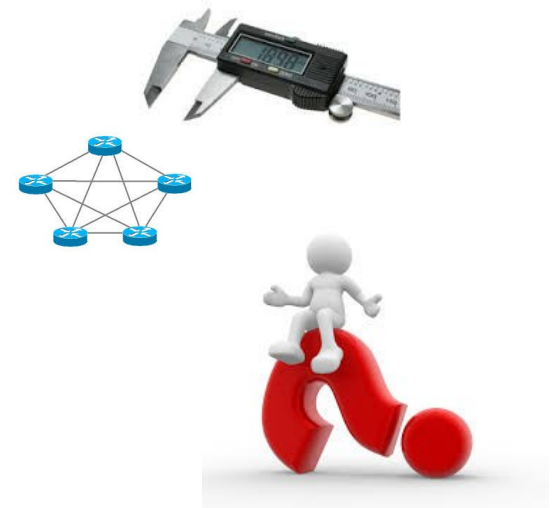


Measurement Networks & Deployment Status

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Kandy, Sri Lanka

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Overview

- ◆ Introduction to network measurements
- ◆ Objectives of measurements
- ◆ Commonly used measurement tools
- ◆ Active vs Passive measurements
- ◆ Measurement networks
- ◆ PerfSONAR
 - ◆ MDM vs PS
 - ◆ Deployment status
- ◆ RIPE AtLas
 - ◆ Definition
 - ◆ Global coverage

Introduction to Network Measurements

- Have you ever done network measurements?
 - What about *ping*?
 - *you all have measured round-trip time (latency)*
 - *have measured packet losses*
 - *reachability, connectivity*
 - Traceroute
 - *measuring path from source to destination*
 - On-line speed test
 - *measuring available bandwidth (download/upload)*
 - DNS response time
 - *dig gives you DNS response time*
 - Interface utilization
 - *monitoring tools (mrtg, ptrg, cacti, etc.)*

Objectives of Measurements

- Why should we measure?
 - To check the readability or connectivity
 - To get an idea about the performance/quality of the network
 - *amount of traffic*
 - *type of traffic*
 - To find and isolate problems of the network
 - To plan future network expansion
 - Provide a source of network measurements for further diagnostics
 - *Tackling potential problems*
 - *Research purposes*

Measurement Tools

- Latency
 - Round trip time (RTT)
 - ping
 - thrulay
 - One way delay
 - OWAMP (client-server app.)
- Packet Loss
 - ping, fping
 - iperf (client-server app.)
- Available bandwidth, Jitter
 - iperf
- Bandwidth utilization
 - monitoring tools
 - mrtg, ptrg, cacti, etc
- DNS response Time
 - dig
- Reachability
 - ping
 - traceroute

There are a lot of free tools

Active and Passive Measurements

- Active Measurements
 - Send traffic through the network and observe the effect
 - *affect the network under test*
 - *generally easy to interpret*
- Passive Measurements
 - Simply observe the network traffic
 - *do not affect the network*
 - *harder to interpret*

Measurements Barriers

- ICMP blocking as a security measure
 - No ping or traceroute
- Firewalls block large flows (prevent flooding)
 - No throughput measurements
- Difficulty in having a measurement point in a foreign network
 - For example for using OWAMP or iperf
- So, how do we do measurement ?
 - Need a common understanding
 - Dedicated devices
 - Rules/policies/control
 - Need a measurement networks
 - Known set of devices and tools all around the globe

Measurement Networks

- perfSONAR

- Network measurement toolkit designed to provide federated coverage of paths
 - *help to establish end-to-end usage expectations*
 - *international collaboration for networking monitoring*
 - *1000s of perfSONAR instances world wide*
 - *EU funded project*



perfSONAR



- RIPE AtLas

- Global network of probes that measure connectivity and reachability
 - *global active measurements*
 - *probes hosted by volunteers*



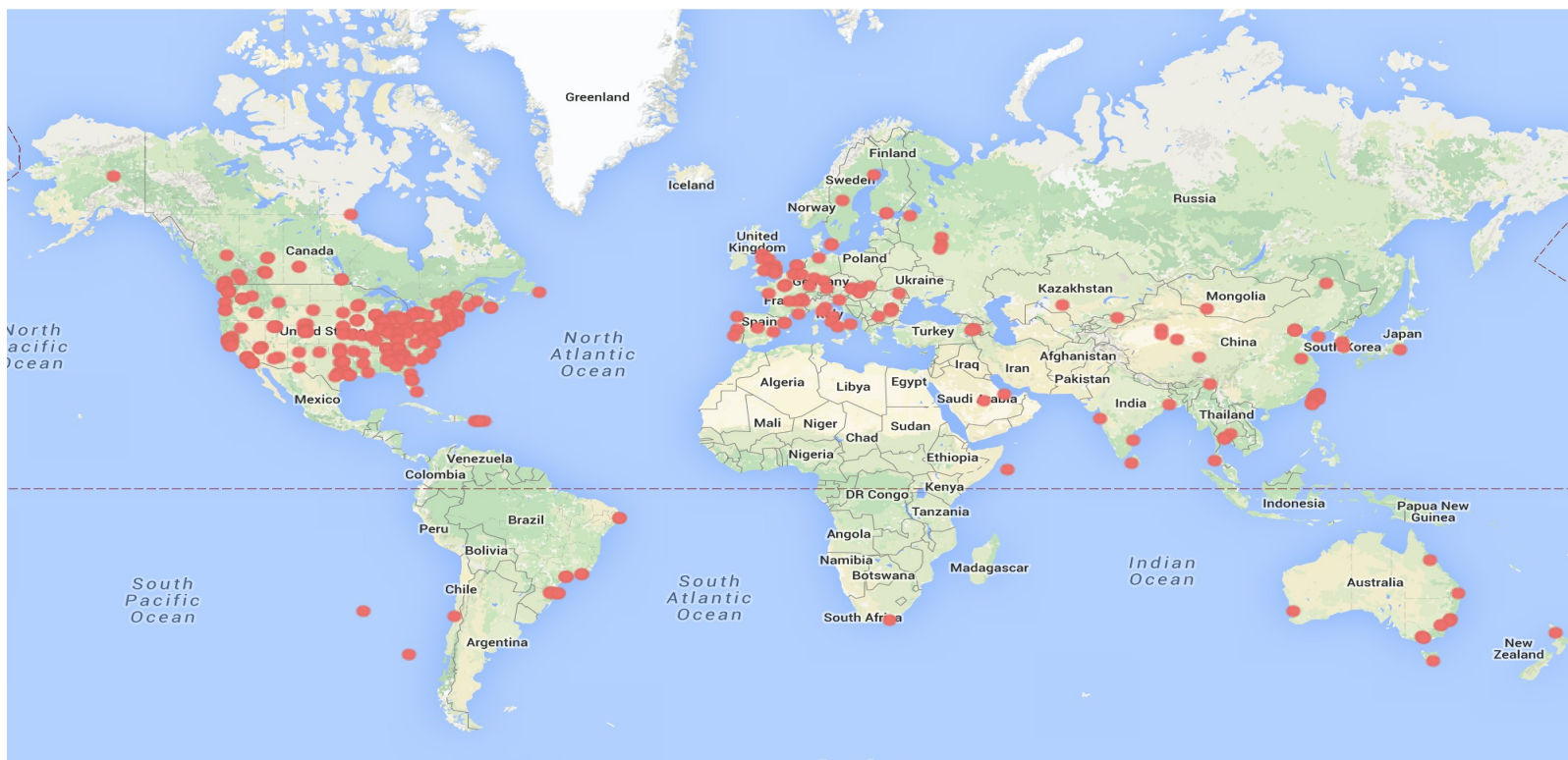
- Performance focused service oriented network monitoring architecture
- International collaboration for network monitoring
- Two main implementations
 - ▶ PerfSONAR MDM 
 - <http://perfsonar.geant.net>
 - ▶ PerfSONAR PS 
 - <http://psps.perfsonar.net>
- Open OGF protocol to exchange data
- Web-service based
- Design goals: flexibility, extensibility, openness and decentralization

- What does perfSONAR measure?
 - Link utilization with possibility to compare two links
 - One-way delay
 - One-way delay variation
 - Packet loss
 - Hopcount (traceroute monitoring) with comparison
 - Regularly scheduled bandwidth measurement
 - On-demand bandwidth measurement
- What tools used?
 - OWAMP – oneway latency packet loss
 - BWCLT – achievable bandwidth (iperf, iperf3, and nuttcp)
 - PING – roundtrip delay
 - SNMP- passive counter values from networking devices

- MDM vs PS
 - ▶ PerfSONAR MDM
 - one-way delay, Jitter and packet loss measurements based on HADES (Hades Active Delay Evaluation System)
 - ▶ PerfSONAR PS
 - one-way delay, Jitter and packet loss measurements based on OWAMP
 - ▶ Both HADES and OWAMP satisfy the same design principles
 - ▶ Bandwidth measurement in both by using BWCTL

Deployment Status

- PerfSONAR hosts ~ 1300
- Domains ~ 320 (.edu 324, .net 211, .ca 75, .org 65, .gov 46)



Regional Coverage

- PerfSONAR hosts ~ 4



- Atlas Definition
 - ▶ World largest active measurements platform
 - ▶ Helps to view Internet reachability/connectivity
 - ▶ Probes/Anchors hosted by volunteers
 - ▶ Users can run customized measurements
 - ping, traceroute, DNS and SSL
 - ▶ Data publicly available

- Probe
 - A small hardware that runs measurements in the RIPE Atlas and reports to the data collection components
 - v1/v2: Lantronix Xport Pro



- v3: TP-Link TL-MR3020

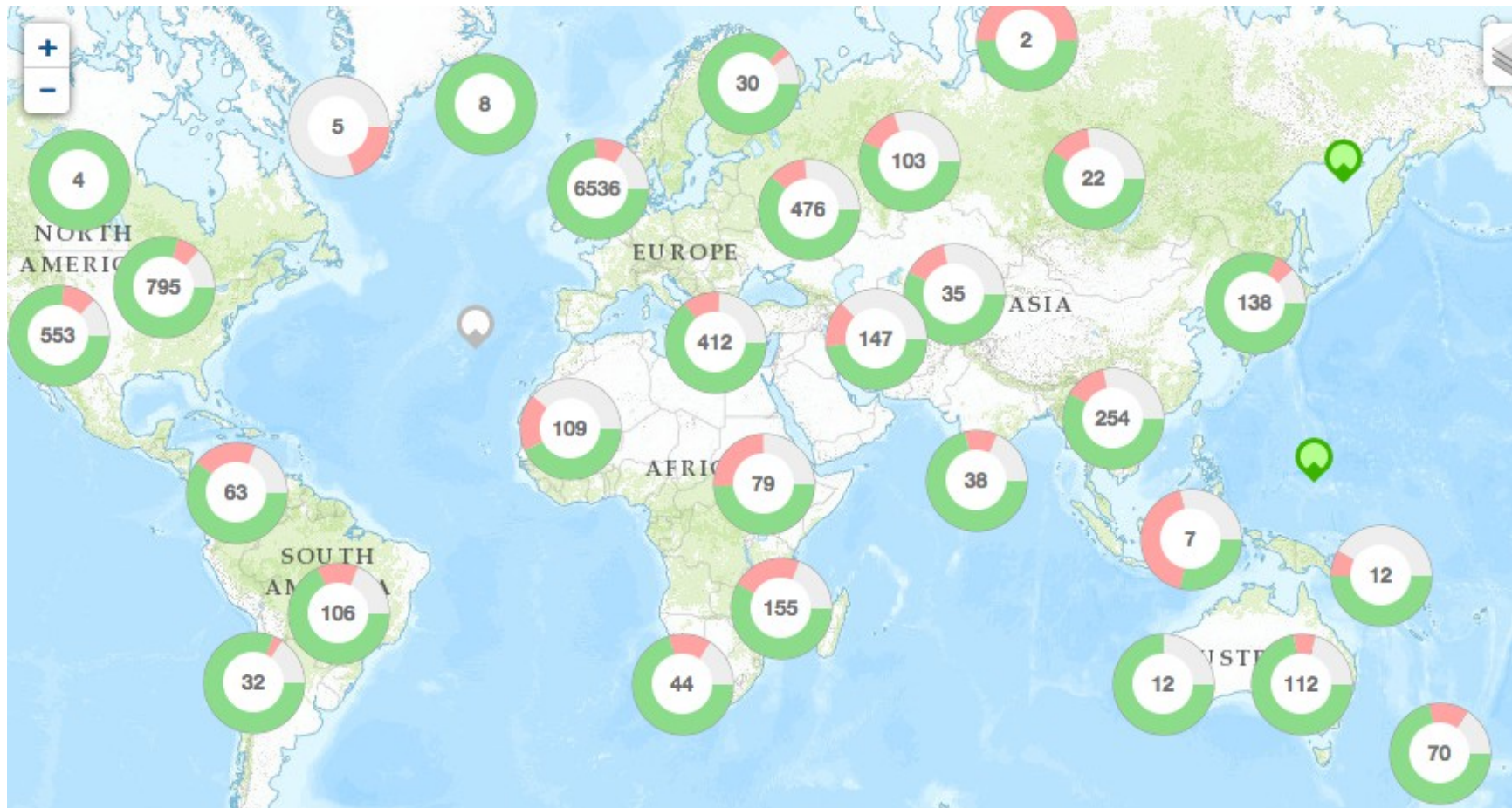


- Anchor
 - an enhanced probes with more measurement capacity
 - well known regional measurement targets
 - valuable information about the local and regional connectivity and reachability
 - collect large amount of data and made available to everyone
- Soekris net6501-70




Atlas Global Coverage

- Probes (active and inactive)



 Connected

 Disconnected

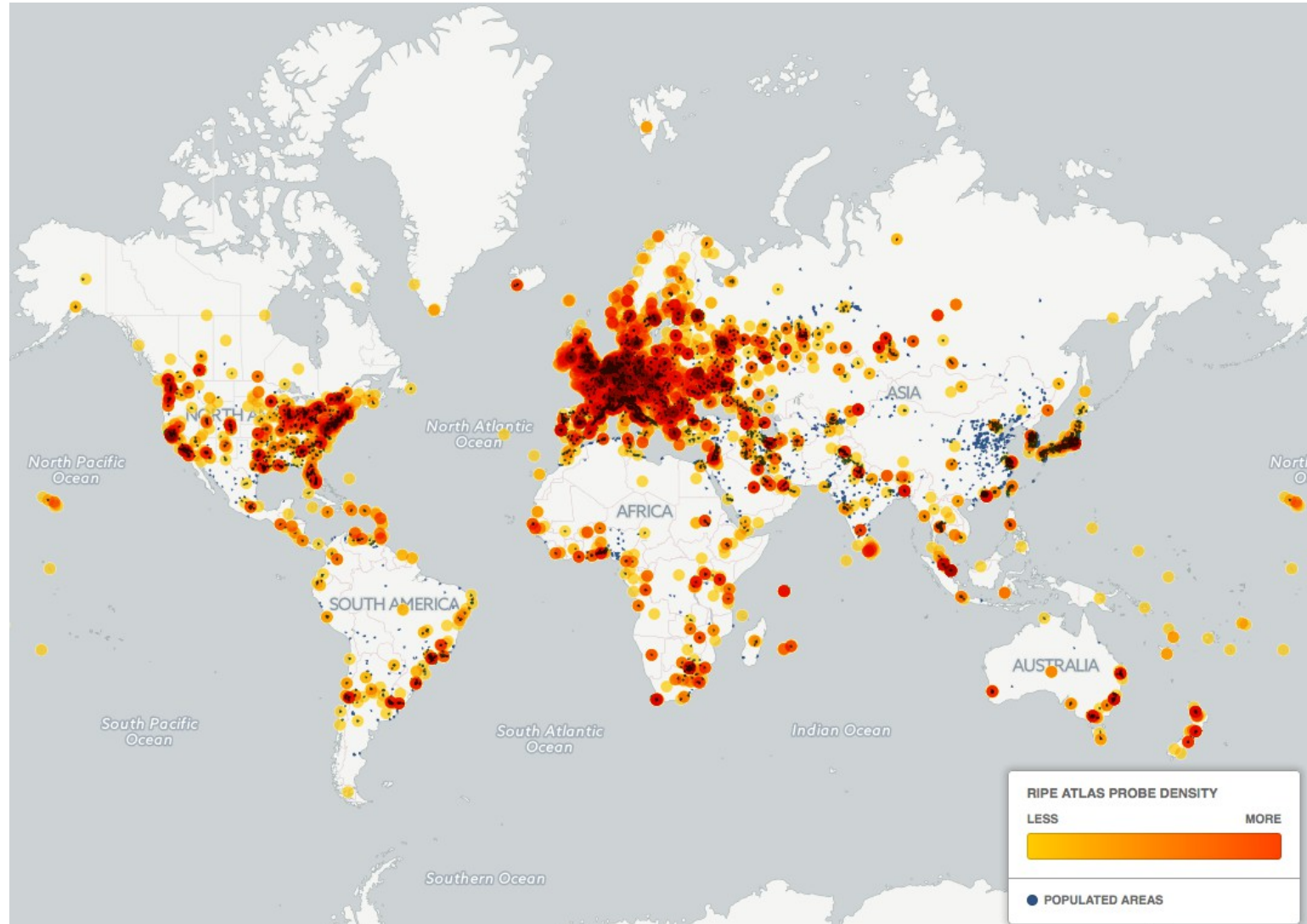
 Abandoned

Deployment Status



- Largest active measurements network
 - ▶ 70+ anchors
 - ▶ 7,100+ probes connected
 - ▶ 8,000+ active users in this year
 - ▶ 5,000+ built-in measurements daily
 - ▶ 5,000+ user-defined measurements daily
 - *Available to hosts and members*
 - *ping, traceroute, DNS, SSL*

Probes density vs urban population area

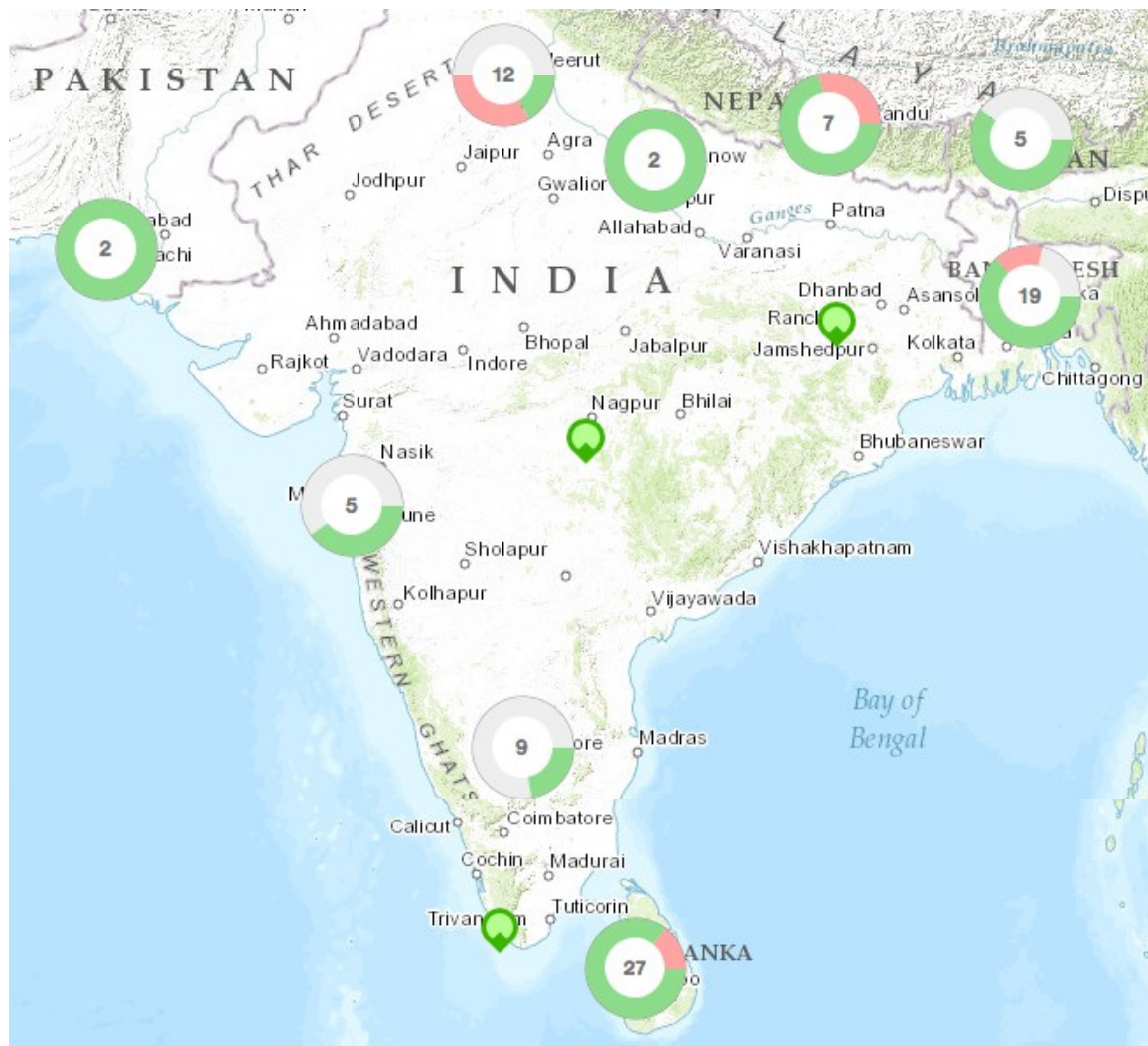


Atlas Regional Coverage



RIPE
NCC

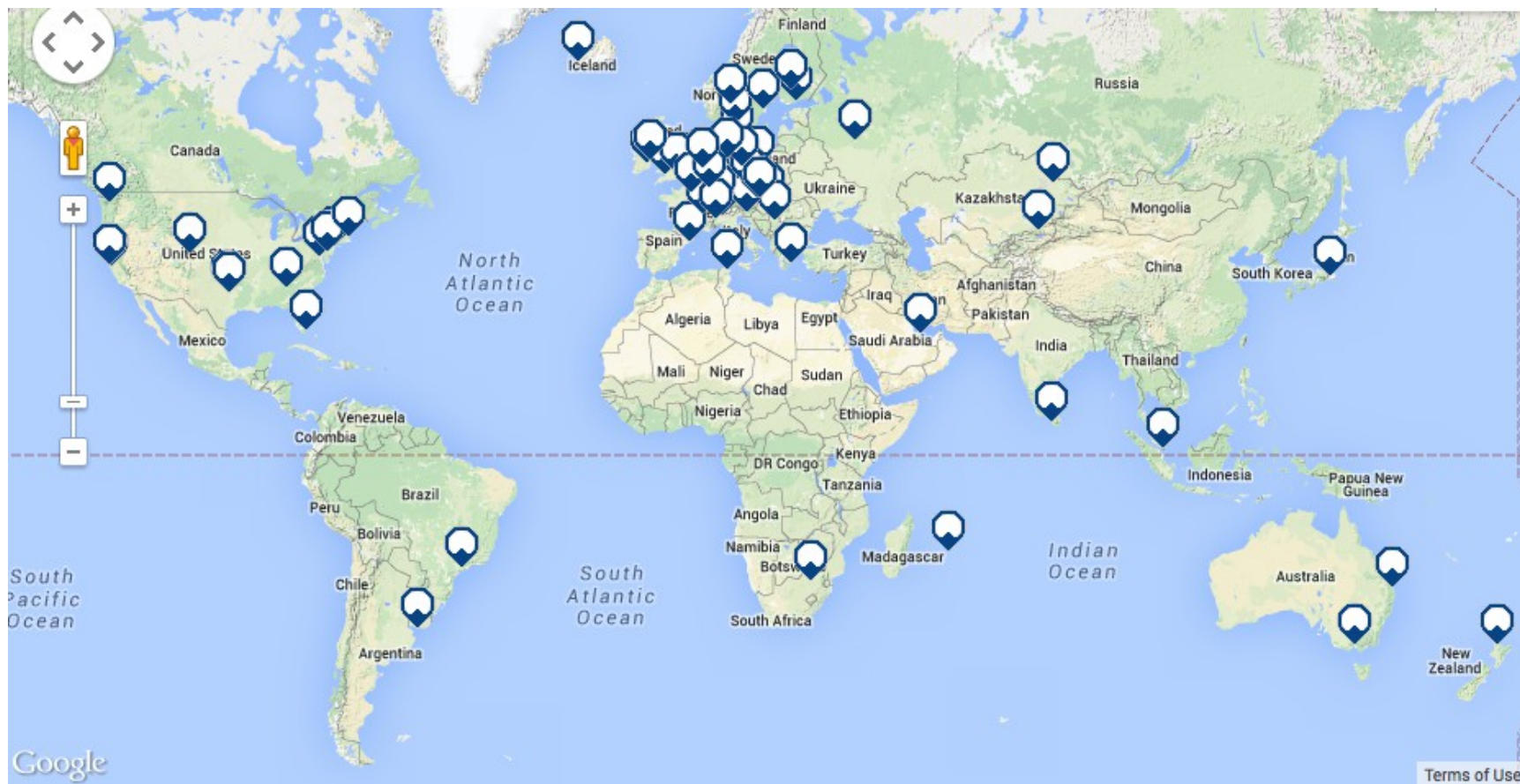
- Probes (active and inactive)



- Connected
- Disconnected
- Abandoned

Atlas Global Coverage

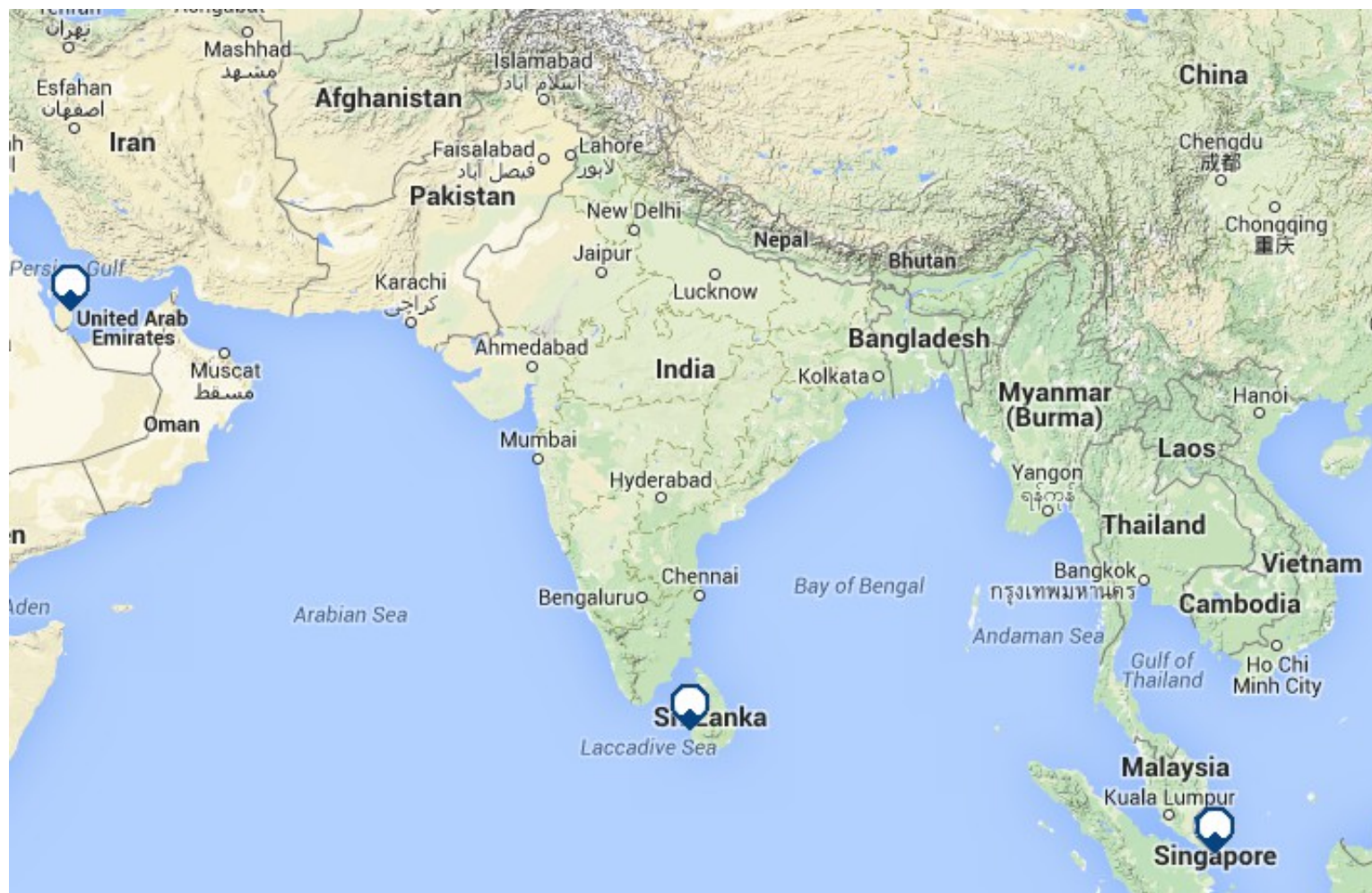
- Anchor Hosts



Atlas Regional Coverage

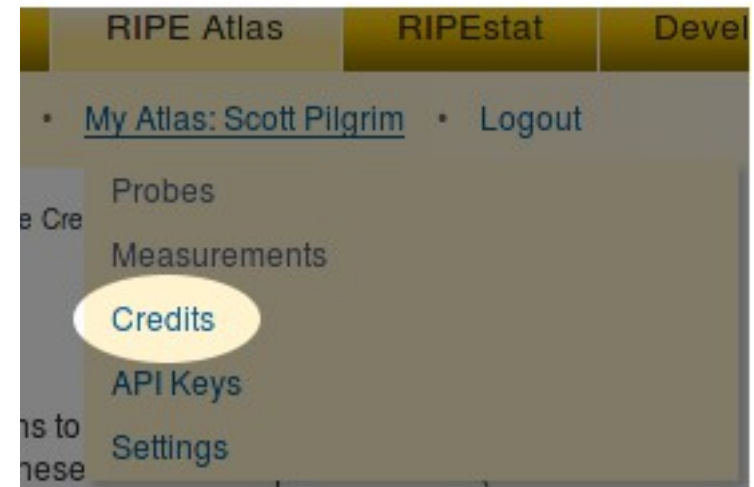


- Anchor Hosts



Credits System

- Measurements cost credits
 - ping = 10 credits, traceroute = 20, etc
- Why?
 - Fairness and to avoid overload
- Hosting a probe earns credits
- Earn extra credited by:
 - Being a member
 - Hosting an anchor
 - Sponsoring probes
- Donate credits to someone



<https://atlas.ripe.net/doc/credits>

Would you like to host a probe ?



- If you don't have any probes or you have only one probe in your AS, you may get a one
 - How to check
 - Visit <https://atlas.ripe.net>
 - Click on the the map on your right
 - Click on the 6th map “*RIPE Atlas network extent*”
 - Type you AS number and then click on filter button
 - You should see the probes in your AS on your country map
 - (given your IP, you may find your ASN at <http://asn.cymru.com/cgi-bin/whois.cgi>)
 - If not, you don't have any probes on your AS – please ask for one by an quick email to

senevih@learn.ac.lk

- RIPE NCC willing to have probes in ASN which has no probes, to increase the diversity of the network.

Thank You

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