

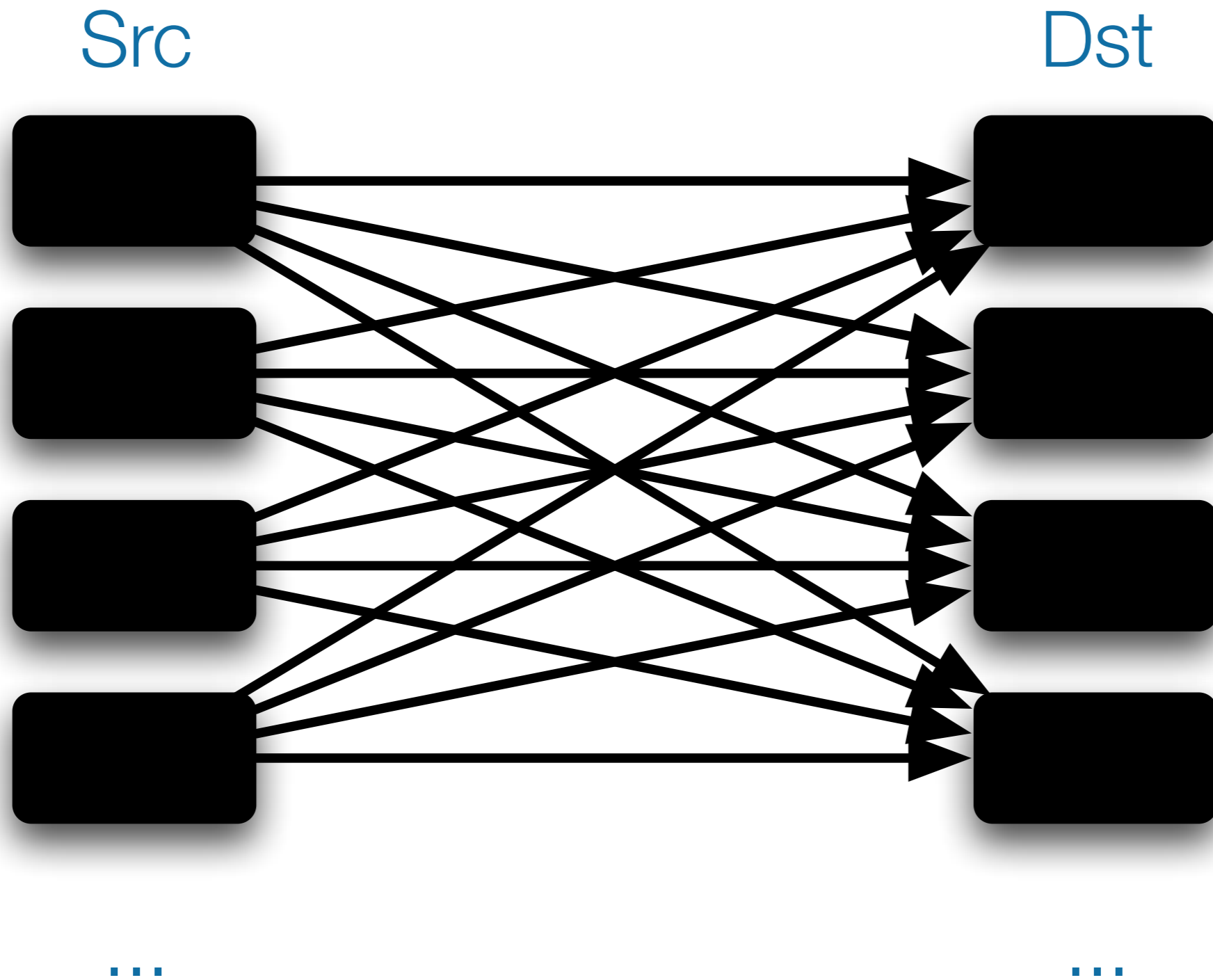
Partial Reachability in IPv4 and IPv6

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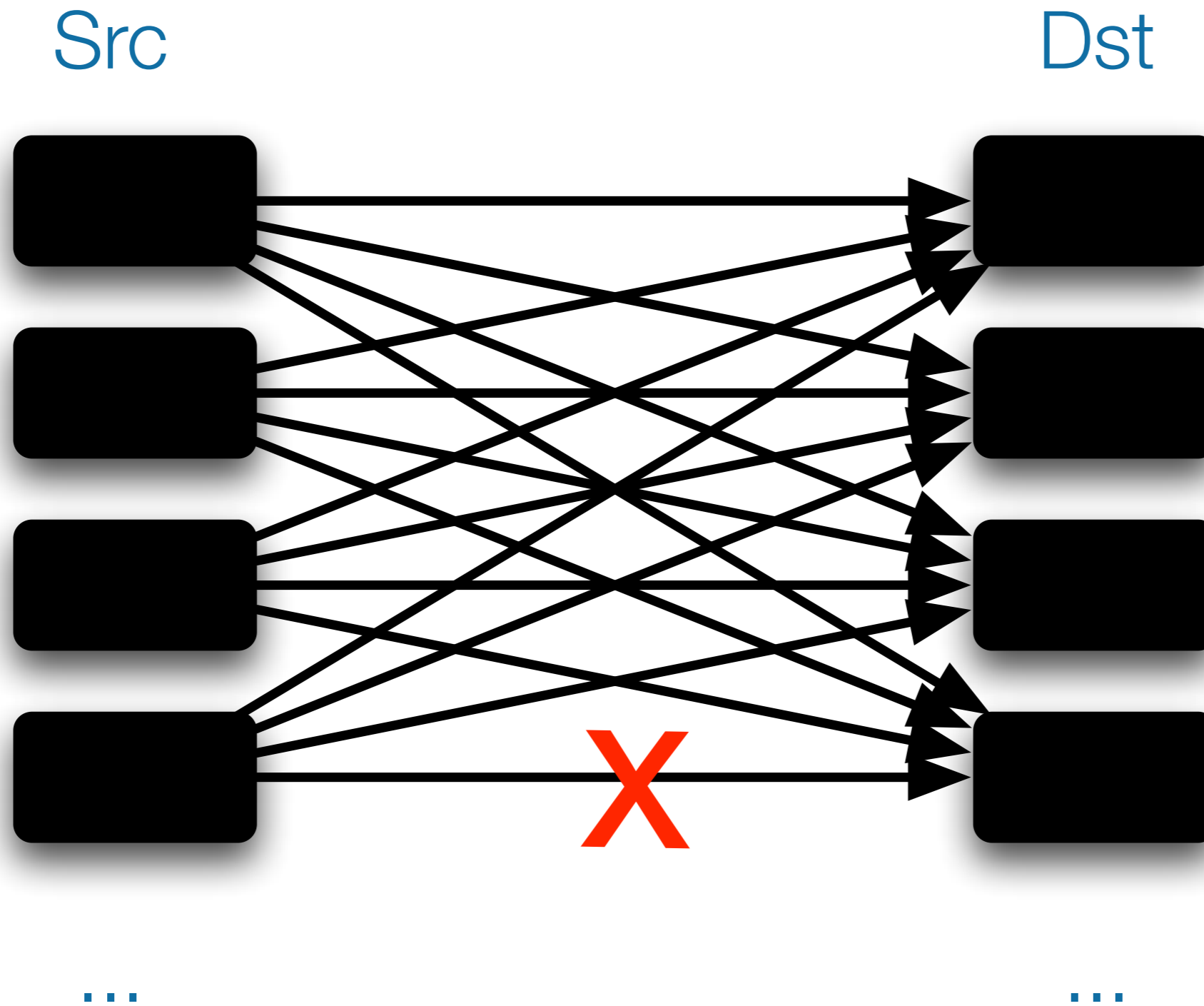
<http://albatross.ipv6.ripe.net/demo-area/v6partial/emile-aims2012-v4v6.pdf>



General Reachability



Partial Reachability



Partial Reachability

- Persistent non-connectivity between A and B where A and B have measurable connectivity
- Causes:
 - Partial filtering: AS border? Destination?
 - Routing: intra AS?
 - BGP - a not-completely full-table

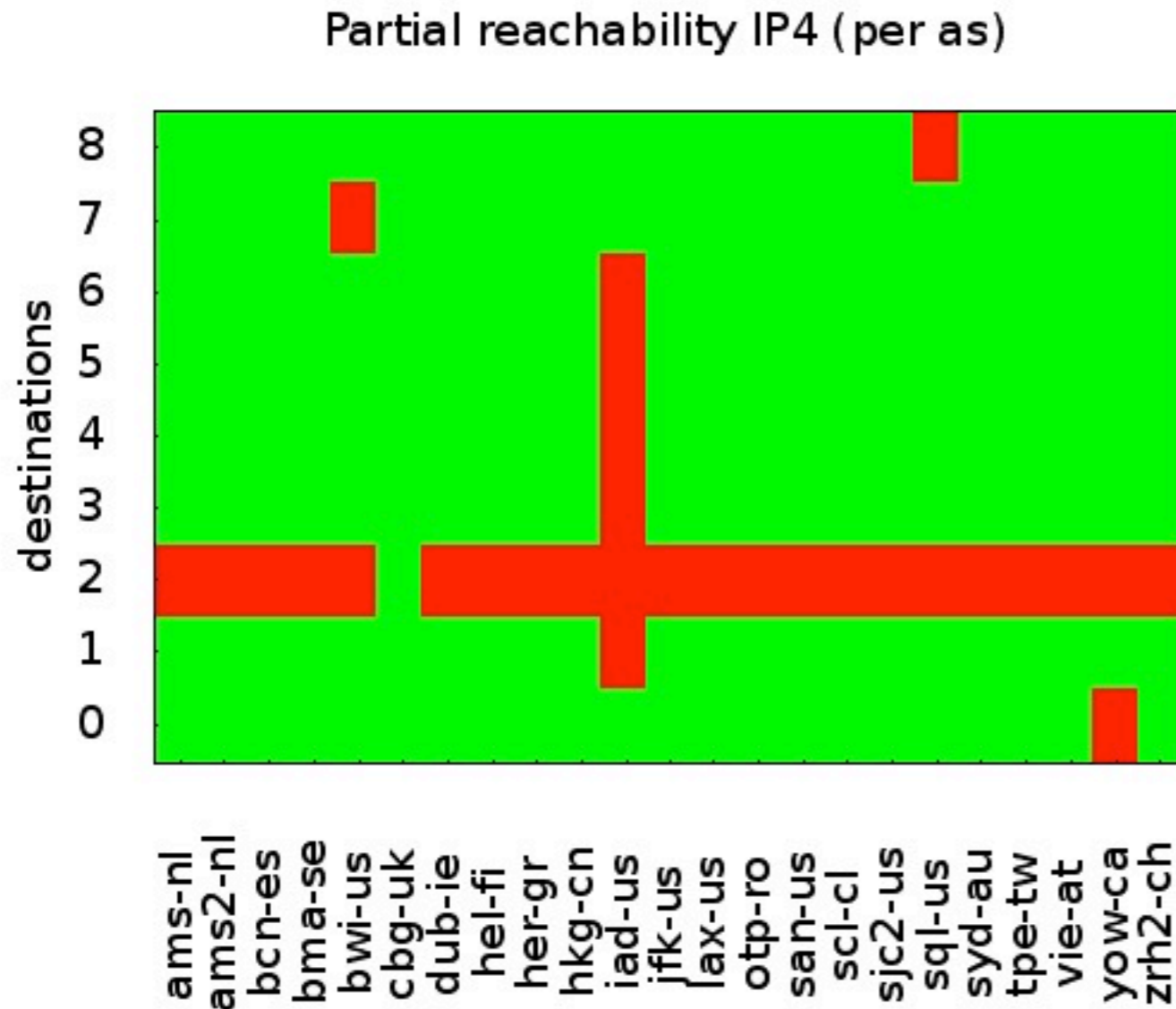
Measuring Partial Reachability with Ark



Ark Measurement Design

- 23 sources
 - All dual-stacked Ark-boxes minus mnl-ph and dkr-sn
- 1273 dual-stacked destinations
 - from Alexa 1M (max 3 per IPv6 AS)
 - 775 IPv4 ASes
 - 716 IPv6 ASes
- 6 runs (2012-01-19 - 2012-02-05)
- Using **topo-on-demand**

Ark - IPv4 Partial Reachability

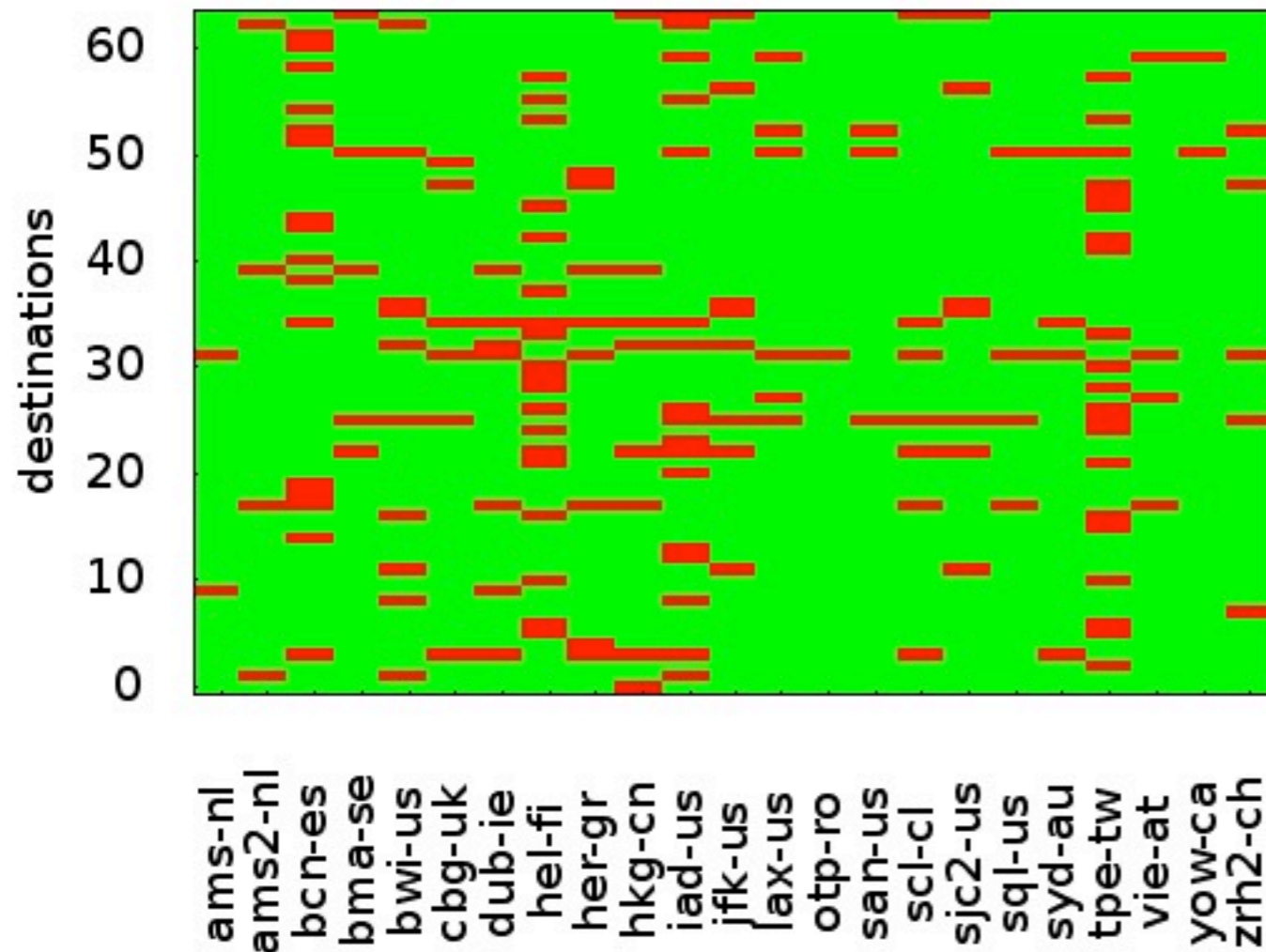


Full/no reachability not shown

Green: Reachable
Red: Persistently unreachable

Ark - IPv6 Partial Reachability

Partial reachability IP6 (per as)



Green: Reachable
Red: Persistently unreachable

Ark - Partial Reachability Comparison

	ASes	Partial Reachability
IPv4	755	9 (1.2%)
IPv6	716	64 (8.9%)

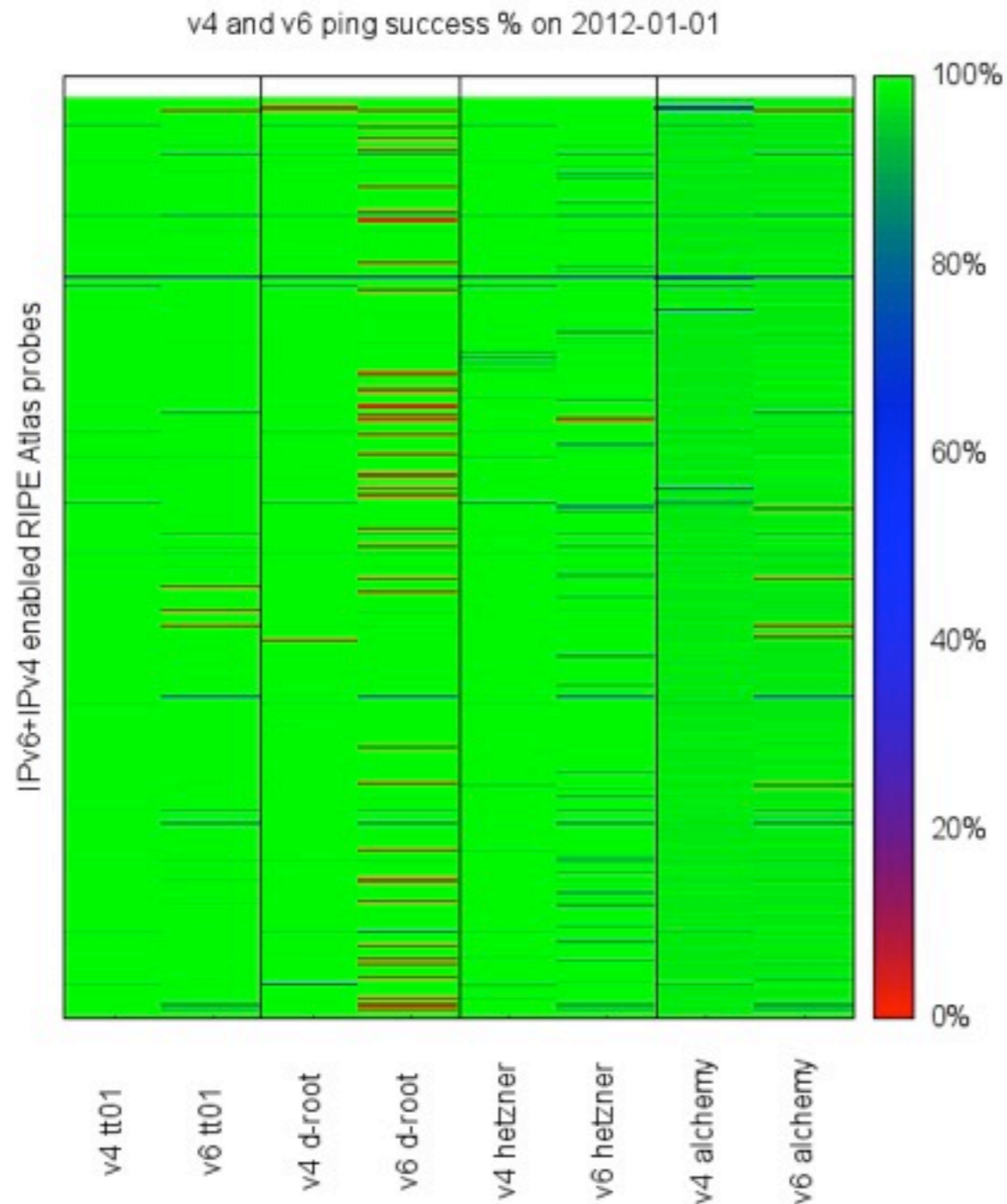
Measuring Partial Reachability with RIPE Atlas



Using RIPE Atlas

- ~ 1200 sources , ~ 430 have working IPv6
- 4 “fixed” destinations that are dual-stacked, unicast (ie. not anycast), and in different ASes
- Measurement:
 - Train of 3 ICMP echo requests between src/dst pairs
 - Once every 240 seconds (with jitter), both in IPv4 and IPv6

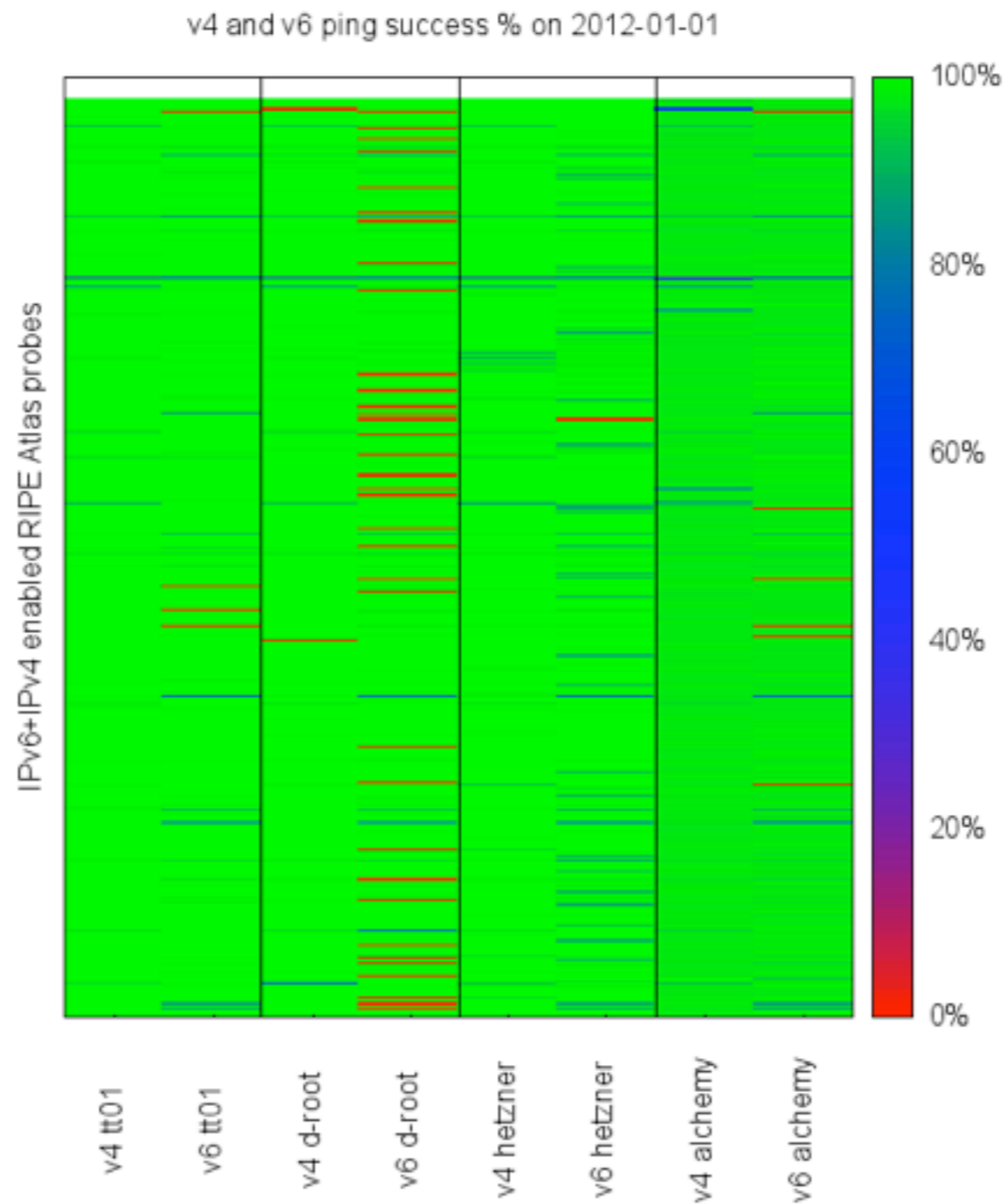
Packet Loss In RIPE Atlas



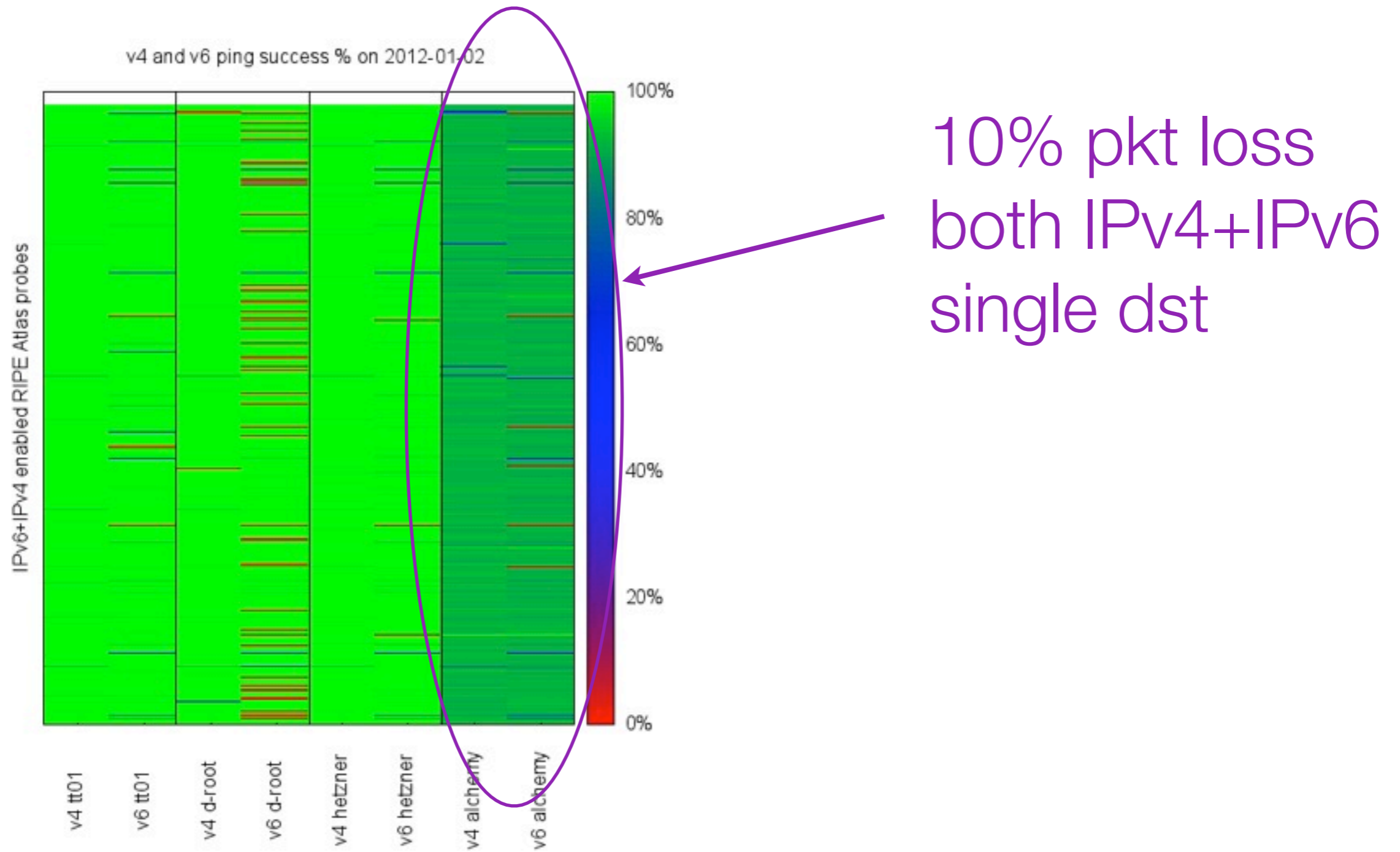
Only probes that got echo replies back from at least one destination in each IP version

Packet Loss - The Movie

<http://albatross.ipv6.ripe.net/demo-area/v6partial/v6partial-movie.gif>

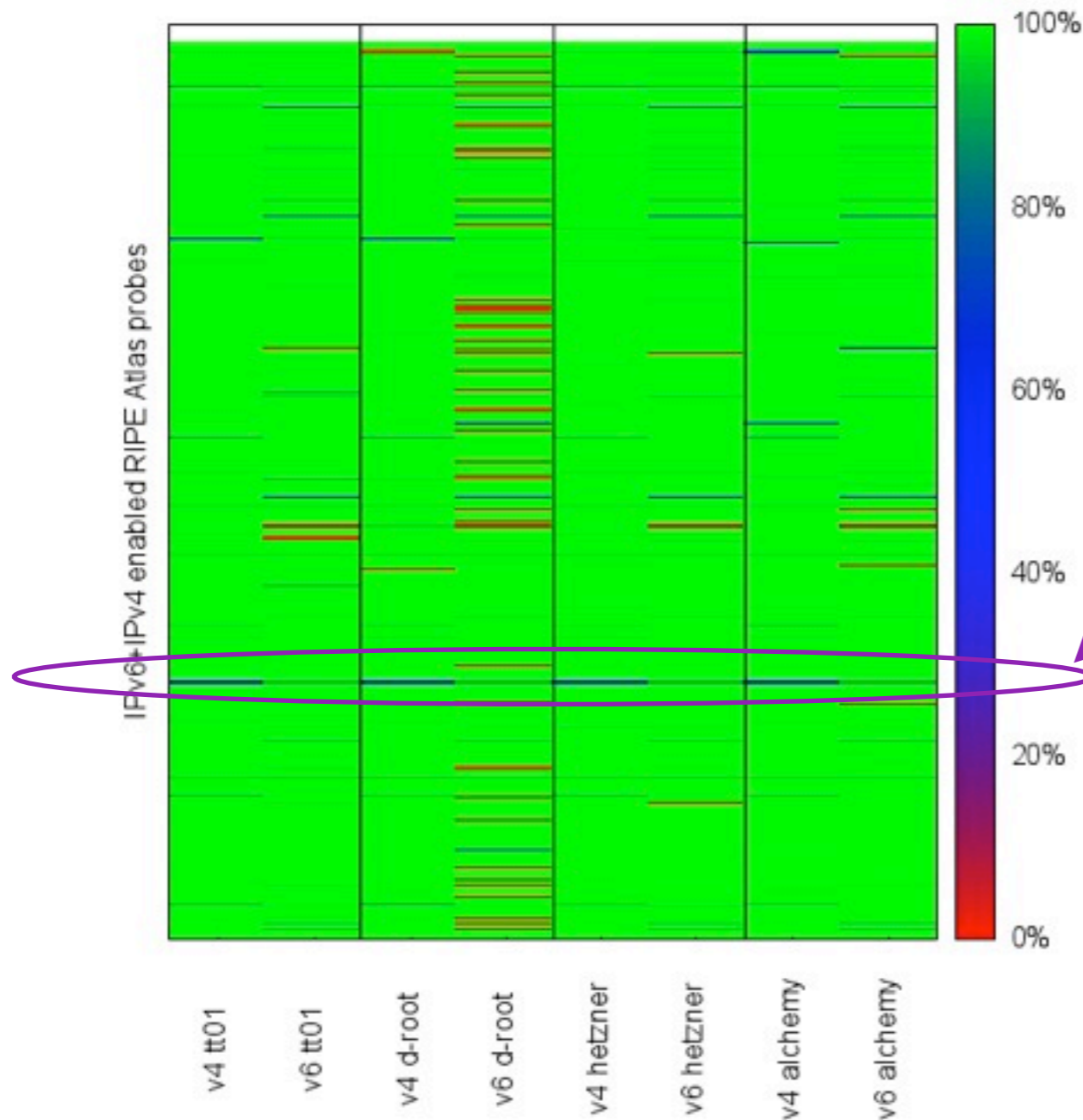


Destination Problems - 2012-01-02



Probe Both Protocols Problem

v4 and v6 ping success % on 2012-01-05



Problem on probe side,
both IPv4 and IPv6
affected

Atlas - Aggregate Over 15 Days

	Src/Dst Pair Count	Partial Reachability	Temporary* Partial Reachability
IPv4	4792	3 (0.06%)	3 (0.06%)
IPv6	1940	25 (1.3%)	46 (2.4%)

* : 100% packet loss for at least 1 day

Atlas - 15 days of 6to4

	Src/Dst Pair Count	Partial Reachability	Temporary Partial Reachability
IPv6	1940	25 (1.3%)	46 (2.4%)
6to4	112	7 (6.3%)	21 (19%)

Native IPv6 better then using 6to4

Atlas - Aggregate Over 15 Days (Corrected)

	Src/Dst Pair Count	Partial Reachability	Temporary Partial Reachability
IPv4	1100	1 (0.09%)	0 (0%)
IPv6	1088	11 (1.0%)	10 (0.92%)

For probes where IPv4 AS = IPv6 AS
(to get rid of tunnels, 6to4 etc.)

Example of BGP-fail to d-root

Reference prefix:

```
RS_AS>show ip bgp ipv6 unicast 2001:67c:2e8::/48
BGP routing table entry for 2001:67C:2E8::/48, version 2060408
Paths: (1 available, best #1, table default)
  Not advertised to any peer
    (65000) 3333
      2001:918:0:5::1 from 2001:918:0:5::1 (138.187.128.158)
        Origin IGP, metric 500000, localpref 300, valid, confed-
internal, best
        Community: 3303:1004 3303:1006 3303:3051
```

D-root prefix:

```
RS_AS>show ip bgp ipv6 unicast 2001:500:2d::/48
% Network not in table
```

Cause: BGP prefix filtering of /48s out of ARIN's critical infrastructure allocations

Conclusion

- Partial reachability exists, both in IPv4 and IPv6
 - Something to consider when designing experiments

	CAIDA Ark	RIPE Atlas
IPv4	1.2%	0.09%
IPv6	8.9%	1.0% (corrected)

- IPv6 a factor 10 worse in both experiments

Questions?

