RIPE NCC
RIPE NETWORK COORDINATION CENTRE

Measuring IPv6 Adoption

What is the status?

Christian Teuschel | September 2016 | IPv6 Day Israel

Measurement Types

- Passive Measurements
  - Registry data
  - Routing Information System (RIS)
- Active Measurements
  - RIPE Atlas
  - APNIC Google ad measurements
  - Google IPv6
  - Cisco IPv6
  - Maxmind IPv6 geolocation
  - Alexa

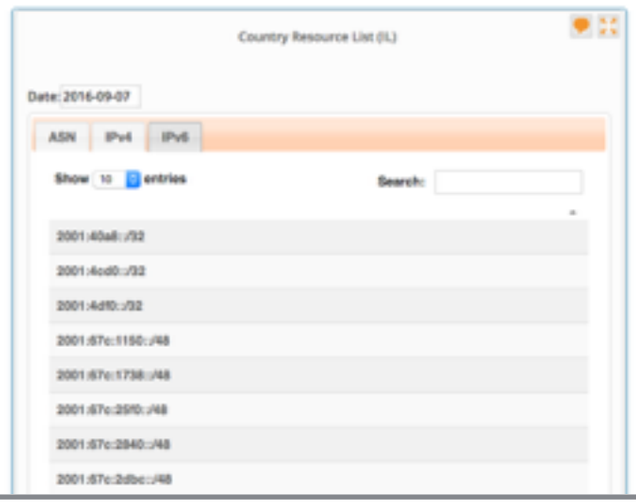
Registry Data

- RIPE Database
  - Allocation and assignment information
  - Resources in Israel:

IPv6 68
IPv4 449

RIPE NCC
RIPEstat

https://stat.ripe.net/IL#tabId=database



Registry Data

- RIPE Database
  - Allocation and assignment information
  - Resources in Israel:

IPv6 68
IPv4 449

15%

Registry Data

- RIPE Database
  - Allocation and assignment information
  - Resources in Israel:

IPv6 68
IPv4 449

15%

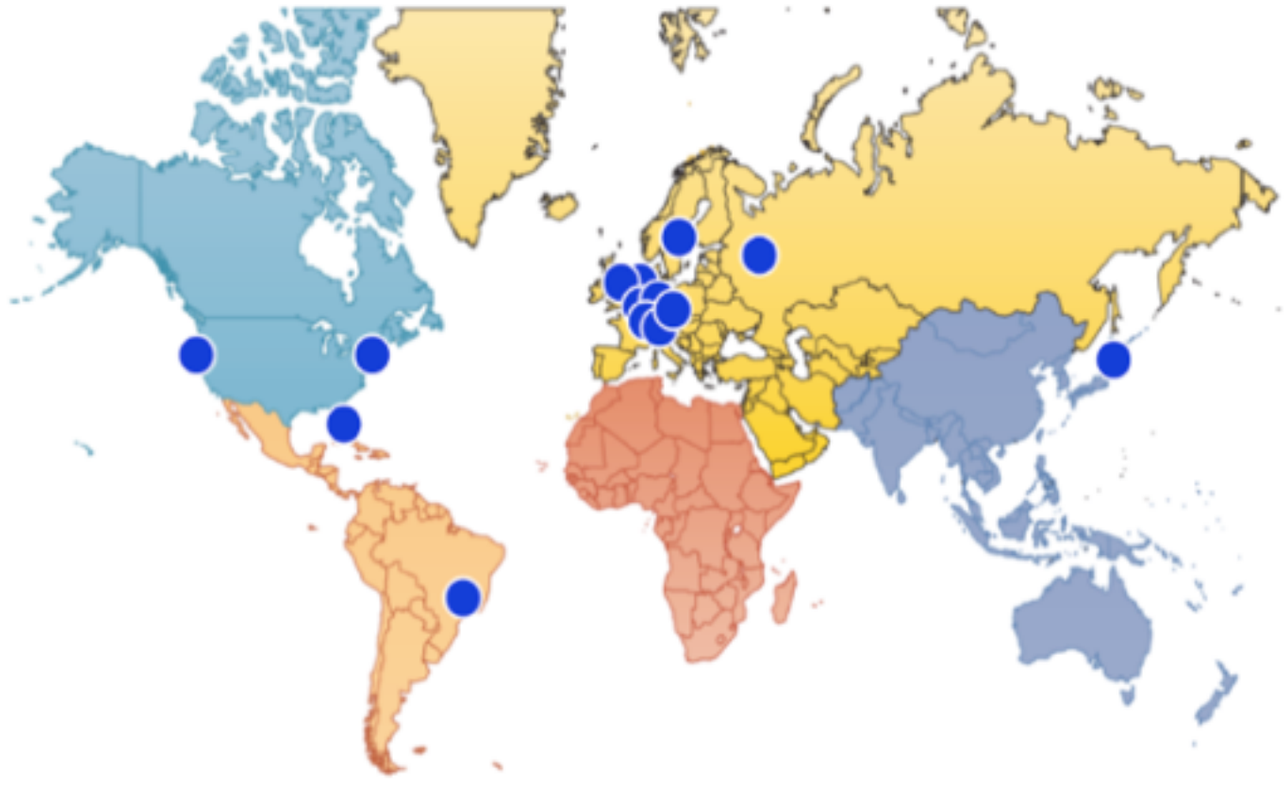
  - Registered space in Israel:

4,194,305,792 IPv6 (/56)
7,607,040 IPv4

550%

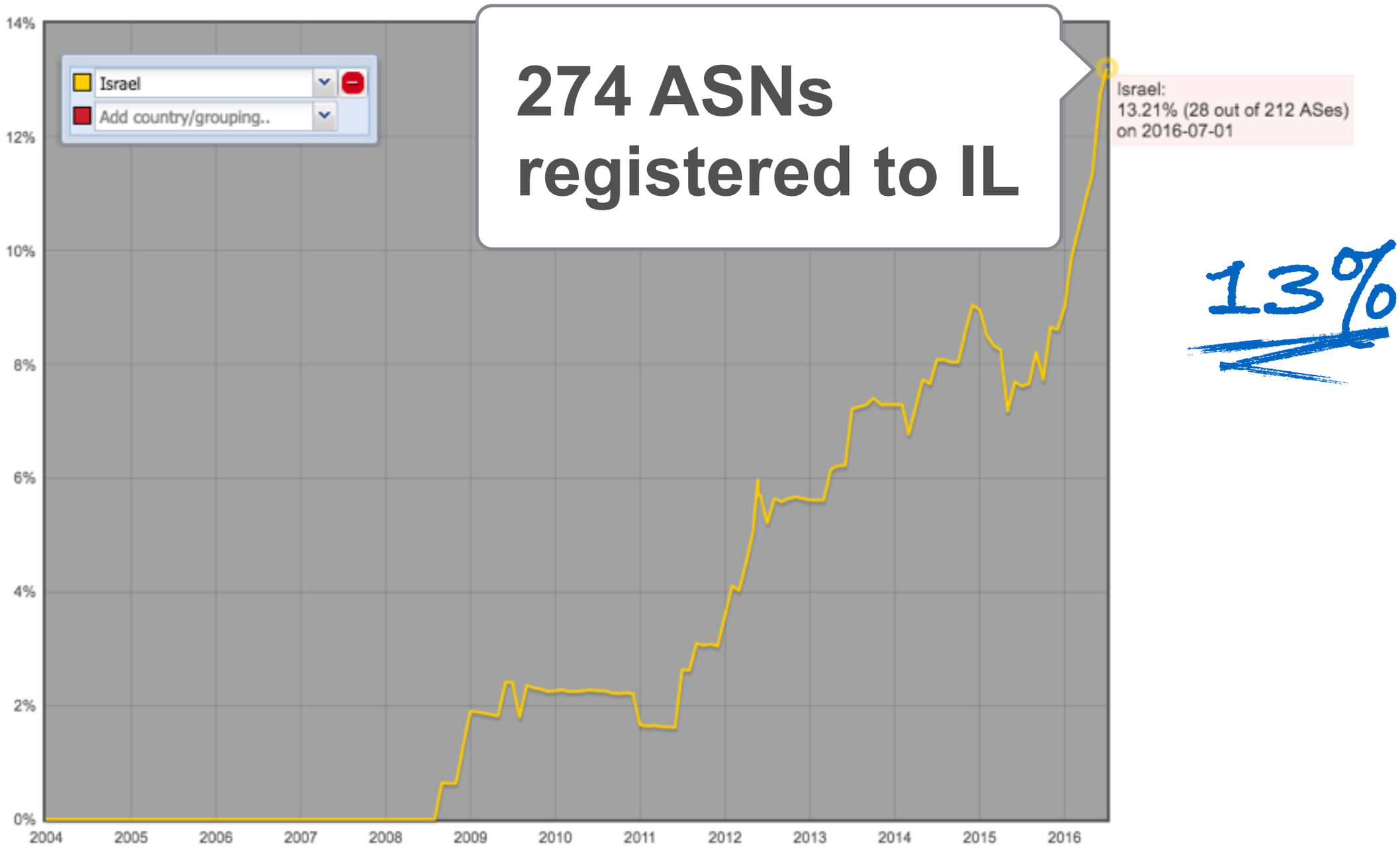
Routing Information

- RIS
  - The RIPE NCC has been collecting BGP information since 1999
  - 18 collectors
  - 160+ full-feed peers
  - http://ris.ripe.net



Routing Information

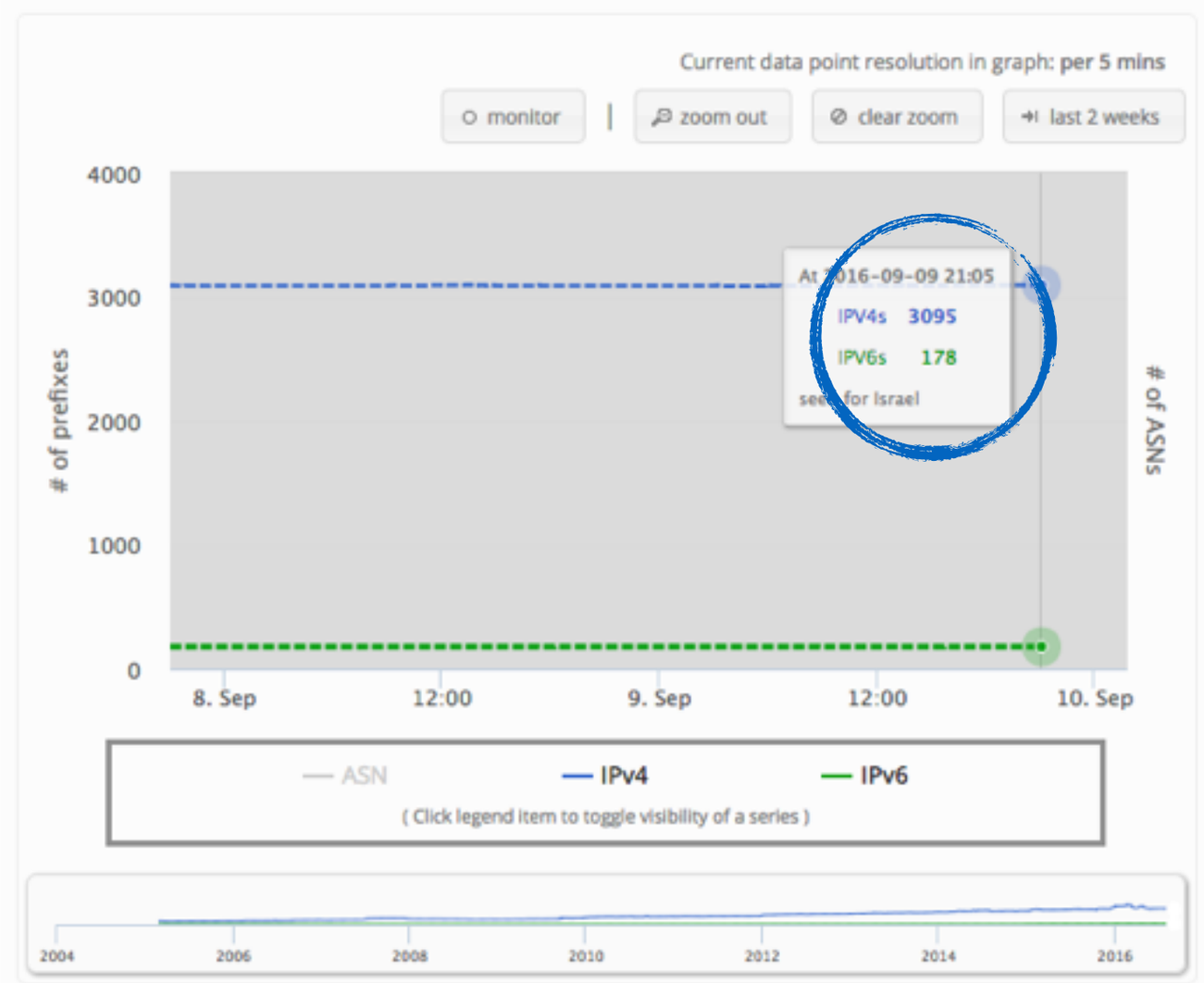
- http://v6asns.ripe.net/v/6?s=IL



13%

Routing Information

- RIS
  - Resources globally seen from Israel



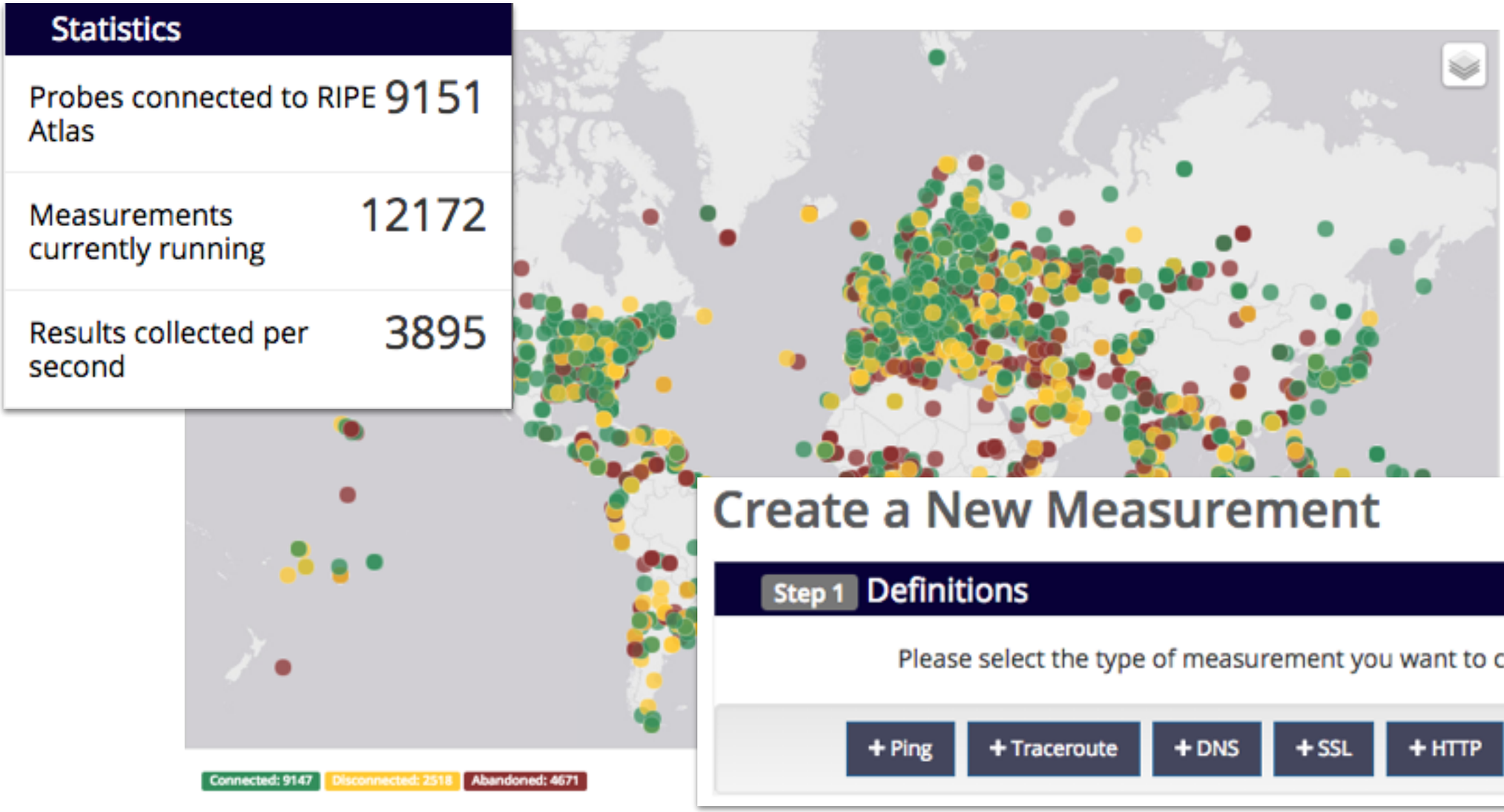
6%

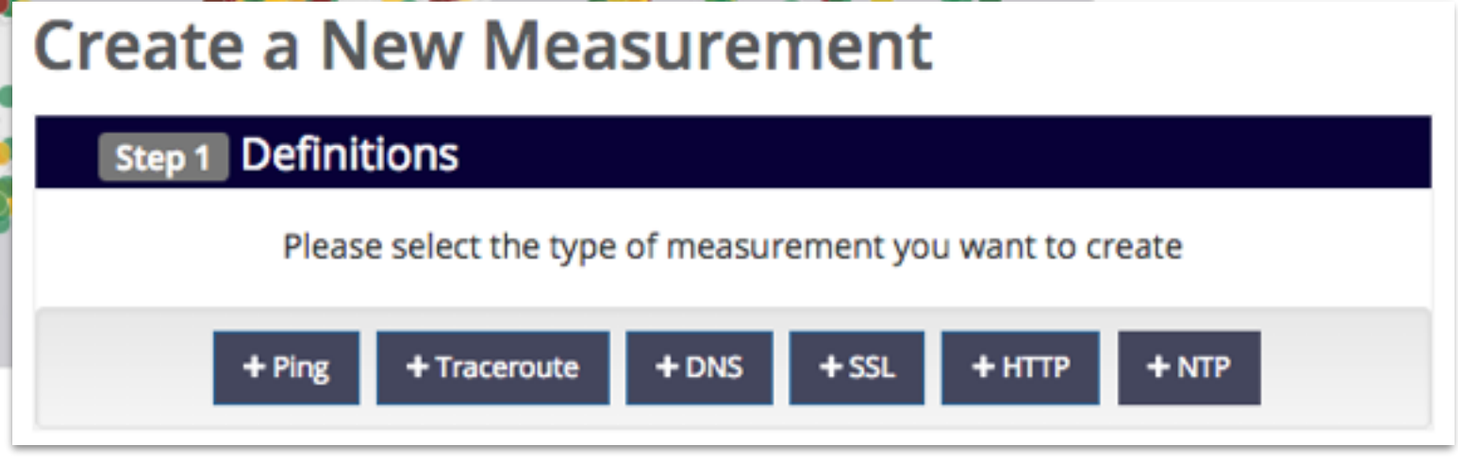
RIPE NCC
RIPEstat

https://stat.ripe.net/IL#tabId=routing

RIPE Atlas

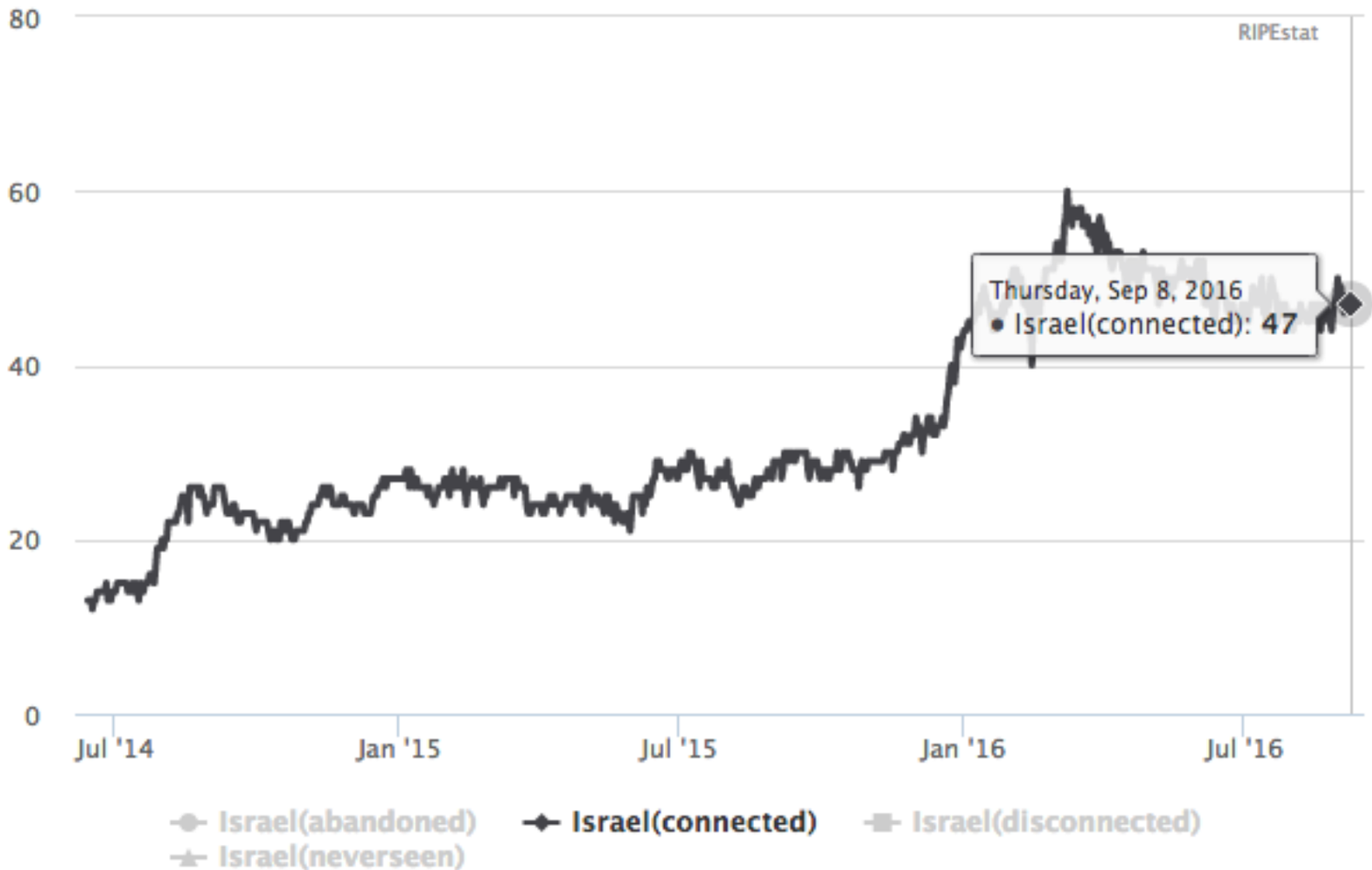
- A brief introduction
  - Global network for Internet measurements





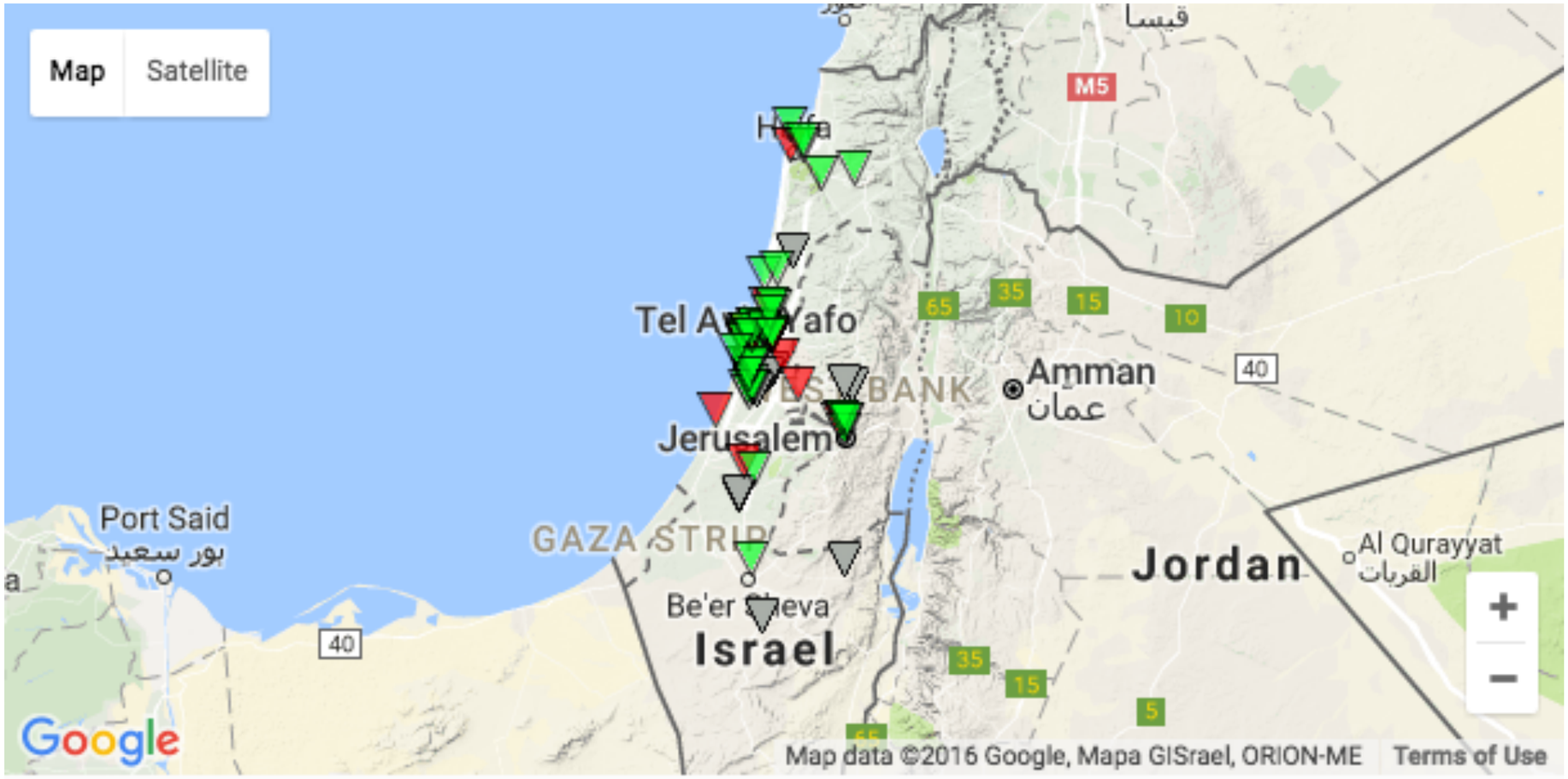
RIPE Atlas

- RIPE Atlas in Israel



RIPE Atlas

- RIPE Atlas in Israel



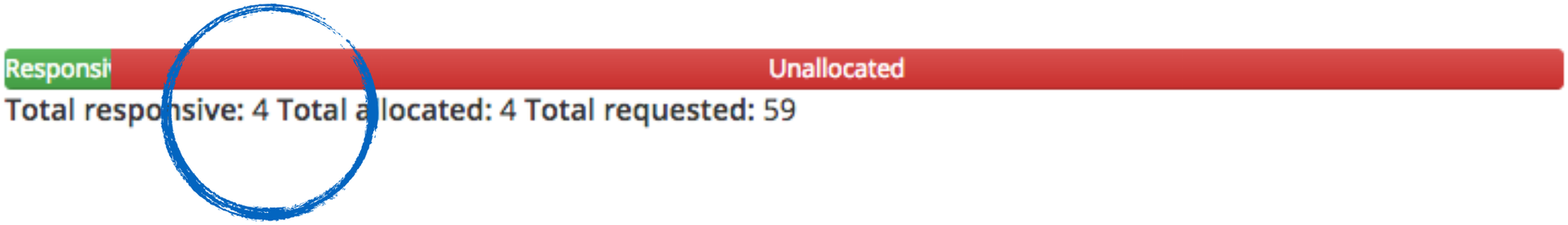
RIPE Atlas

- IXP-Country-Jedi

RIPE Atlas

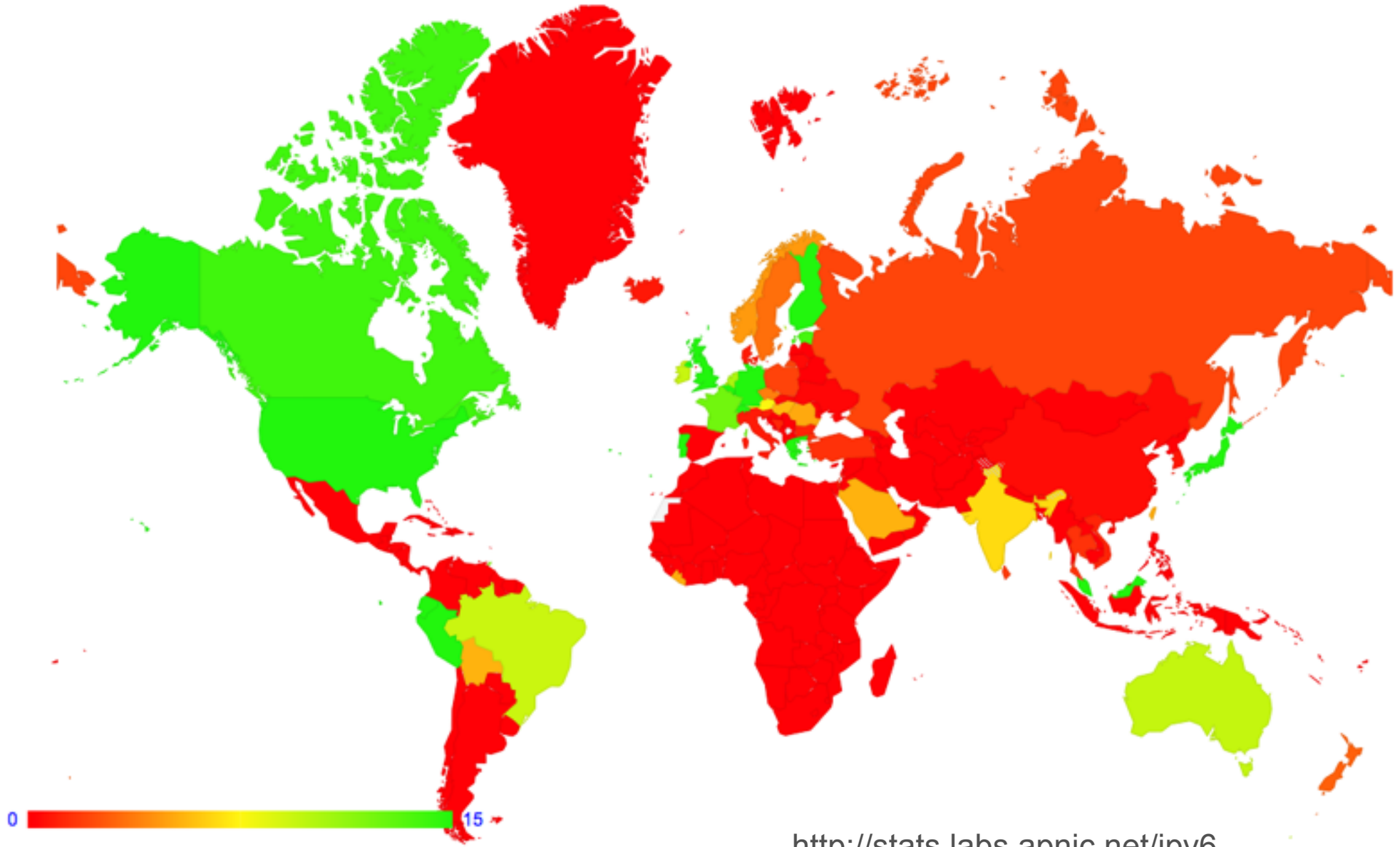
- A closer look at the probes in Israel
  - Test with a simple measurement

Specification	Number of Probes	Include probe tags	Exclude probe tags
Country: IL	59	system: IPv6 Works	system: IPv6 Doesn't Work



APNIC IPv6 Measurements

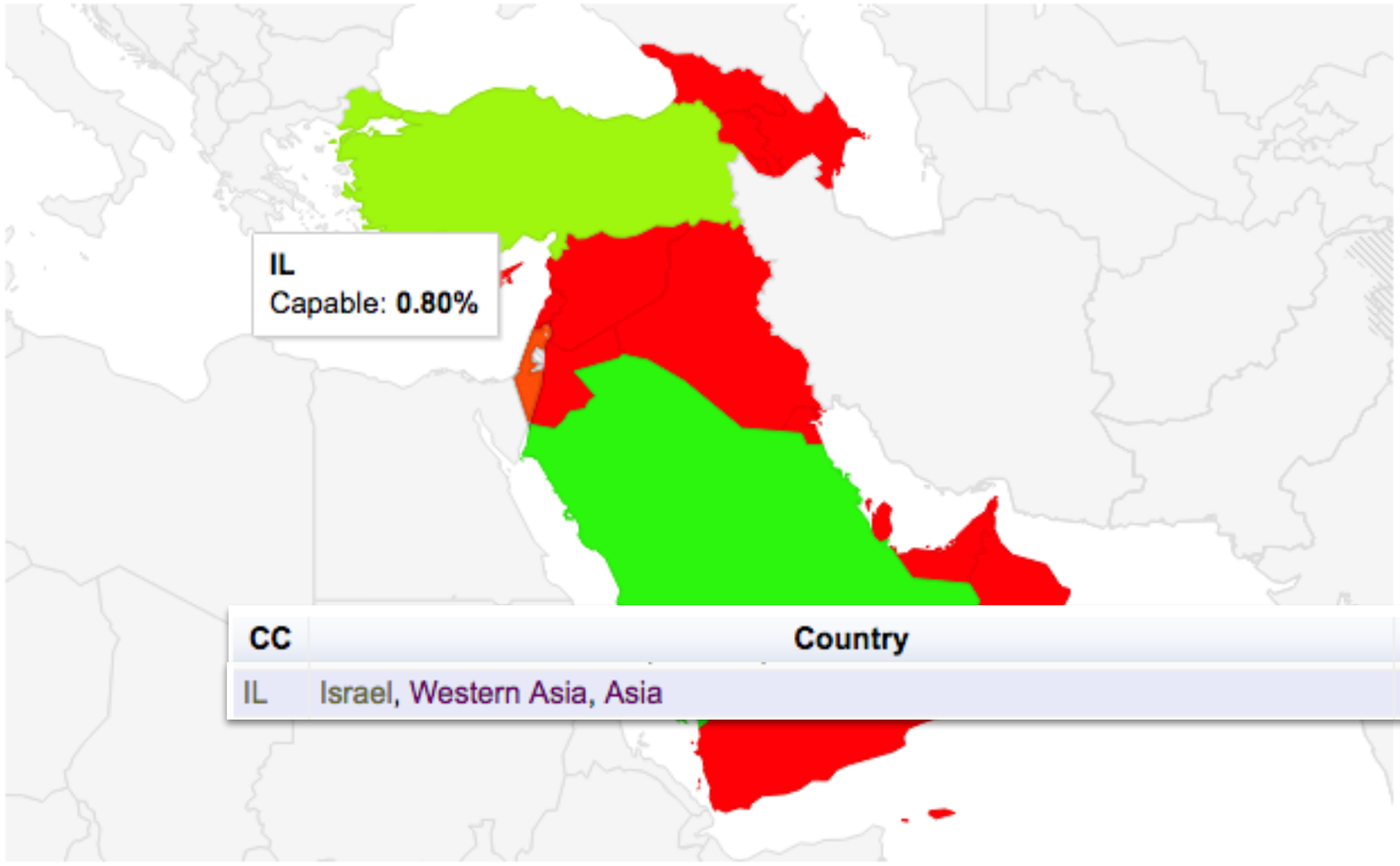
- Based on Google advertisements



http://stats.labs.apnic.net/ipv6

APNIC IPv6 Measurements

- Results for Israel



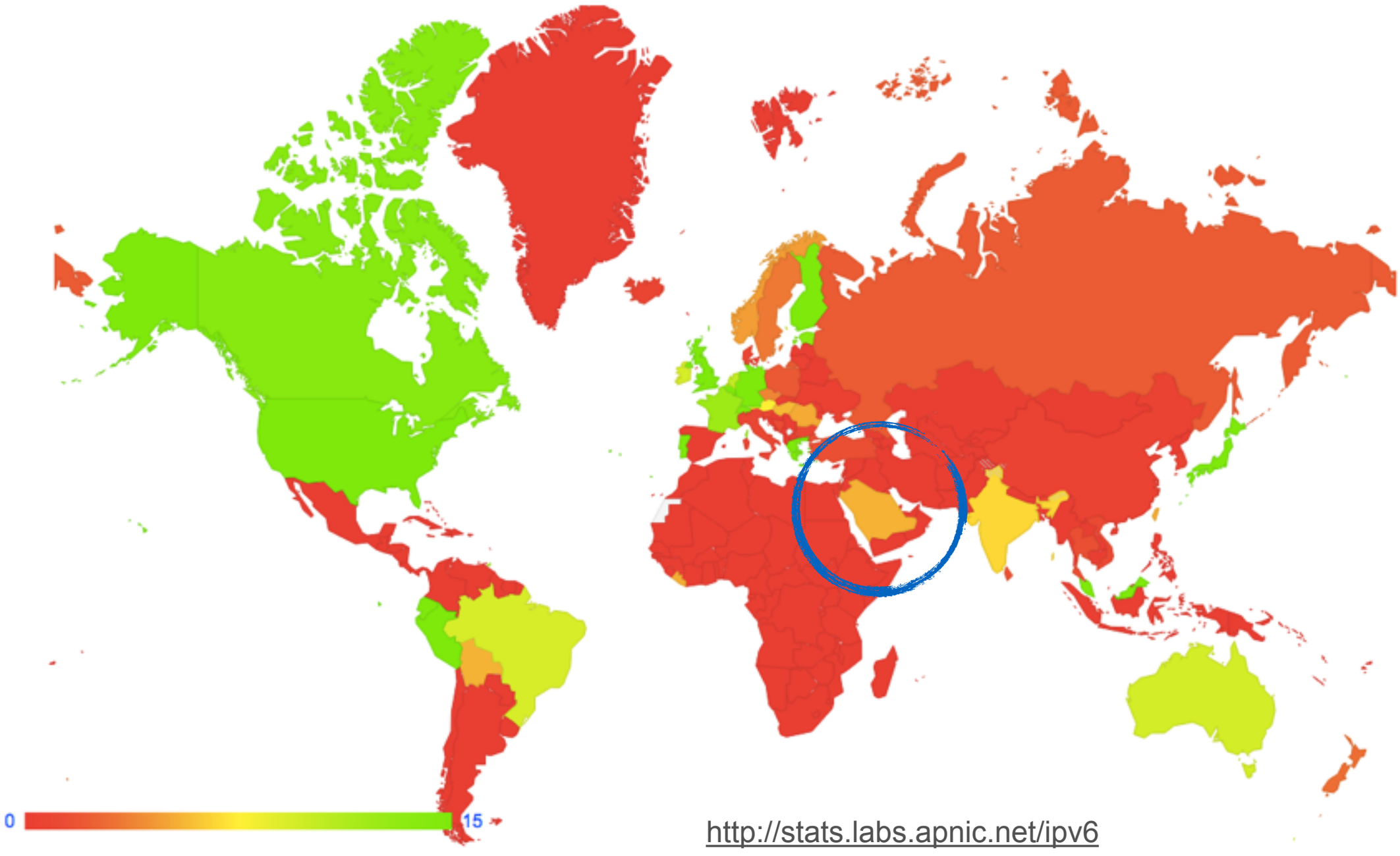
http://stats.labs.apnic.net/ipv6/IL

CC	Country	IPv6 Capable	IPv6 Preferred	Samples
IL	Israel, Western Asia, Asia	0.80%	0.75%	1,834,292

0.8%

APNIC Measurements

- World map again



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APNIC Measurements

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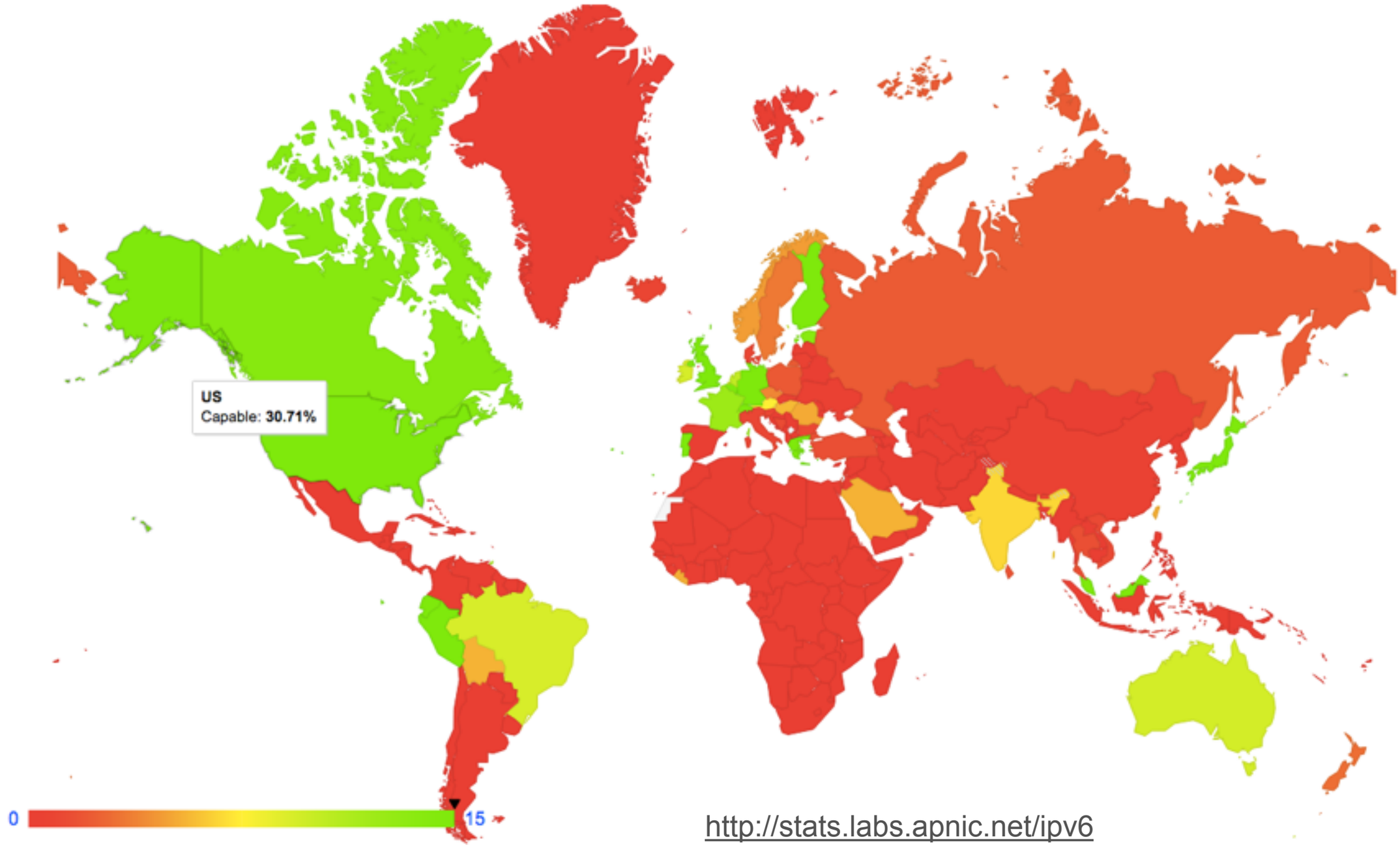

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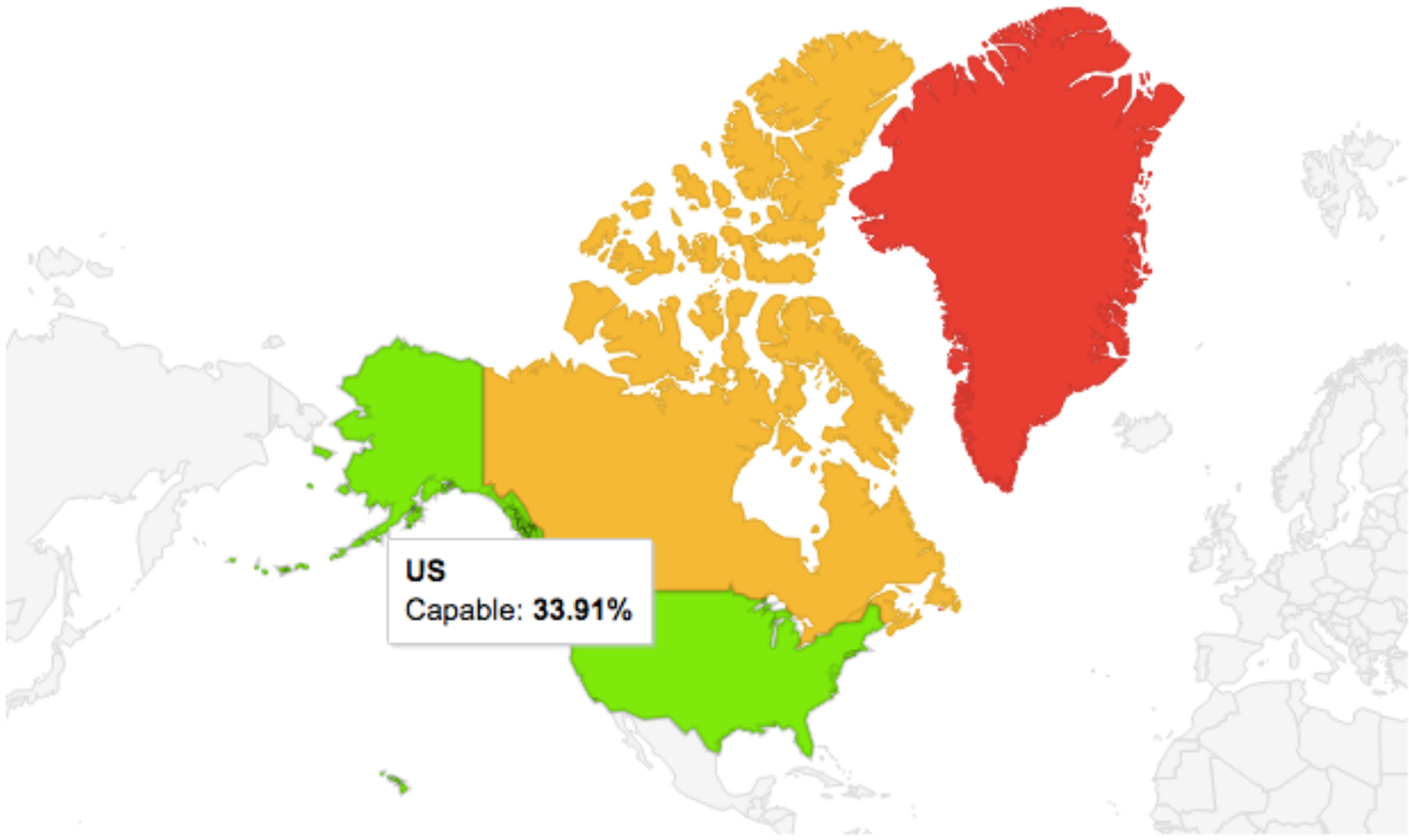
APNIC Measurements

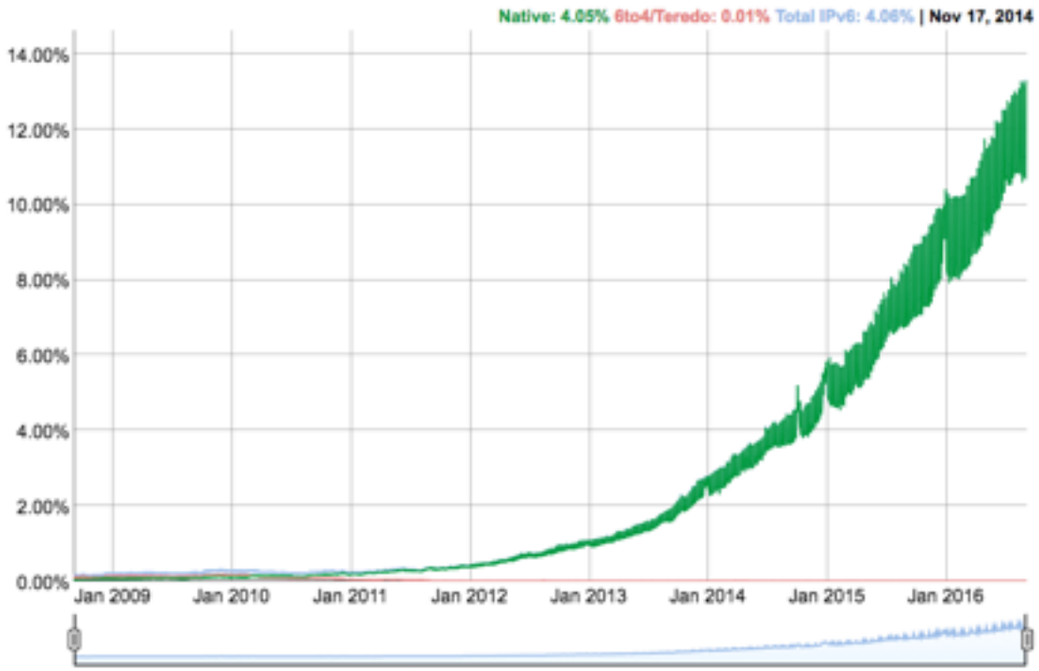
- Results for the US

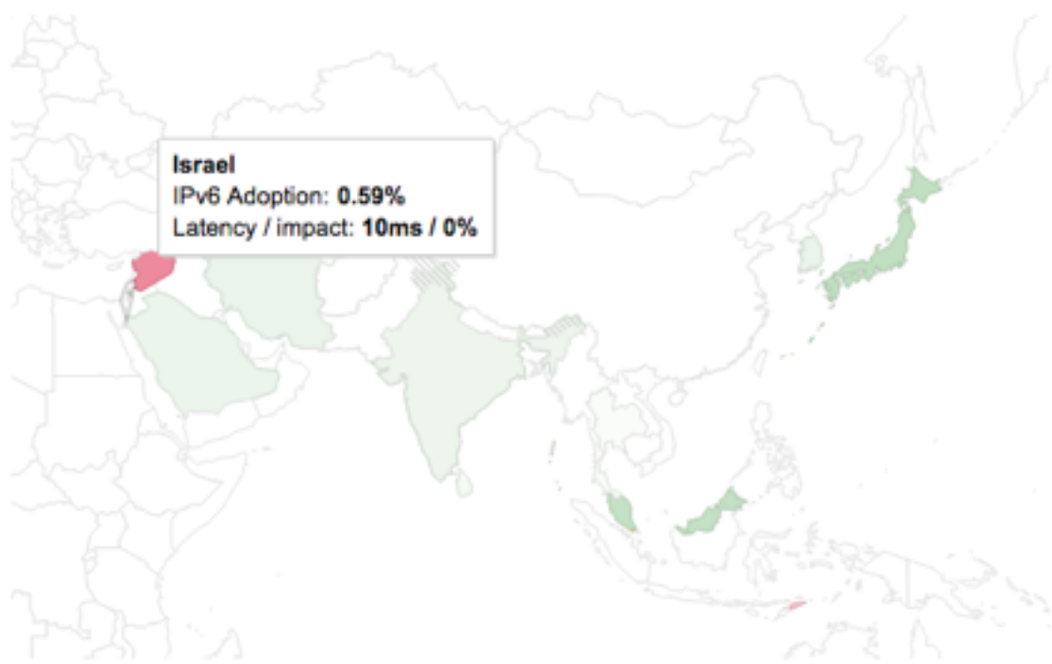
http://stats.labs.apnic.net/ipv6/US



Google IPv6 Statistics

- Based on Google's view of the Internet
  - https://www.google.com/intl/en/ipv6/statistics.html





0.59%

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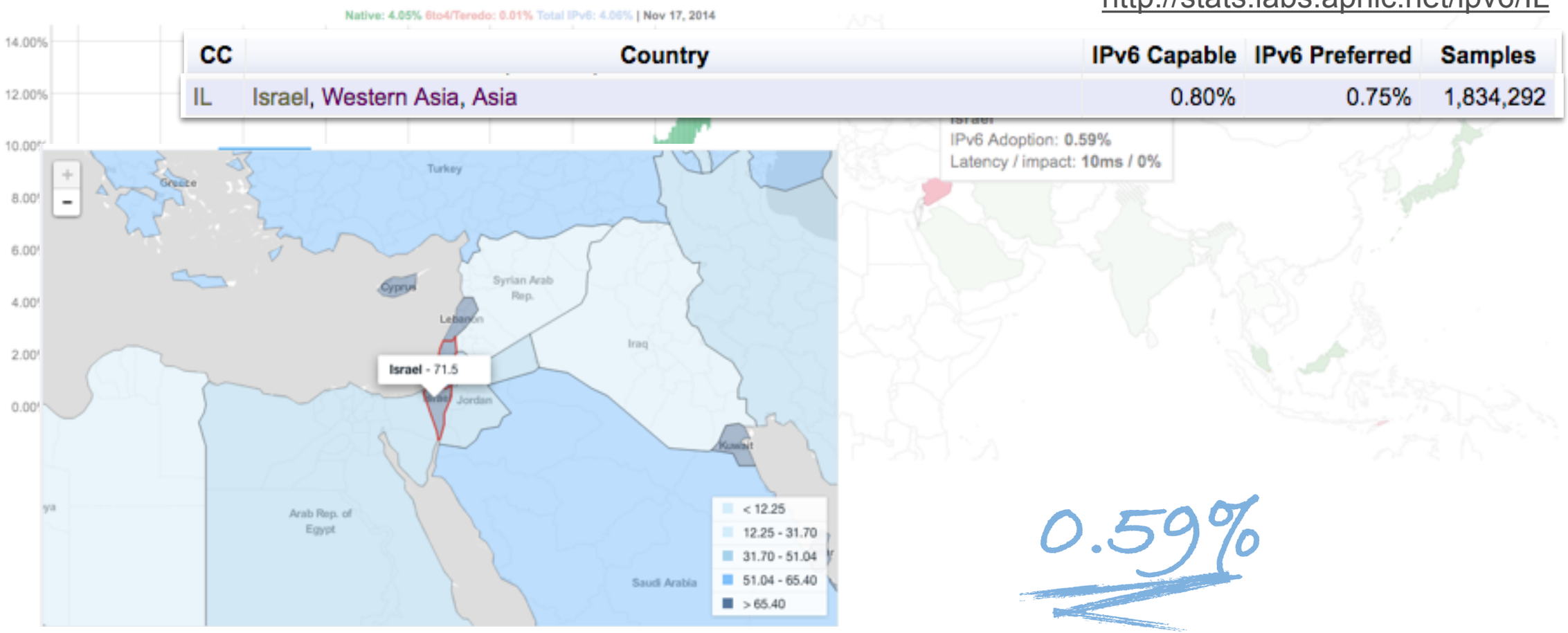

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IL	Israel, Western Asia, Asia	0.80%	0.75%	1,834,292

0.59%

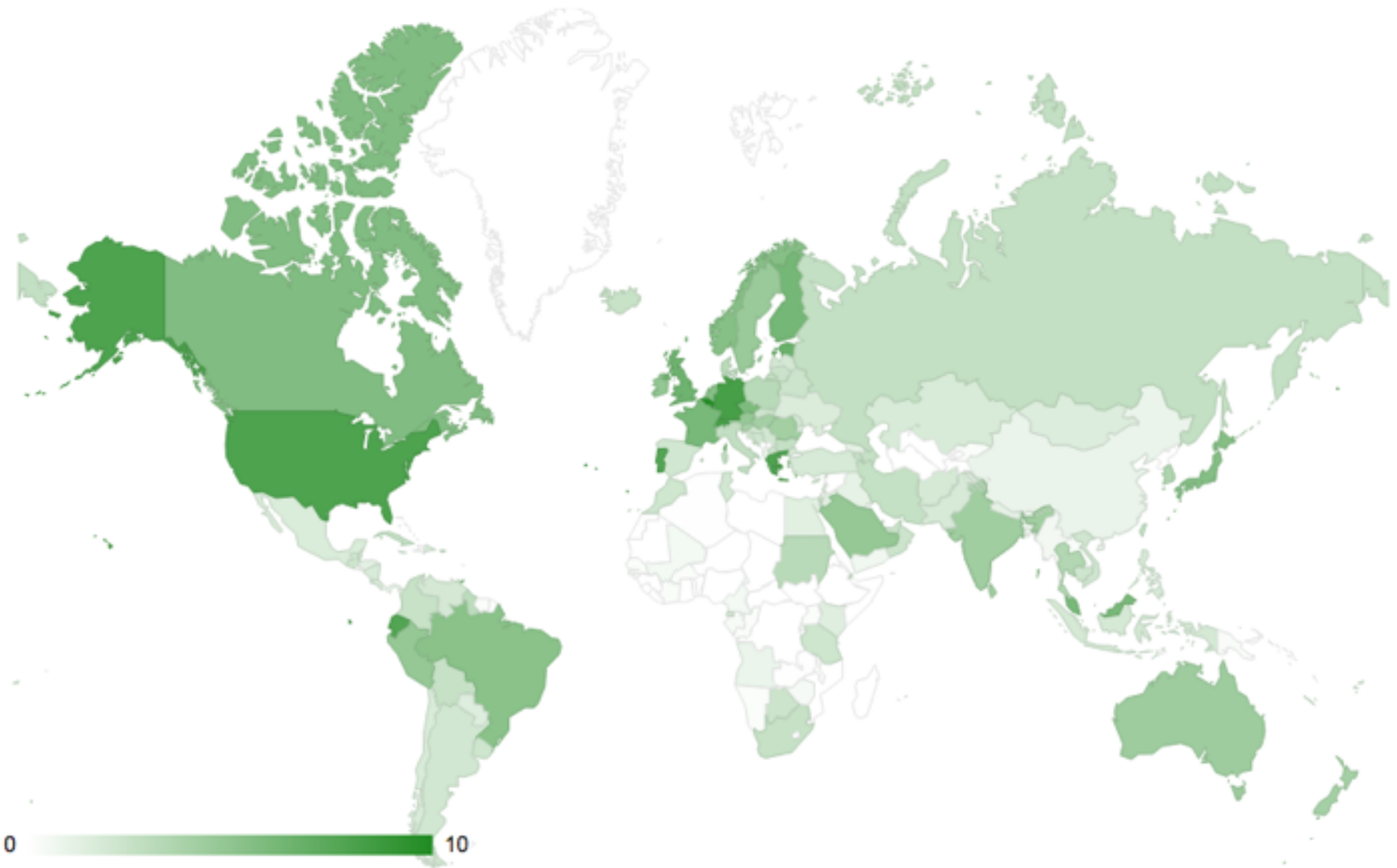
http://http://data.worldbank.org/

Cisco IPv6 Lab

- http://6lab.cisco.com/
- Based on data from:
  - RIRs
  - routeviews
  - Alexa
  - Google
  - ITU
  - APNIC

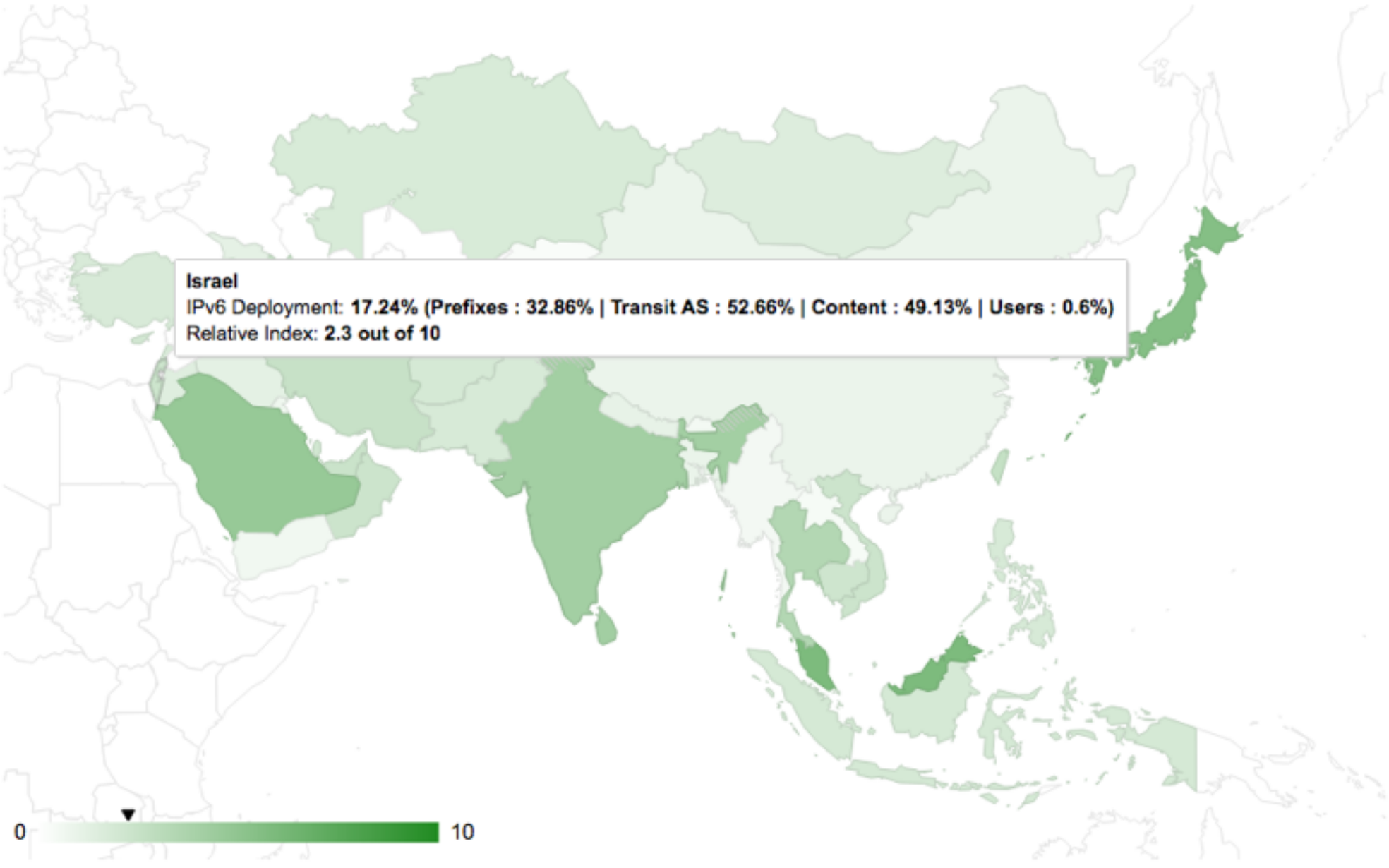
Cisco IPv6 Lab

- World Map



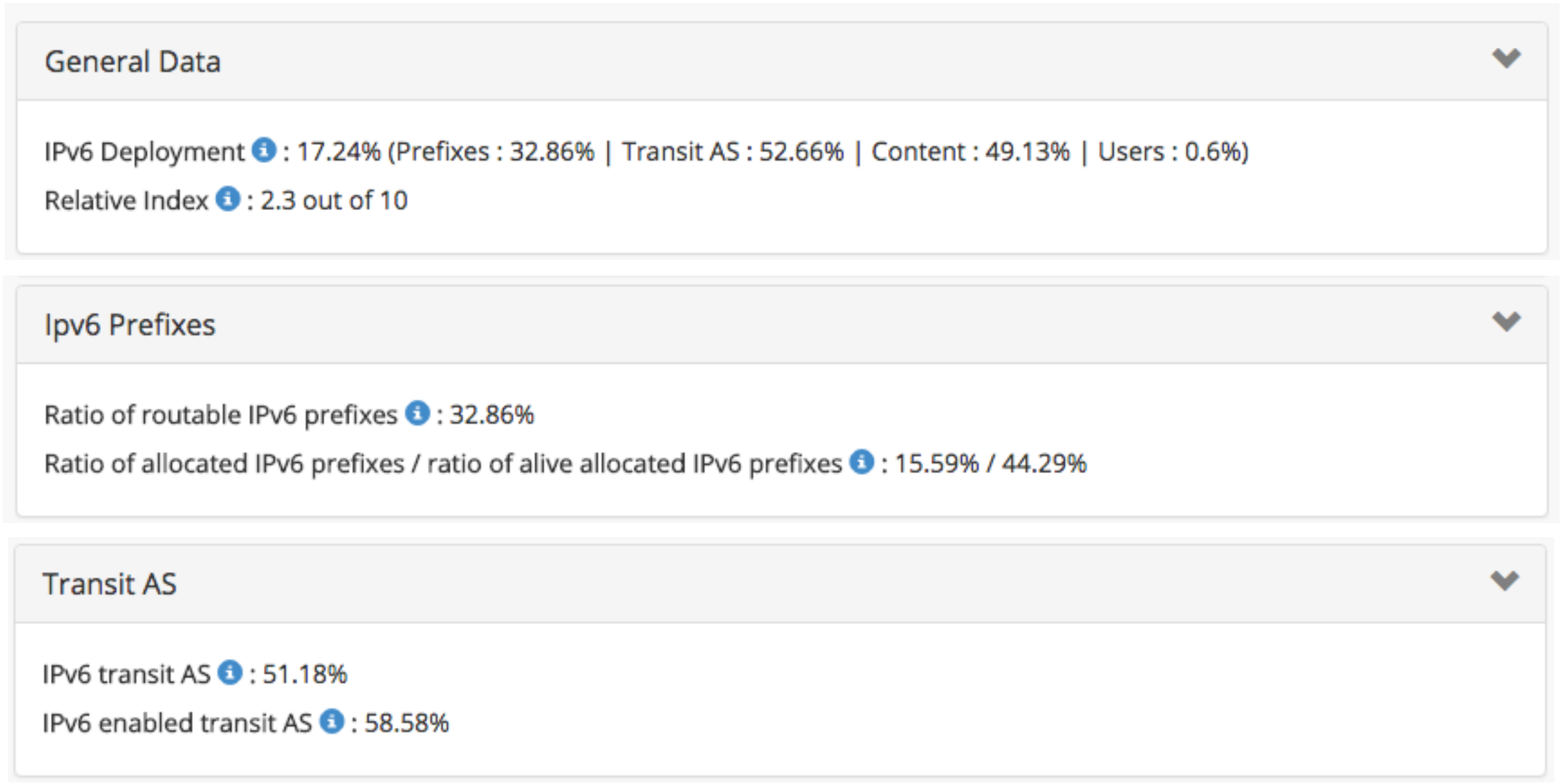
Cisco IPv6 Lab

- Zoom into Israel



Cisco IPv6 Lab

- http://6lab.cisco.com/stats/search.php



Cisco IPv6 Lab

- http://6lab.cisco.com/stats/search.php

Content

% of Web pages available over IPv6 : 49.13% | number of working IPv6 sites: 62/500

In development/test : 0.08% (2/500) | Failing IPv6 sites: 0.19% (2/500) | Not V6 enabled: 50.64% (434/500)

Users

Google Search / APNIC data : 0.6% / 1.03%

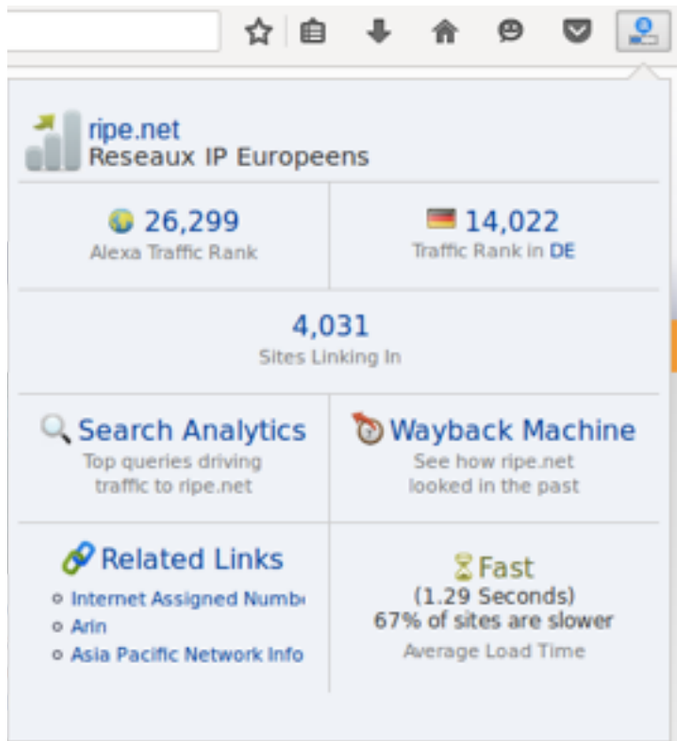
Estimation : 37 K IPv6 users

$$DeploymentRatio = \frac{\%TransitAS + 3 \times \sqrt{\%content \times \%user}}{4}$$

17.24%

Active Measurements

- Alexa
  - Data from sink via Alexa toolbar (25k users)
  - Data from source with Alexa script running onsite
  - Measures are relative over time period (three months or one)
  - Methodology: **unique visitors & page views**



Active Measurements

- Alexa
  - “.il” domains out of 1 million
  - 1,575 domains (as of 2016-09-08)
  - Results of DNS resolution:

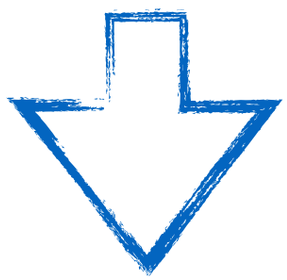
1,543 resolved to an A record (IPv4)
57 resolved to an AAAA record (IPv6)

3.6%

Maxmind

- Geolocation database
  - IPv6 data set filtered for country Israel:

1,688 IPv6 location blocks



4,194,251,392 IPv6 space (/56)

Remember: IPV6 allocation space is 4,194,305,792 (/56) in Israel.
Difference is 54,400!

What's the Takeaway?

- We face data sets with varying quality and purpose
- Data is not wrong but be careful when it comes to interpretation
- Statistical methods can help to deal with uncertainty

RIPEness: The Fifth Star

- Measurement of actual IPv6 deployment at the edge (/LIR)
- Access (eyeballs) networks
  - APNIC Google ad measurements
  - Monthly and half-yearly aggregates
- Content networks
  - Alexa
  - Weighted by inverse of rank (1/<rank>)

RIPEness: The Fifth Star

- Issues
  - Measurement bias
  - Large organisations with multiple LIRs
- Threshold
  - 2012: 1% > 2013: 2% > 2014: 4% > 2015: 8% > 2016: 16%

Questions

christian.teuschel@ripe.net
@cteuschel