AS Topology Visibility – You Can't Get There from Here

2010.03.02 / APRICOT Kuala Lampur

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<http://archive.psg.com/100302.apricot-visibility.pdf>

We Study *Visibility*

- What is the real routing graph of the Internet?

- What is the AS topology of BGP routing?

- How do we debug our network?
  - Are ping and traceroute the best we can do?

- How biased is our methodology?

RIPE-RIS & RouteViews

- RIPE RIS/RouteViews were designed for operators
- Researchers discovered them – most **without consideration of limitations**

Google Scholar search for papers mentioning the term "RouteViews"
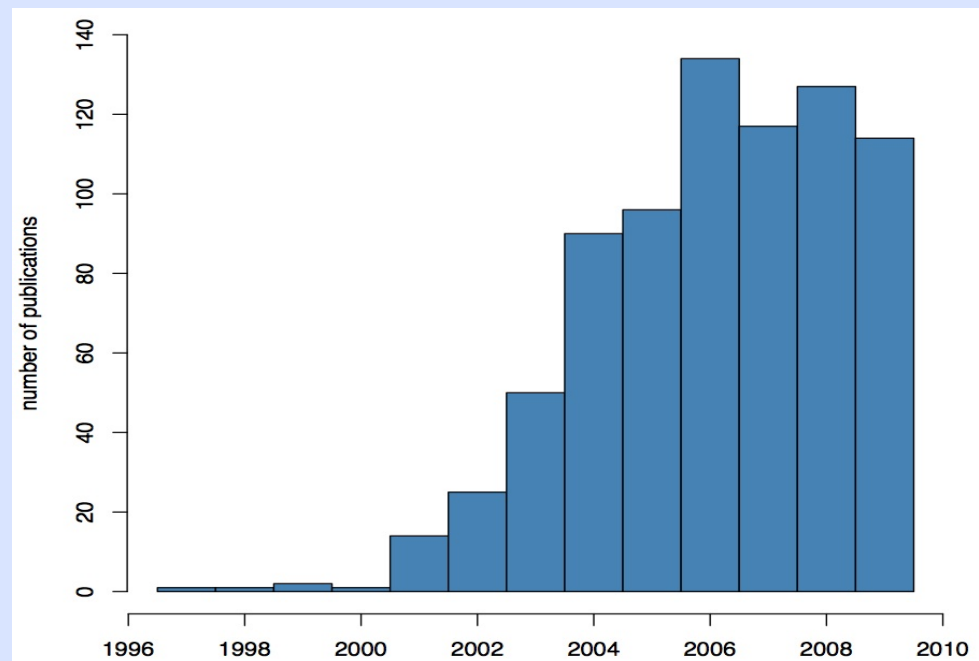
Bogon Diagnosis Work

- R&D for ARIN to enable them to diagnose what ASs were filtering newly allocated address space. See 2007 SIGCOMM NetMgt Workshop.

- Though ARIN never deployed, we continued to measure to see how long it takes to get filters removed.

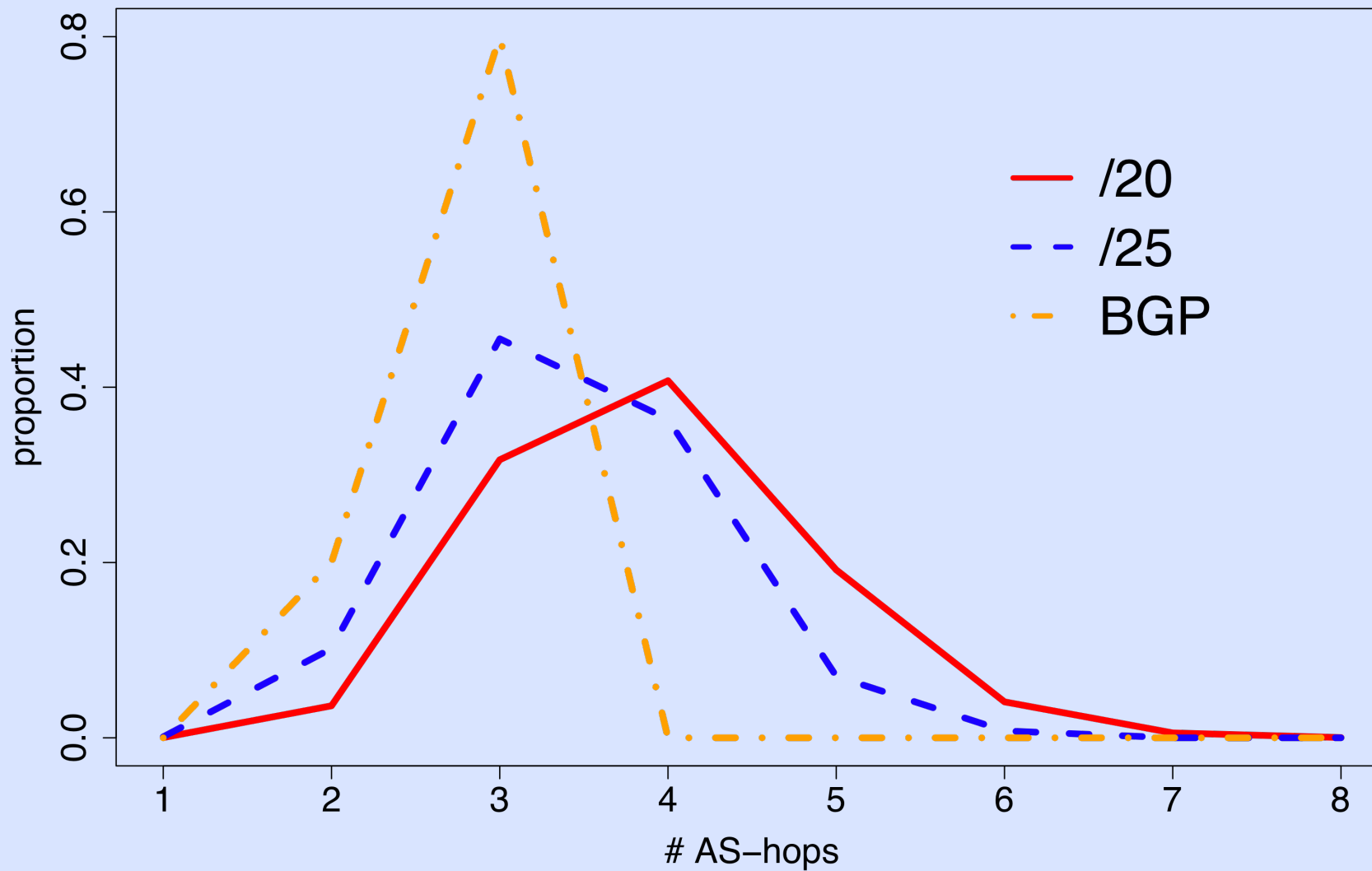- Bored, we turned the tool to other use

Announcing a /25

- We announced a /25 to NTT

- They passed it only to customers

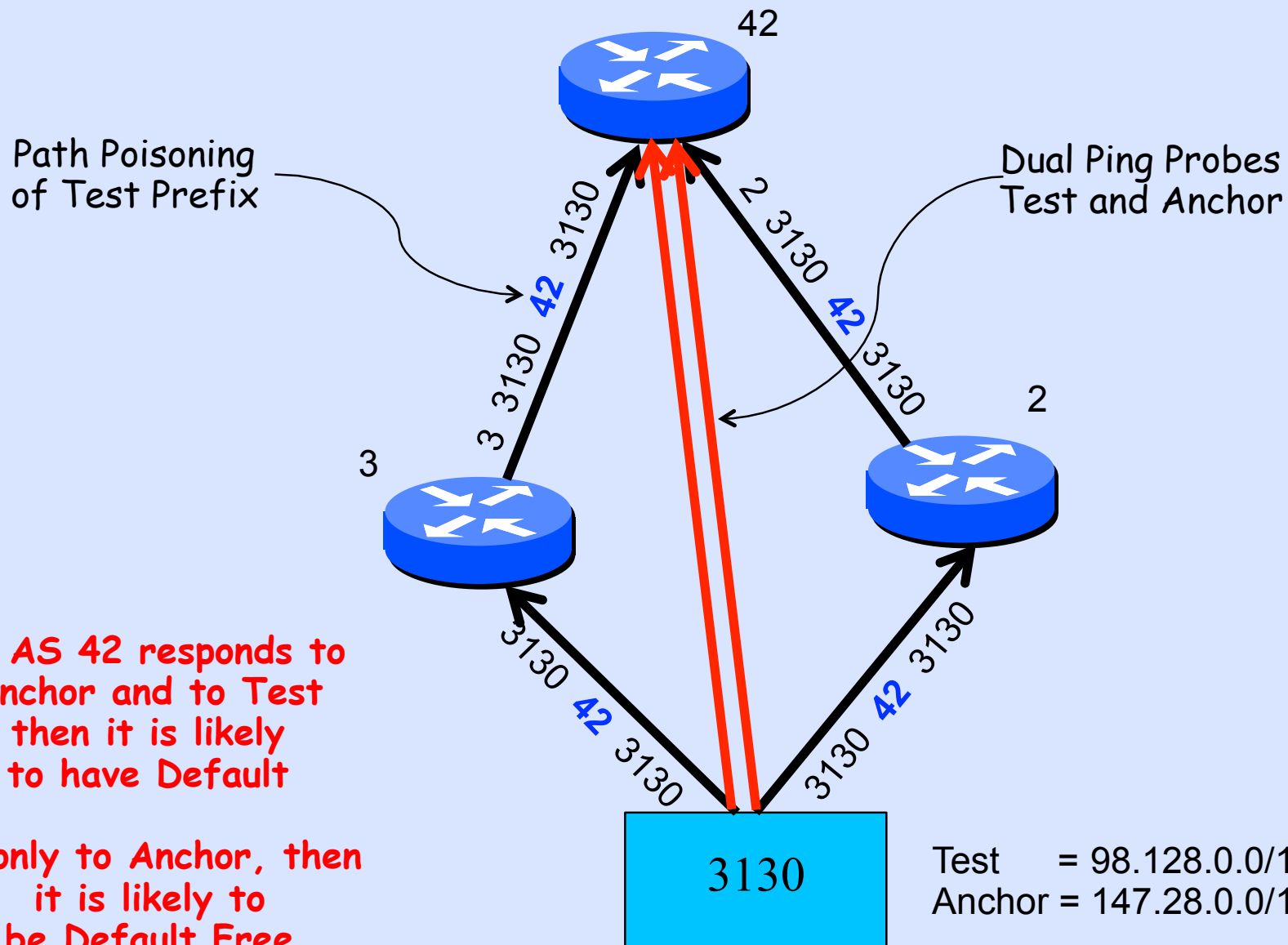- RV/RIS/... showed 15 ASs could see it

Whoops!

- We used ping from the /25 to 'all' ASs
- 1024 ASs could get packets back to the /25 source!
- So Route-Views and RIS were off by a FACTOR OF 60!
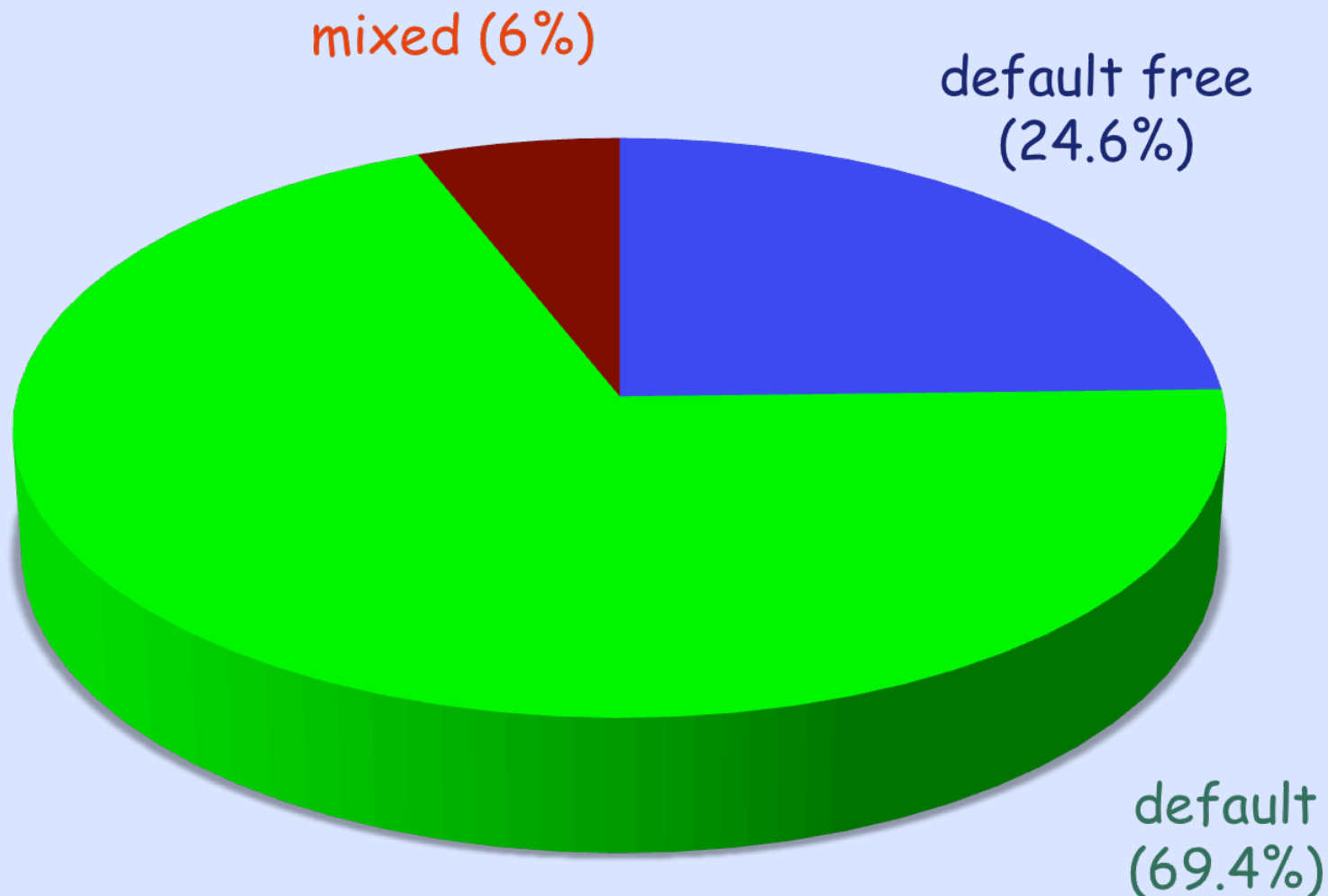- And one was as good/bad as another, adding more views did not help.

/25 AS Hops

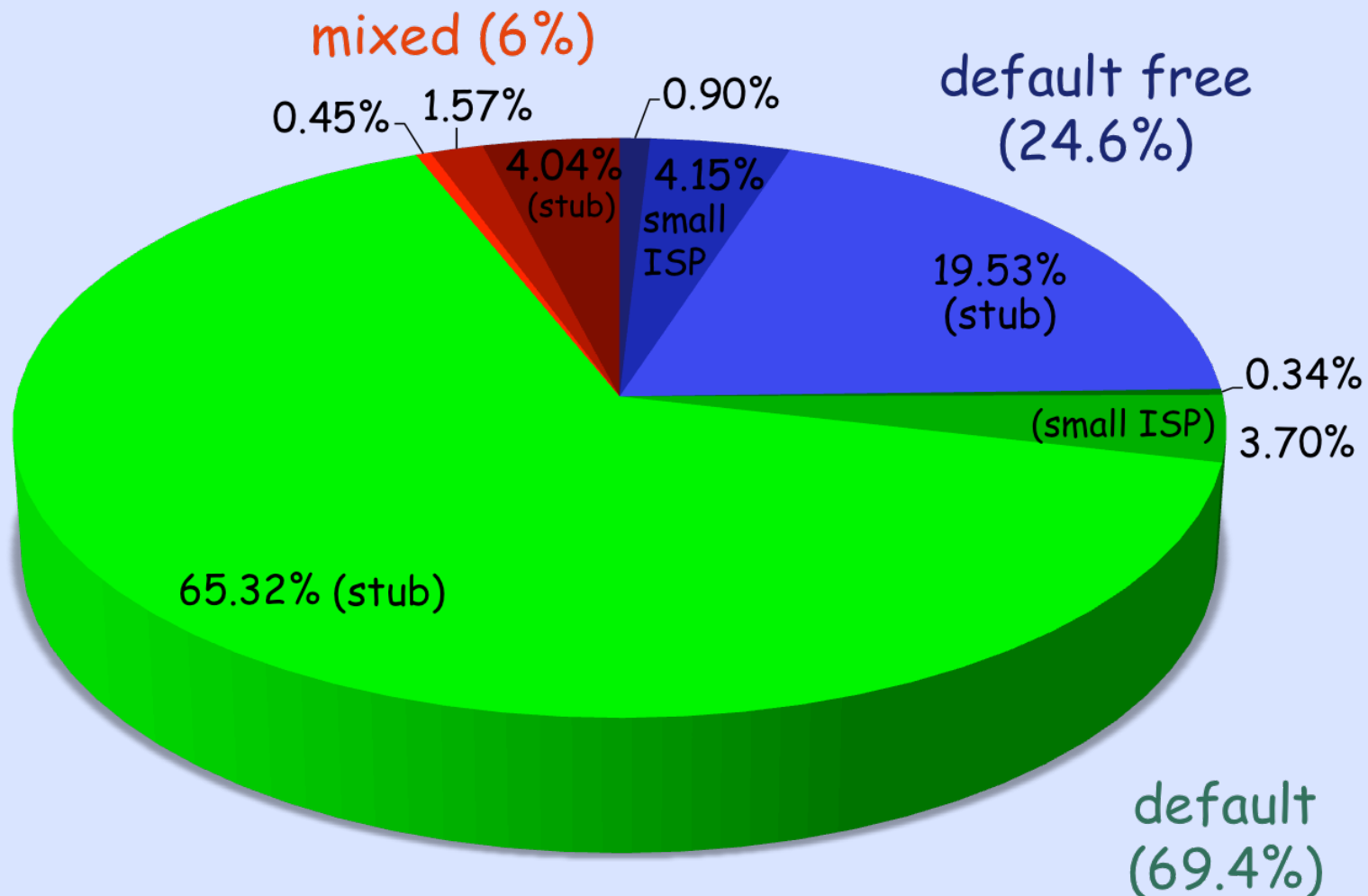# How Much of This was Due to Default as Opposed to Poor BGP Visibility?

Default Detection

42

Path Poisoning
of Test Prefix

Dual Ping Probes
Test and Anchor

3130

42 3130

2 3130

3 3130

42 3130

3 3130

42 3130

3

2

3130 42 3130

3130 42 3130

**If AS 42 responds to
Anchor and to Test
then it is likely
to have Default**

**If only to Anchor, then
it is likely to
be Default Free**

3130

Test   = 98.128.0.0/16
Anchor = 147.28.0.0/16

Use of Default toward /25

mixed (6%)

default free (24.6%)

default (69.4%)

Defaults in /25-Experiment

mixed (6%)

0.45% 1.57%

0.90%

4.04% (stub)

4.15% small ISP

default free (24.6%)

19.53% (stub)

0.34%

(small ISP)

3.70%

65.32% (stub)

default (69.4%)

Default Free Zone?
Not Really!

Testing Most ASes

UCLA taxa	tested/total	default	default-free	mixed
stub	24,224/31,517	77.1%	19.3%	3.6%
small ISP	1,307/1,361	44.5%	42.2%	13.3%
large ISP	246/255	17.1%	60.6%	22.3%
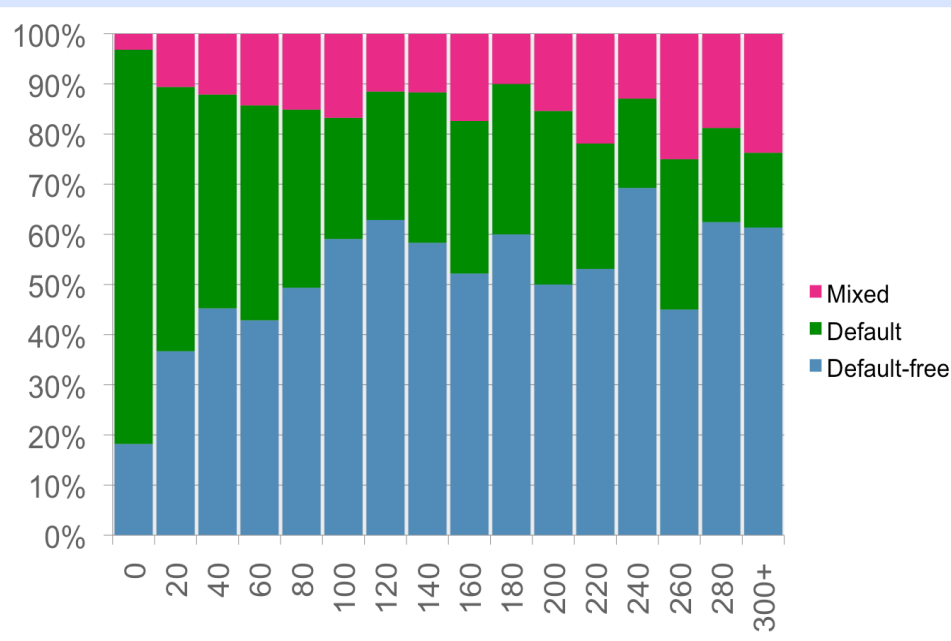
Default routing use as a function of AS out-degree

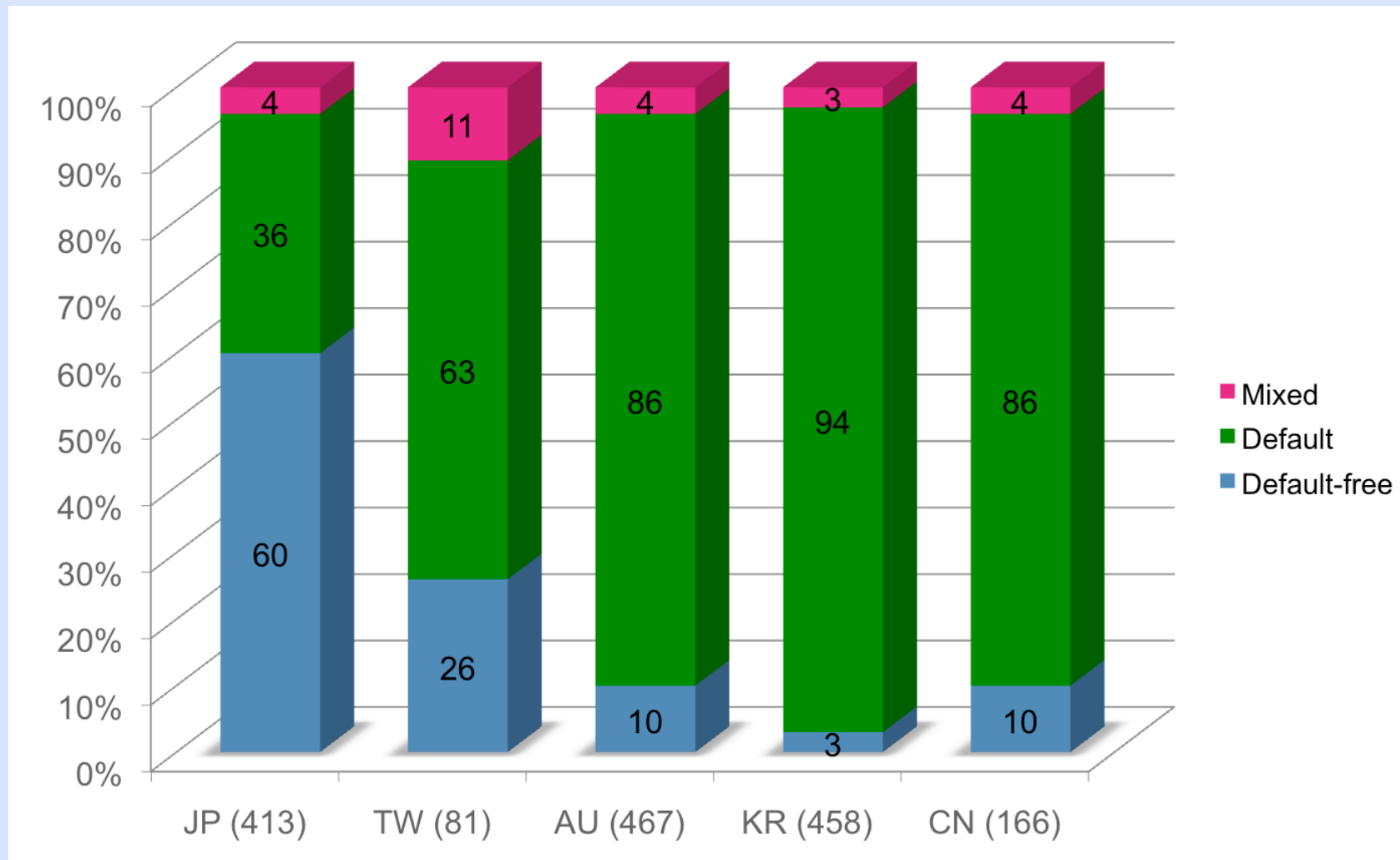ASes with out-degree ≥ 300 are combined in the last value.

But Japan is Different
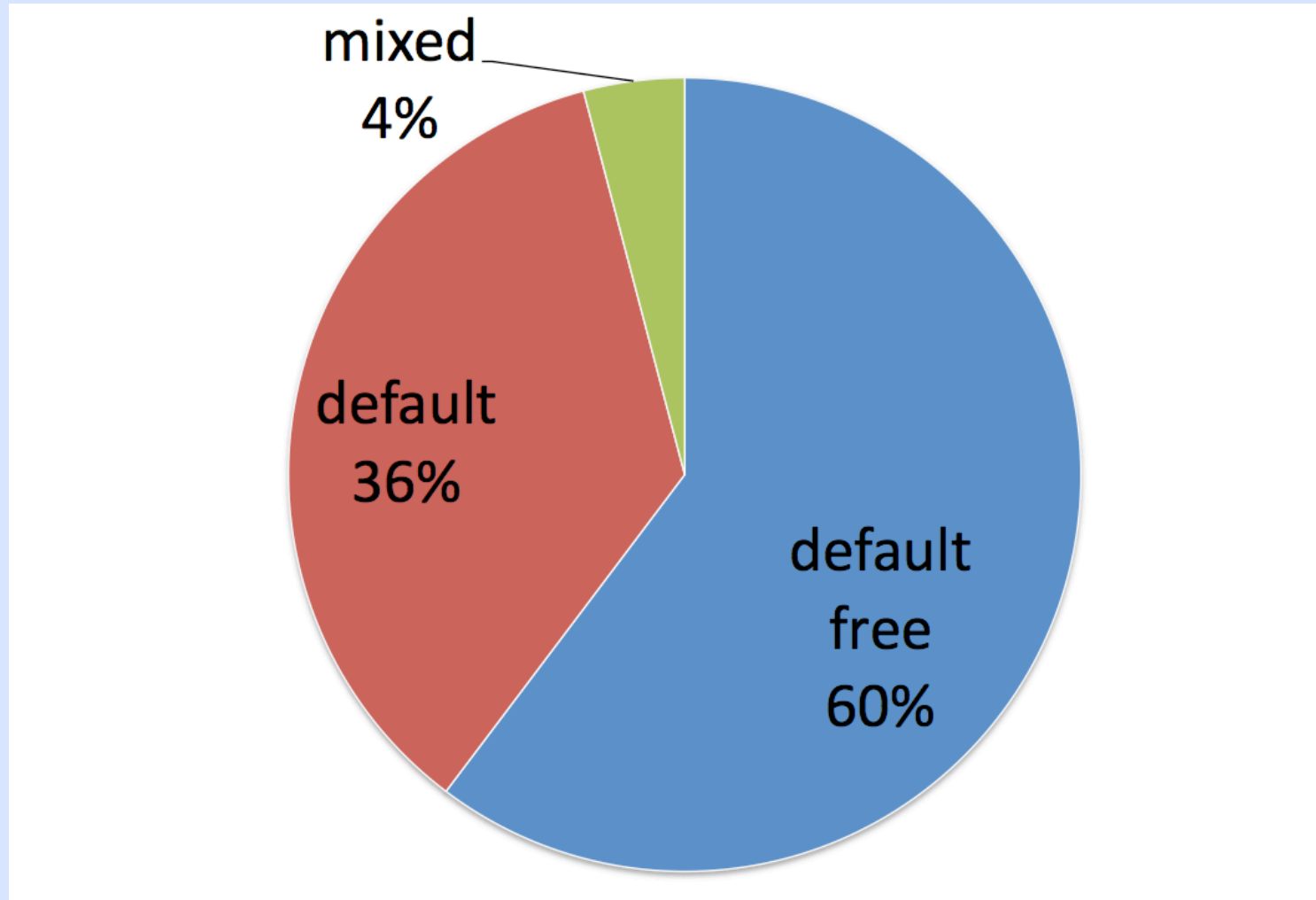
Tomoya Yoshida <yoshida@nttv6.jp>

Asia Varies Widely
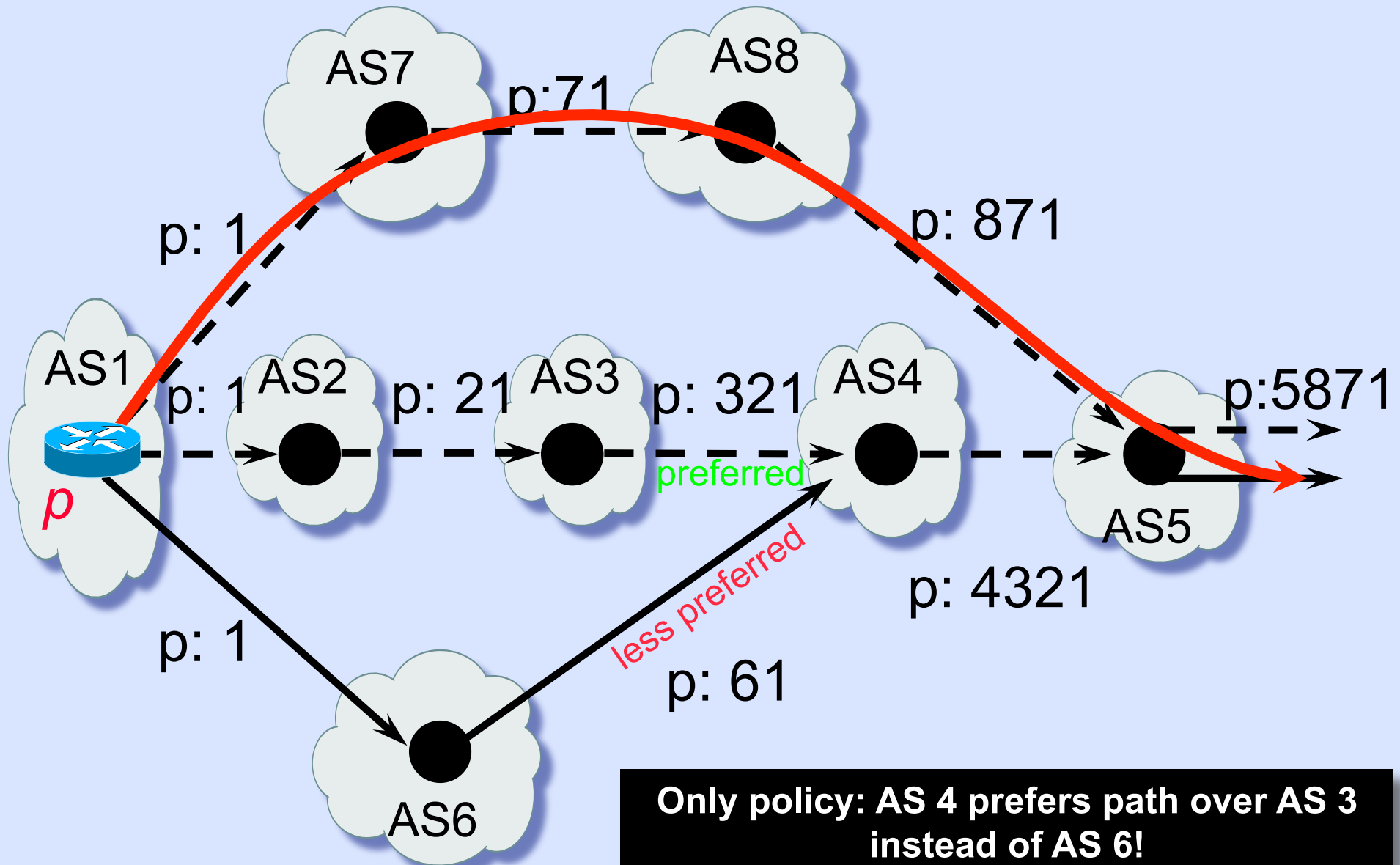

Tomoya Yoshida <yoshida@nttv6.jp>

Validation – We Asked

- 216 operators answered,
- 172 (79.6%) said "correct",
- 21 (9.7%) "almost" correct (e.g., correctly measured, but network is more complex),
- 10 (4.6%) believed we were right (did not recheck),
- 8 (3.7%) we measured wrongly (e.g., AS address space from different provider),
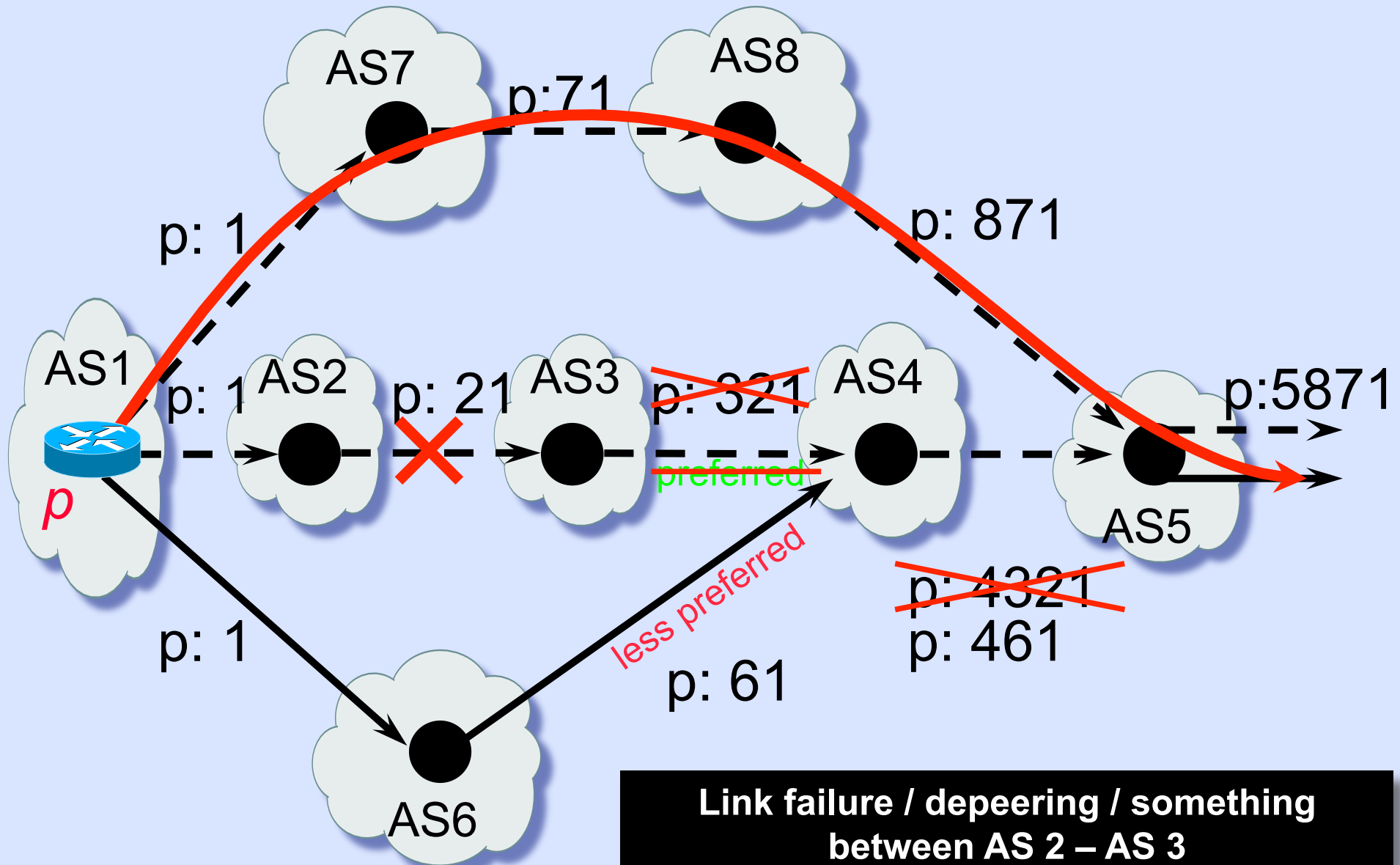- 5 (2.3%) said we must be wrong ☺

Our Glasses are Broken

- Looking in RV/RIS/... does not tell you if they can reach you
- Looking just in RV or RIS is as good (well bad) as hundreds of BGP feeds
- Researchers should be very wary of using RV/RIS data for many classes of analysis, e.g. AS topology, traffic
- Are Renesys-style presos bogus?

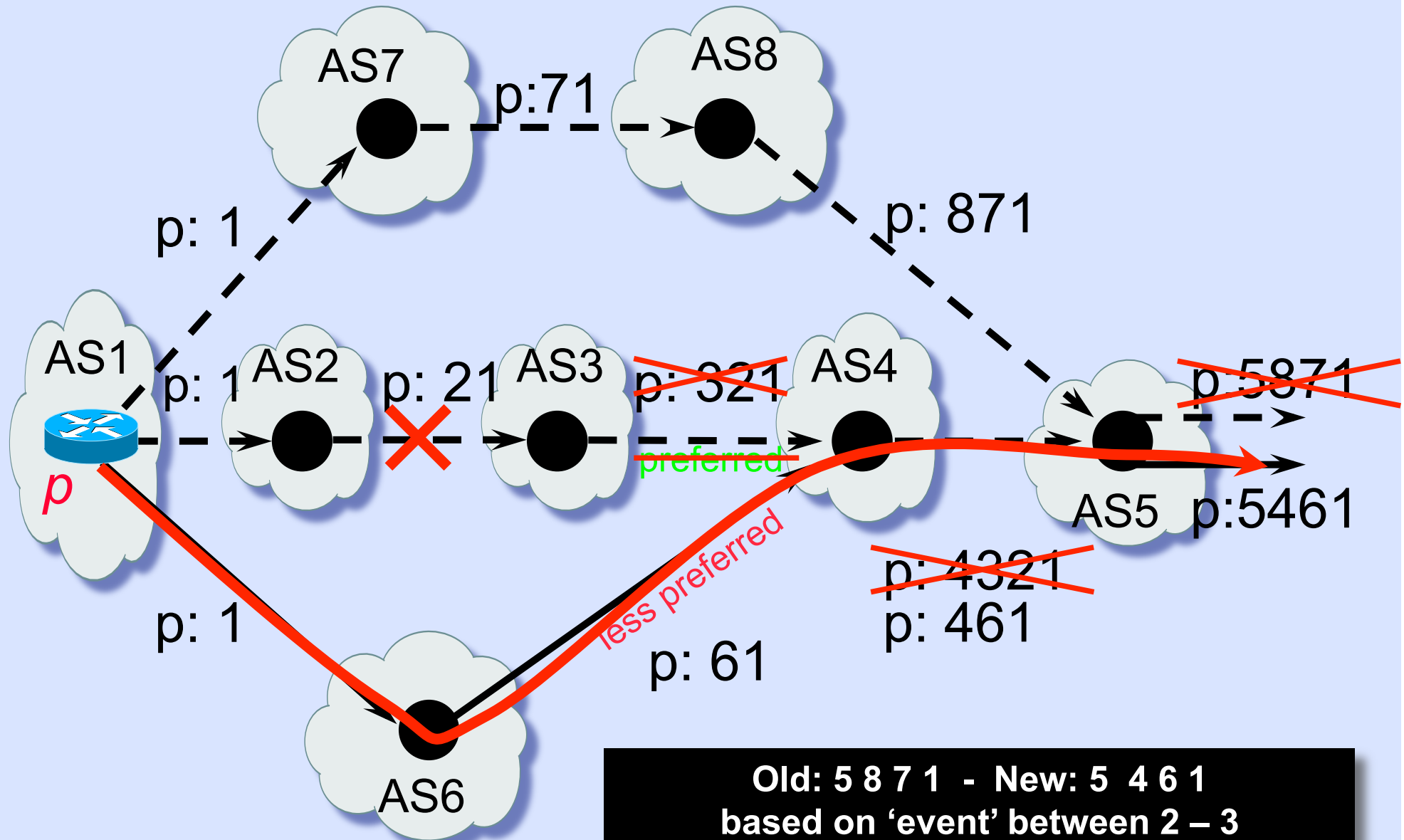**Policy Interactions** – the "fun" of BGP research… ;-)

AS7

AS8

p:71

p: 871

p: 1

AS1

p: 1 AS2   p: 21 AS3   p: 321 AS4   p:5871

p

preferred

AS5

p: 4321

p: 1

less preferred

p: 61

AS6

Only policy: AS 4 prefers path over AS 3 instead of AS 6!

Policy Interactions – the "fun" of BGP research… ;-)

AS7

p:71

AS8

p: 1

p: 871

AS1

p: 1 AS2   p: 21   AS3   p: 321   AS4   p:5871

p

preferred

less preferred

AS5

p: 1

p: 4321
p: 461

p: 61

AS6

Link failure / depeering / something between AS 2 – AS 3

Policy Interactions – the "fun" of BGP research… ;-)

How do you know

if this is what happened?

-

Not good for BGP-based

formal Root Cause Analysis

Work Supported By

- ## Cisco
  SUPPORTED IN PART BY A CISCO UNIVERSITY RESEARCH PROJECT GIFT VIA KEIO UNIVERSITY

- ## Internet Initiative Japan

- ## Google, NTT, Equinix