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Connectivity in the LAC region

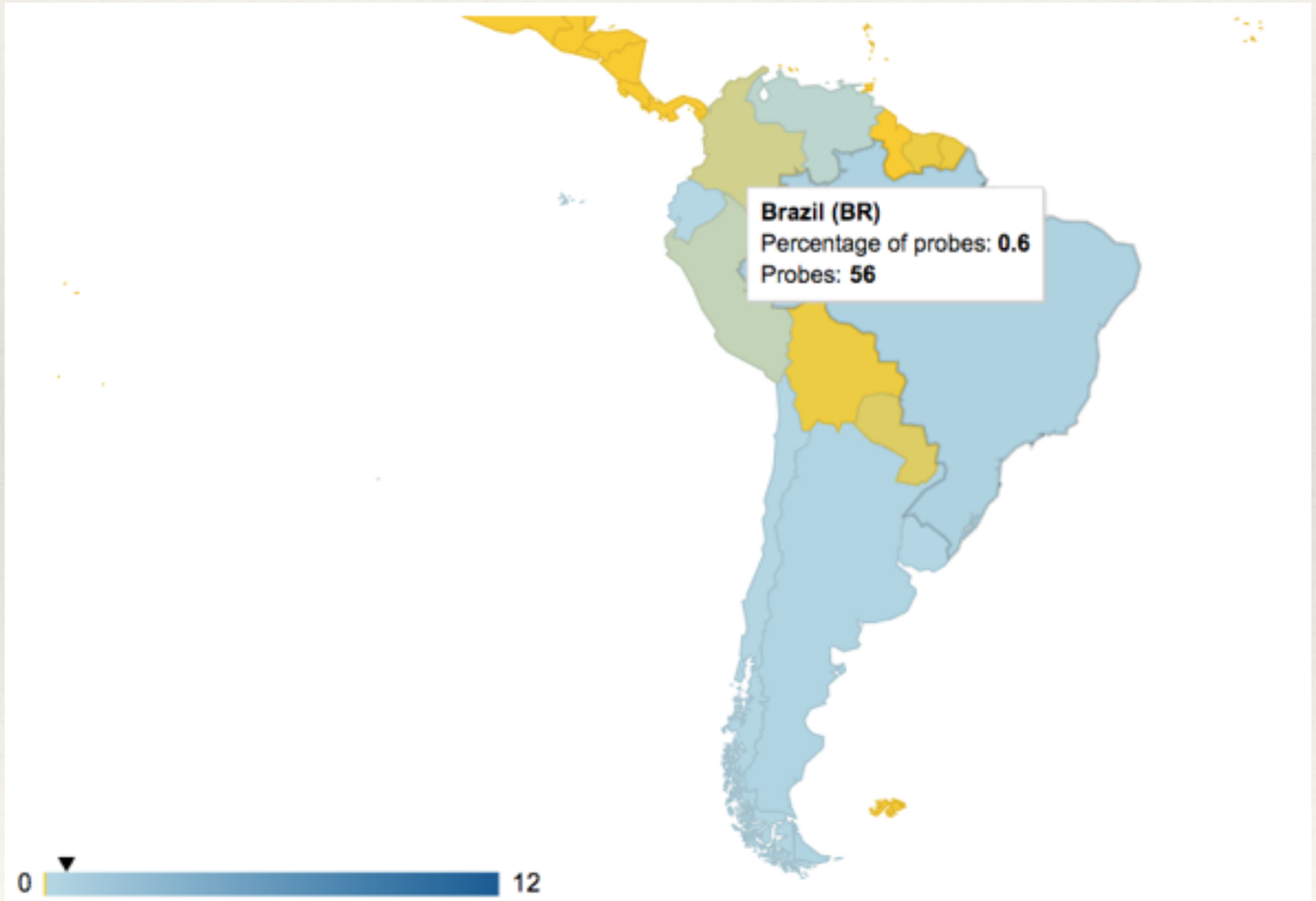
A study made by LACNIC Labs and Speedchecker Ltd.

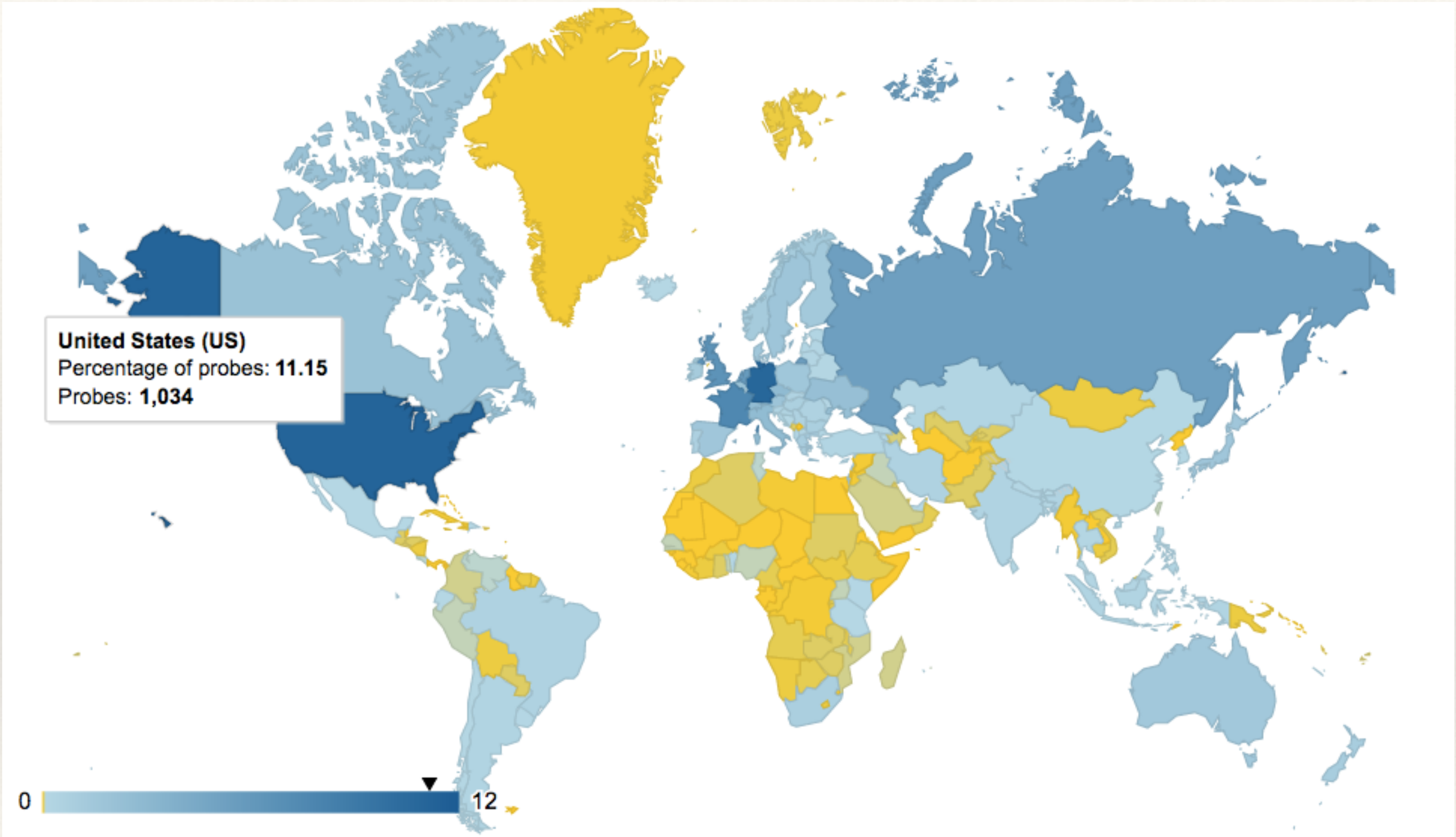
Outline

- The challenge of measuring regions not well covered by RIPE Atlas.
- Software Probes
- The Experiment
- Defining Connectivity
- Results and Discussion
- Open questions

Measuring the LAC Region

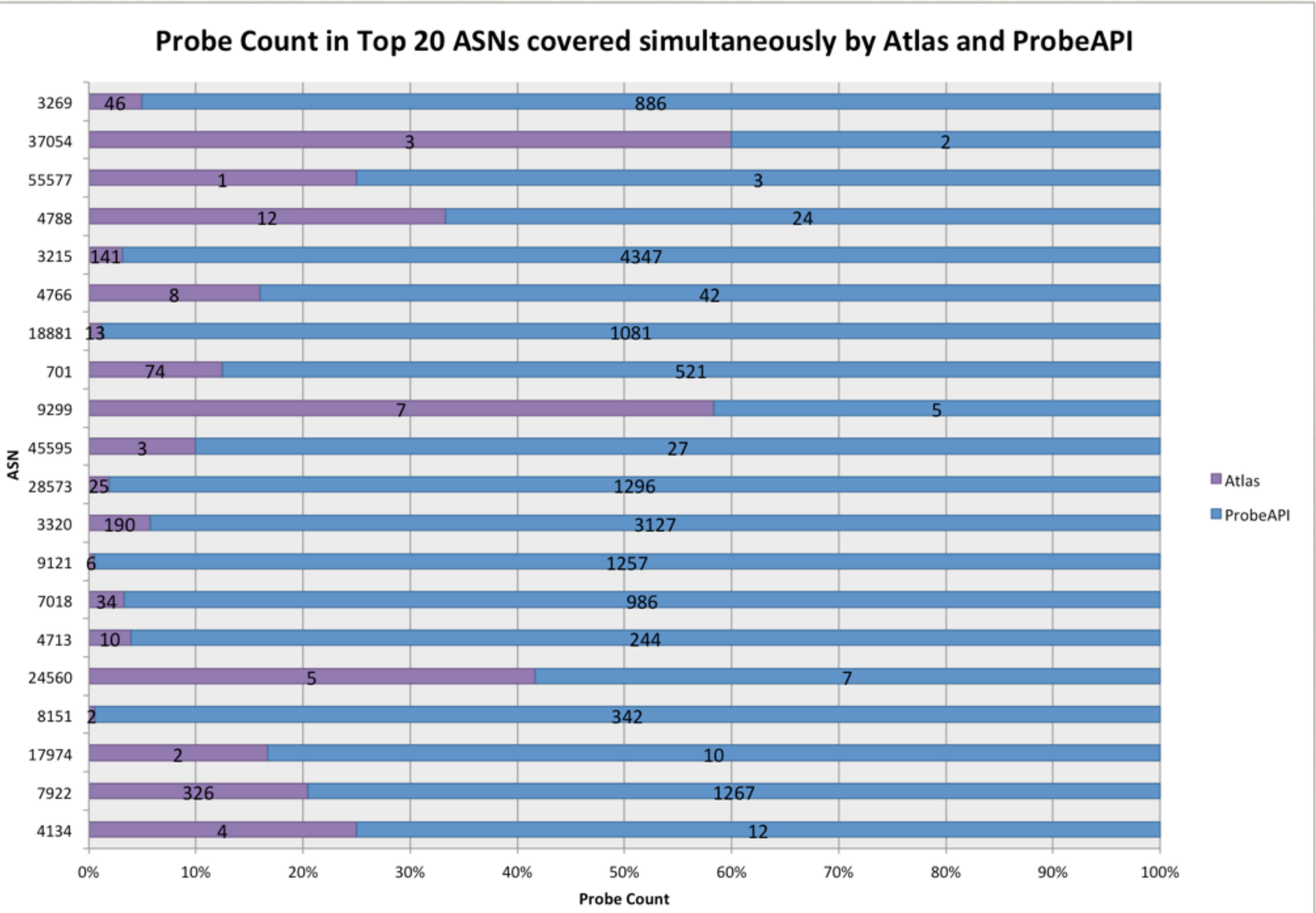
- There is still a relative lack of fixed probes in the region, which makes comprehensive measurements rather difficult.




United States (US)
Percentage of probes: 11.15
Probes: 1,034
0
12

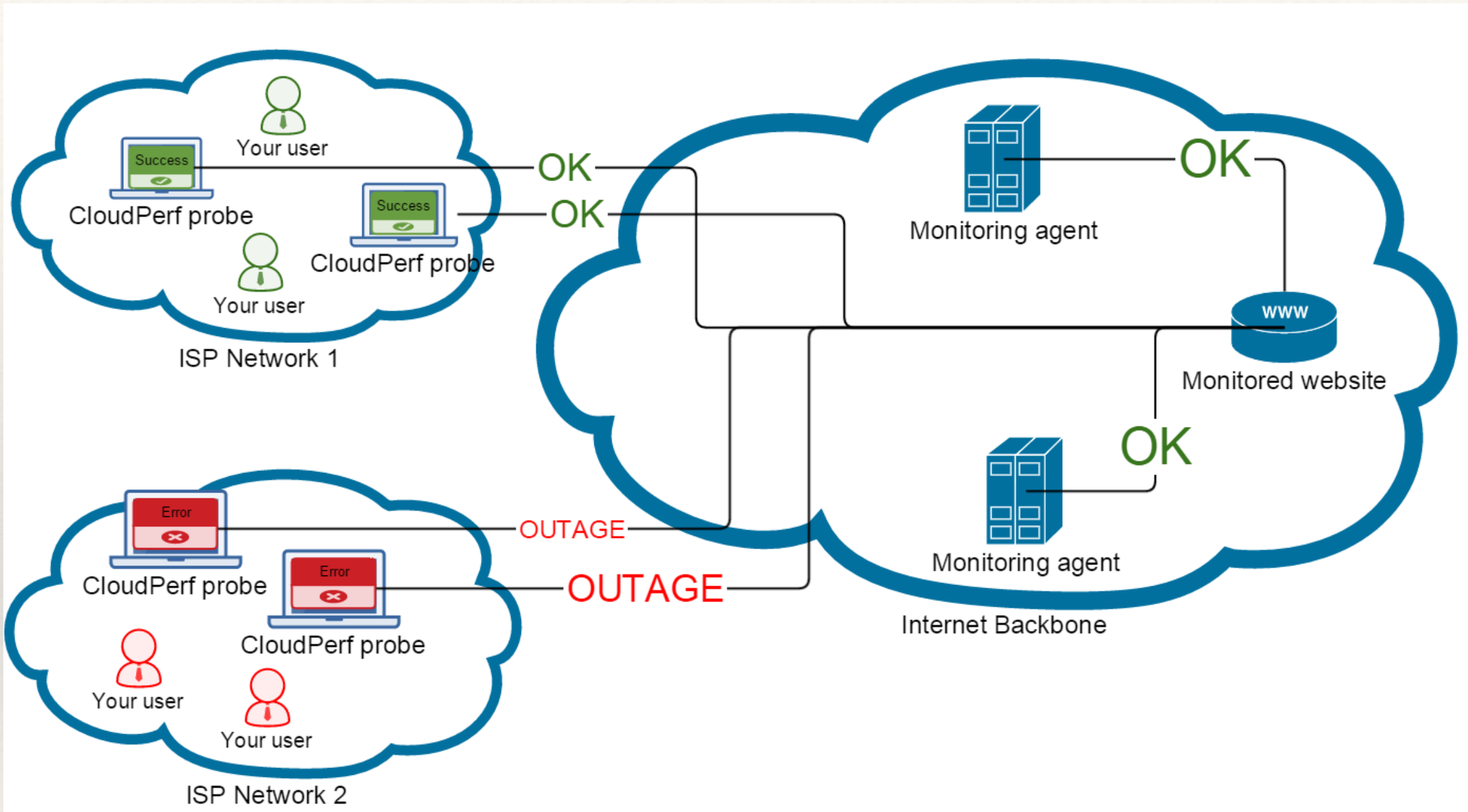
Software Probes

- Speedchecker ProbeAPI provides control over hundreds of thousands of software probes running in real user's computers.
- They are easy to deploy and spread rapidly over otherwise difficult to cover areas.
- The probes measure using Synthetic Measurement Traffic.


Probe Count in Top 20 ASNs covered simultaneously by Atlas and ProbeAPI
ASN
3269 46 886
37054 3 2
55577 1 3
4788 12 24
3215 141 4347
4766 8 42
18881 13 1081
701 74 521
9299 7 5
45595 3 27
28573 25 1296
3320 190 3127
9121 6 1257
7018 34 986
4713 10 244
24560 5 7
8151 2 342
17974 2 10
7922 326 1267
4134 4 12
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Probe Count
Atlas
ProbeAPI

- While software probes are abundant in number they are also highly volatile, requiring a higher number of engaged users to provide a stable measurement experience.

- On the other hand, monitoring from the user's perspective let us detect problems that are otherwise invisible for other tools.

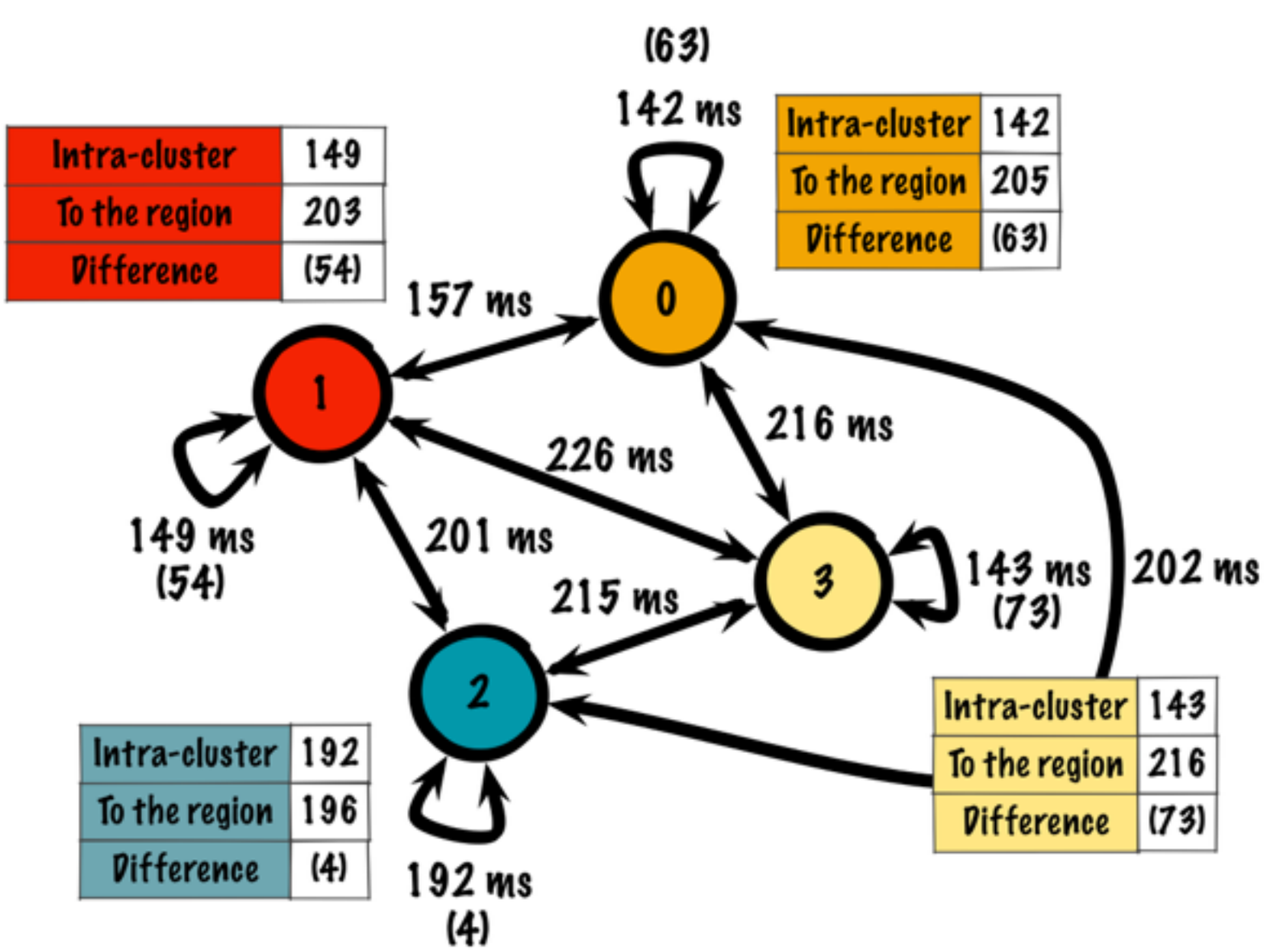

Success
Your user
CloudPerf probe
Success
CloudPerf probe
Your user
ISP Network 1
OK
OK
Monitoring agent
OK
www
Monitored website
OK
Monitoring agent
Internet Backbone
Error
CloudPerf probe
OUTAGE
Error
CloudPerf probe
OUTAGE
Your user
Your user
ISP Network 2

The Experiment

- Around 200 ICMP pings per day over 12 months.
- Covered 21 countries in the LAC Region.
- Geolocation info. was taken from Mozilla Geolocation API and Maxmind Lite DB.
- Each measurement consists on 10 samples one second apart from each other (like a traditional ping)
- Countries were grouped by results, forming clusters, which permitted to build a graph showing their relationships.

Defining Connectivity

- As a consequence of this experiment, we we able to define connectivity in a useful manner using three metrics:
  - The number of clusters found
  - Intra-Cluster Latency
  - Inter-Cluster Latency



Cluster 0: Belize, Colombia, Costa Rica, Cuba, Ecuador, Honduras, República Dominicana, Suriname, Trinidad and Tobago

Cluster 1: Mexico, El Salvador, Guatemala, Panama, Venezuela

Cluster 2: Bolivia, Chile, Peru

Cluster 3: Argentina, Brazil, Paraguay, Uruguay

Results

- The links connecting different nodes depict the average minimum measurement taken for that subset of measurements. Meaning that from each sample set of 10 measurements, the best RTT was taken for calculating the grand averages for each country.
- We found that countries inside each cluster are both geographically and functionally related and therefore their designation as such was a natural conclusion from observing the results.

Results

- Cluster 2 (Chile, Peru, and Bolivia) has weak intra-cluster connectivity, almost the same as its average inter-cluster connectivity. At a glance, we can say that cluster 2 has the weakest connectivity of all.
- Additionally, by looking at cluster 3, we can see that it has good intra-cluster latency values, but high inter-cluster ones. This means that the countries belonging to this cluster have good connectivity between them, but still need to get the cluster closer to the region .
- Finally, clusters 0 and 1 don't have a clear boundary between them, as their inter-cluster and the edge 0 <–> 1 have very similar values. They are very close geographically and their boundaries not as well defined as the rest of the cases. That means clusters in Central America and the Caribbean have good ICMP connectivity!

Detecting bad connectivity

- By following the same procedure, we calculated a similar graph using 1/RTT values which resulted in a dis-connectivity graph.
- Surprisingly bad connectivity was detected in these neighbouring countries:
  - Argentina and Chile
  - Colombia and Venezuela
  - Brazil and Peru
- Probably these countries are still preferring routs through coast-cables, which results in some routes being unnecessarily long. Opening up an interesting point of view for improving connectivity in these neighbouring countries.

Open questions…

- Is there one index that could summarise country-level connectivity health, based on this kind of measurements?
- Do you see any physical connections that are not being fully used?
- Are there any links that are escaping our measurements platform?

The End

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