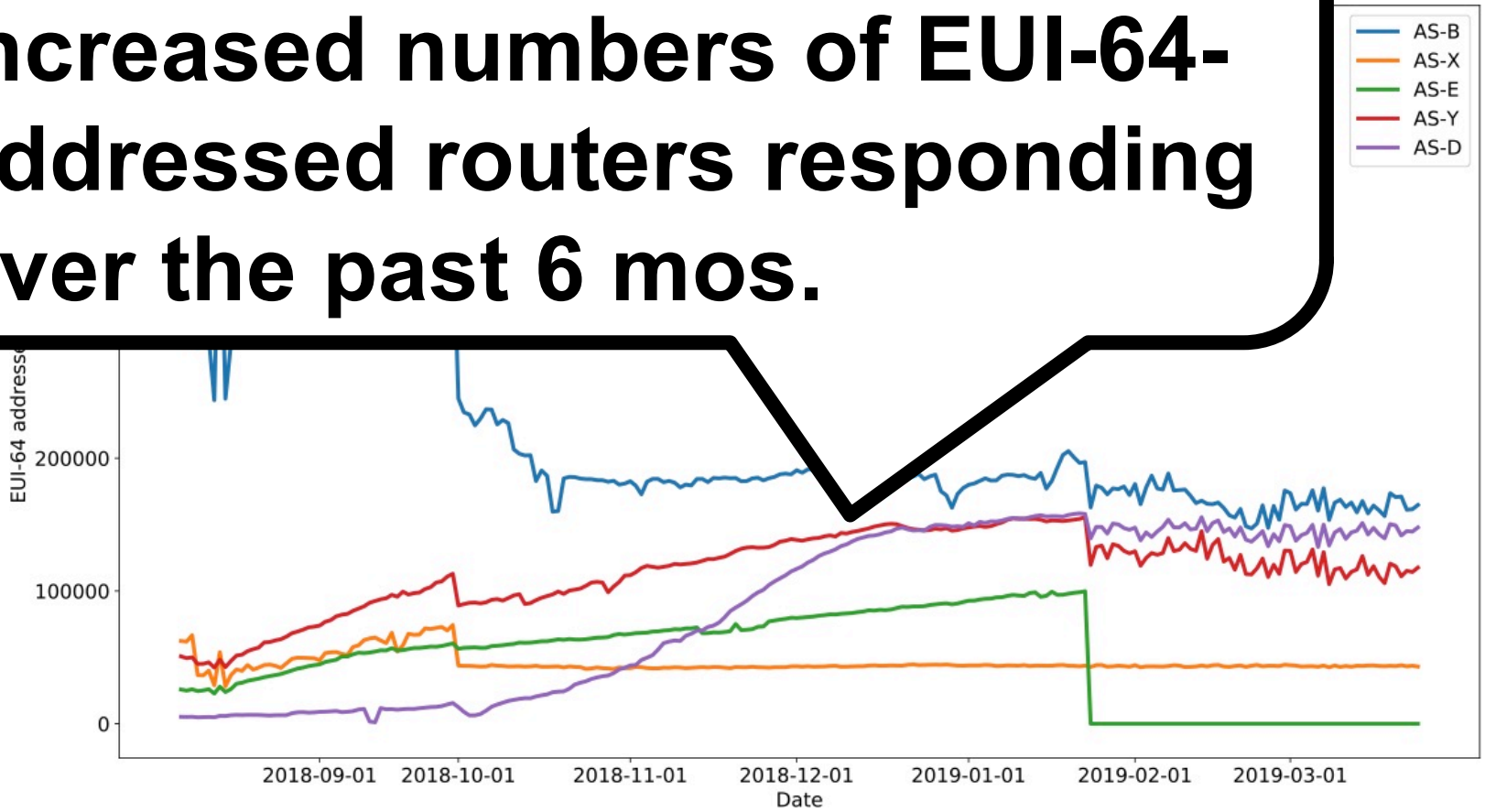


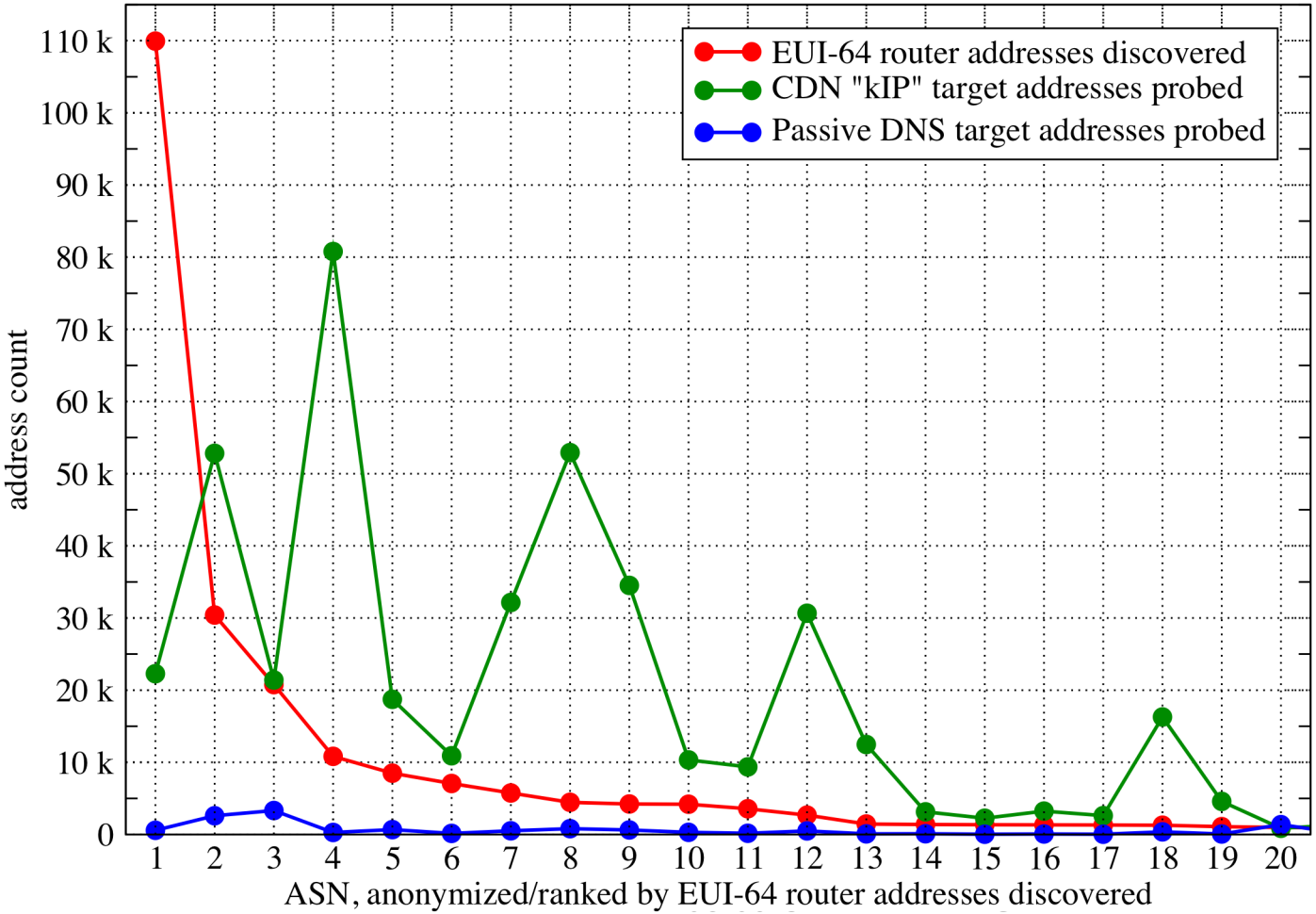
Plot suggests some decreased responses from EUI-64-addressed routers, but investigation found this to be a measurement system artifact.



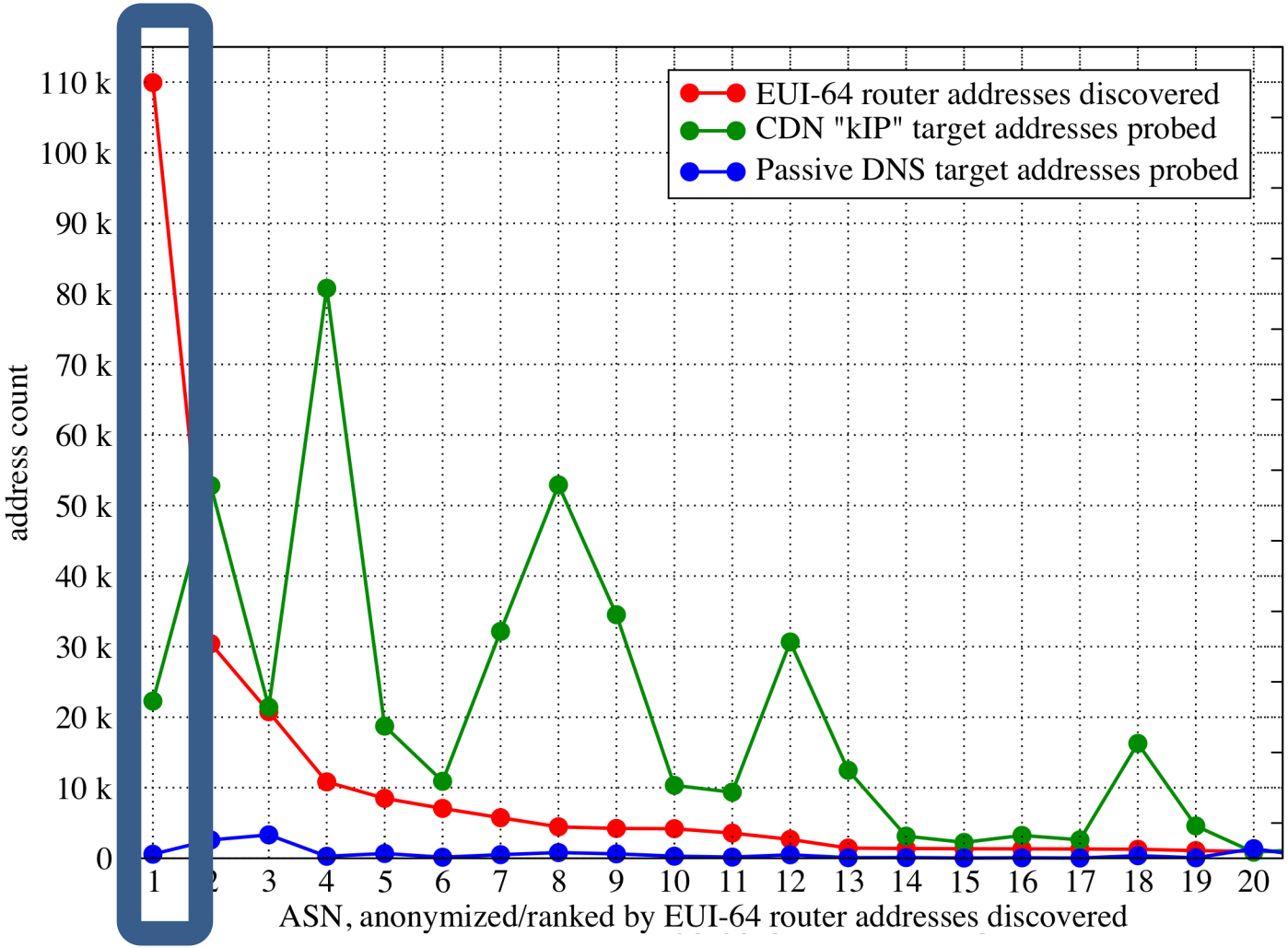
Some networks show increased numbers of EUI-64-addressed routers responding over the past 6 mos.

data





Top 20 ASNs ranked by EUI-64 router addresses discovered in “private” trace campaigns



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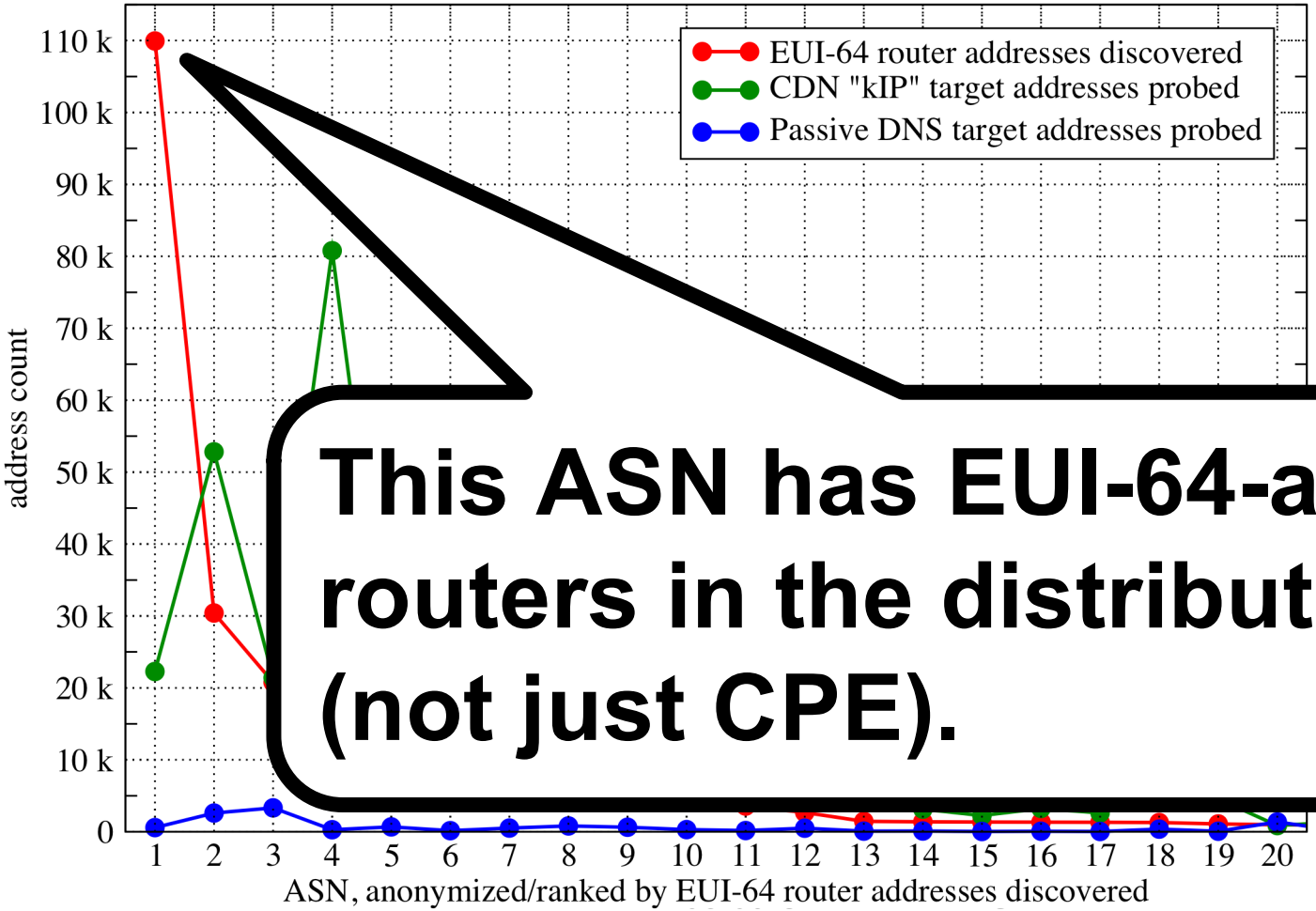
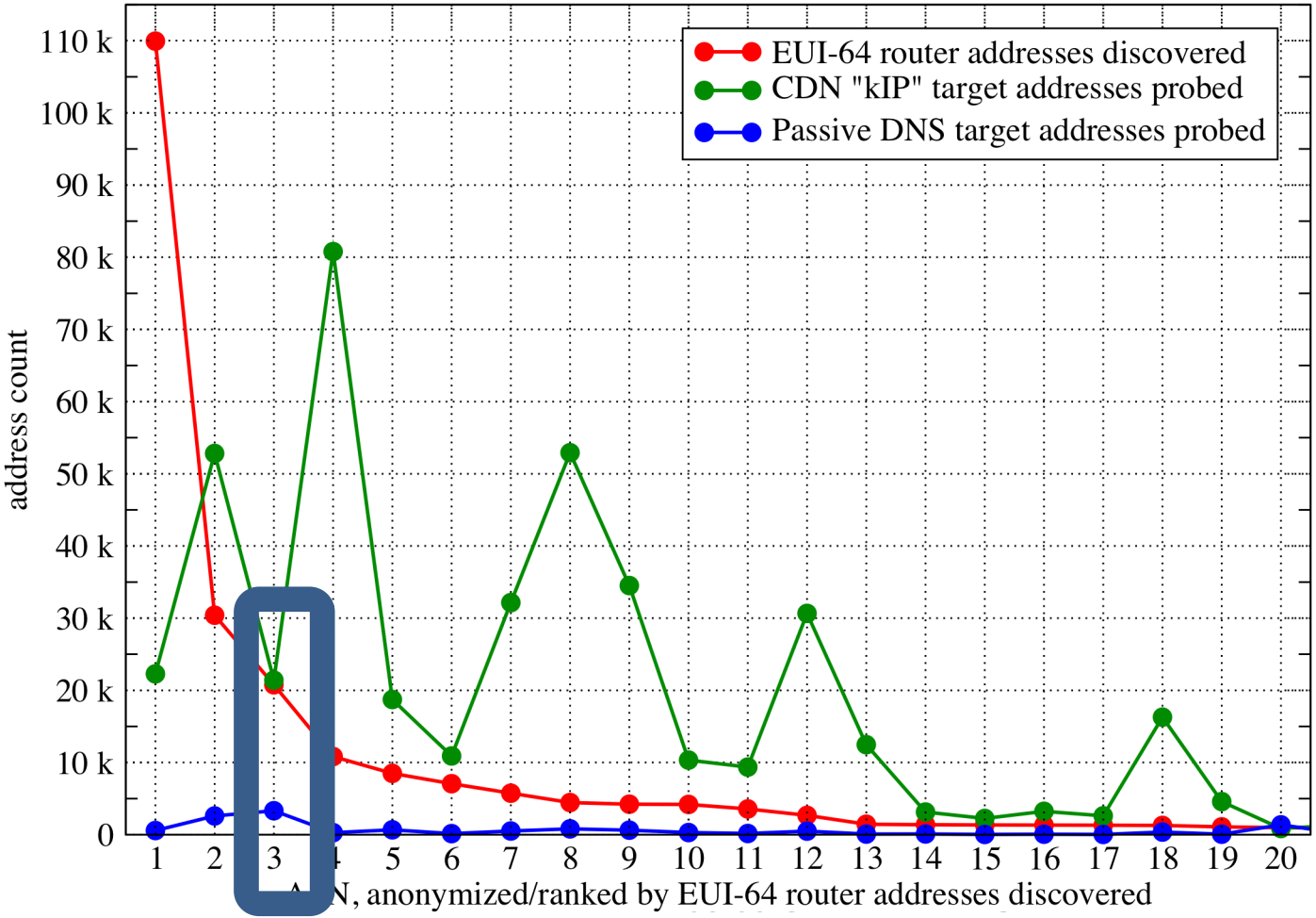


Top 20 ASNs ranked by EUI-64 router addresses

This ASN has EUI-64-addressed routers in the distribution layer (not just CPE).



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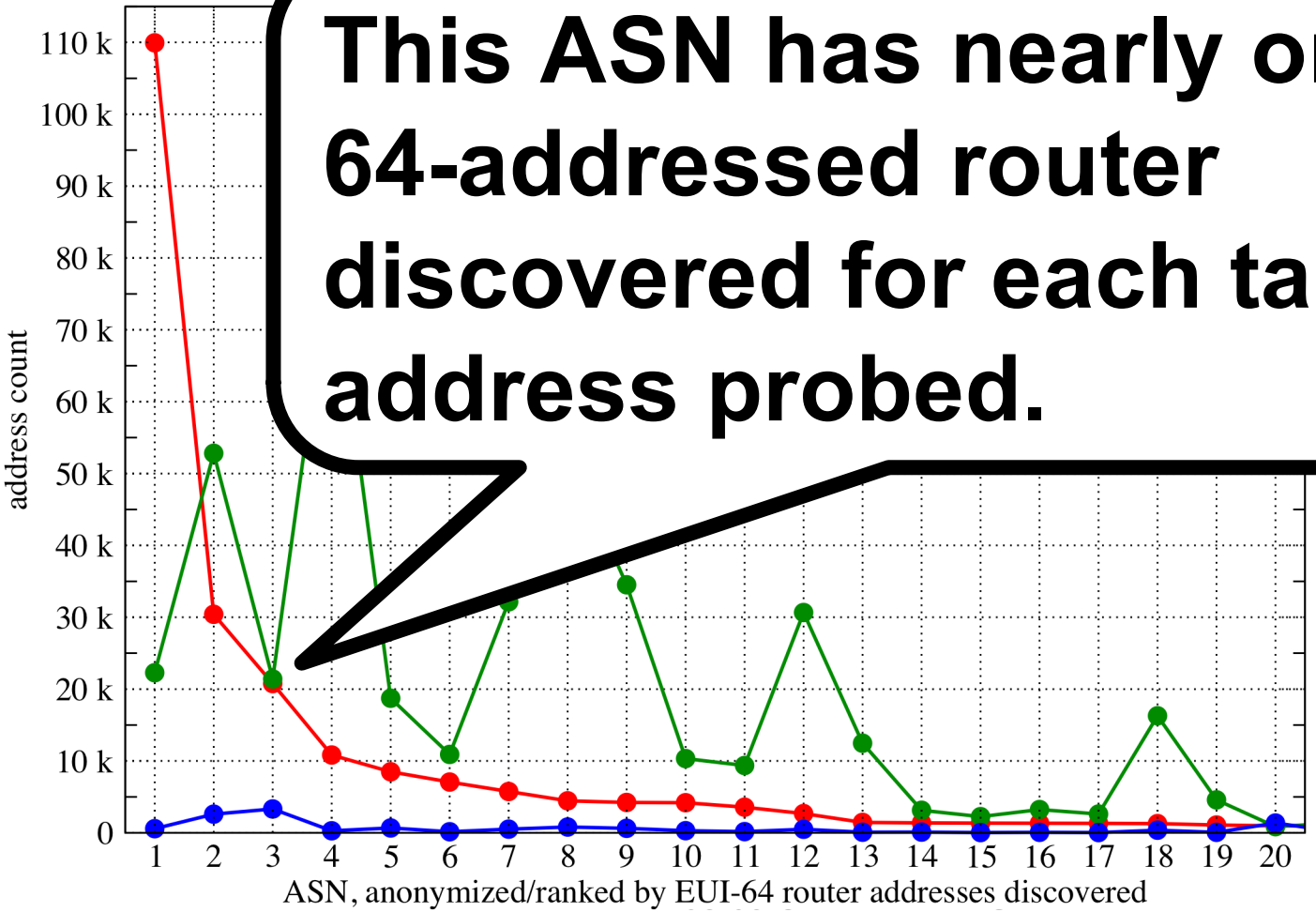
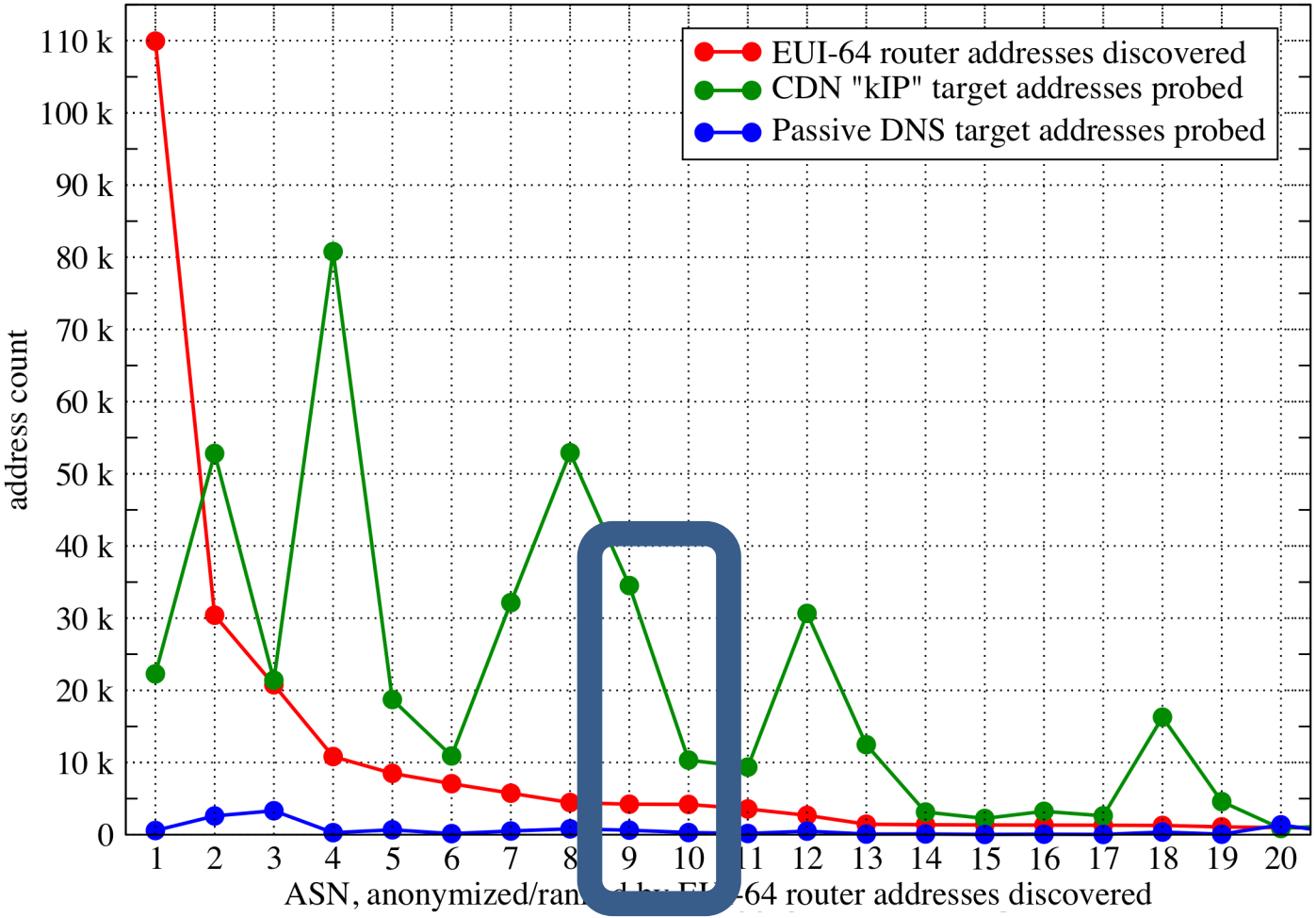


This ASN has nearly one EUI-64-addressed router discovered for each target address probed.

discovered in “private” trace campaigns



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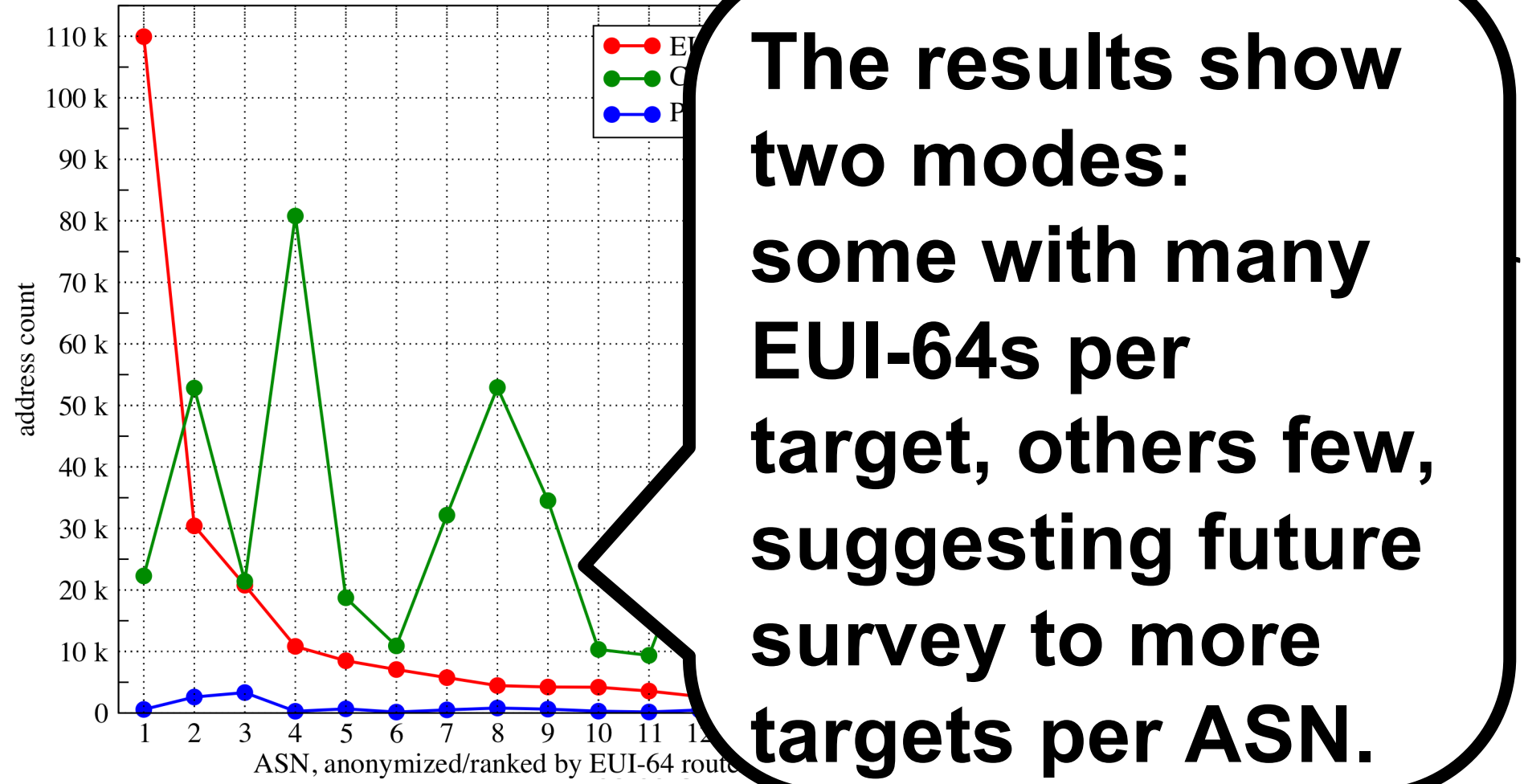


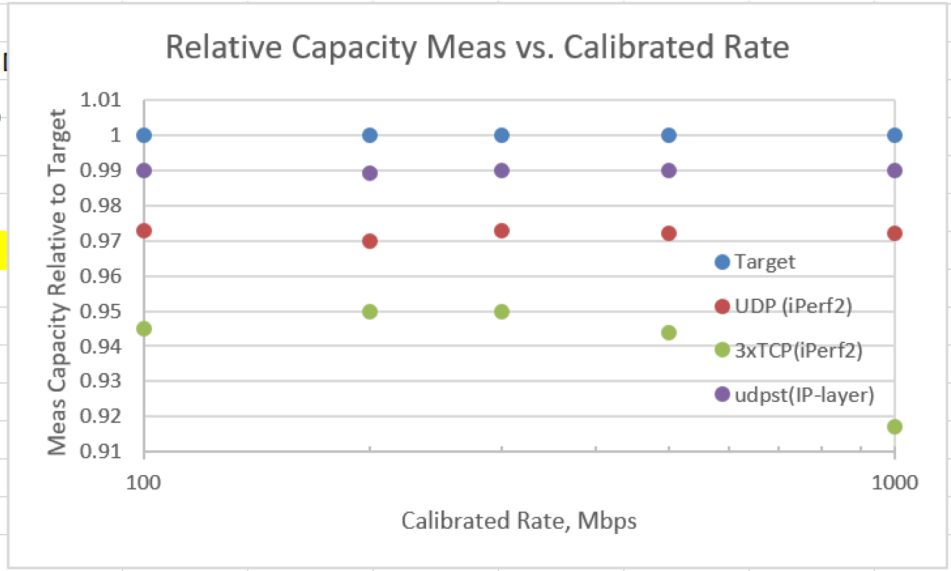
The results show two modes: some with many EUI-64s per target, others few, suggesting future survey to more targets per ASN.

IP Network Performance and Capacity Measurement Method Comparisons (Project 2)

What we did & learned:

- Collected Interesting Test Conditions for Evaluation <doc>
- Calibrated Lab Setup (tc shaper) & Performed tests on 3 methods

				Hack-104
C-Rate, Ml	Target	UDP (iPerf	3xTCP(iPe	udpst(IP-l
100	1	0.973	0.945	0.99
200	1	0.97	0.95	0.9892
300	1	0.973	0.95	0.9899
500	1	0.972	0.944	0.99
1000	1	0.972	0.917	0.99
		2-Jan		



Quick measurement study with PATHspider

- See pathlspider.net
- Measured ECN support of 4294 web servers (IPv6 only)
  - Negotiated successfully: 4007
  - Did not negotiate ECN: 287
  - Seems to work without ECN but not with: 2 (may be transient errors)
  - 0 CE markings observed (but no high load scenario)
  - 1 host used only ECT(1); 2 used both ECT(0) and ECT(1)
- Come help measure the Internet and share some data at MAPRG!

Wrap Up

Team members:

Dave Plonka
Mirja Kühlewind
Oliver Gasser
Al Morton
Iain Learmonth
Alexander Isavnin

First timers @ IETF/Hackathon:
Oliver Gasser
Ian Learmonth

MAPRG meets 10:50 Thursday morning:

https://datatracker.ietf.org/rg/maprg/about/

https://trac.ietf.org/trac/irtf/wiki/map

maprg-chairs@ietf.org