RIPE Atlas

A “Real Big” Measurement Network

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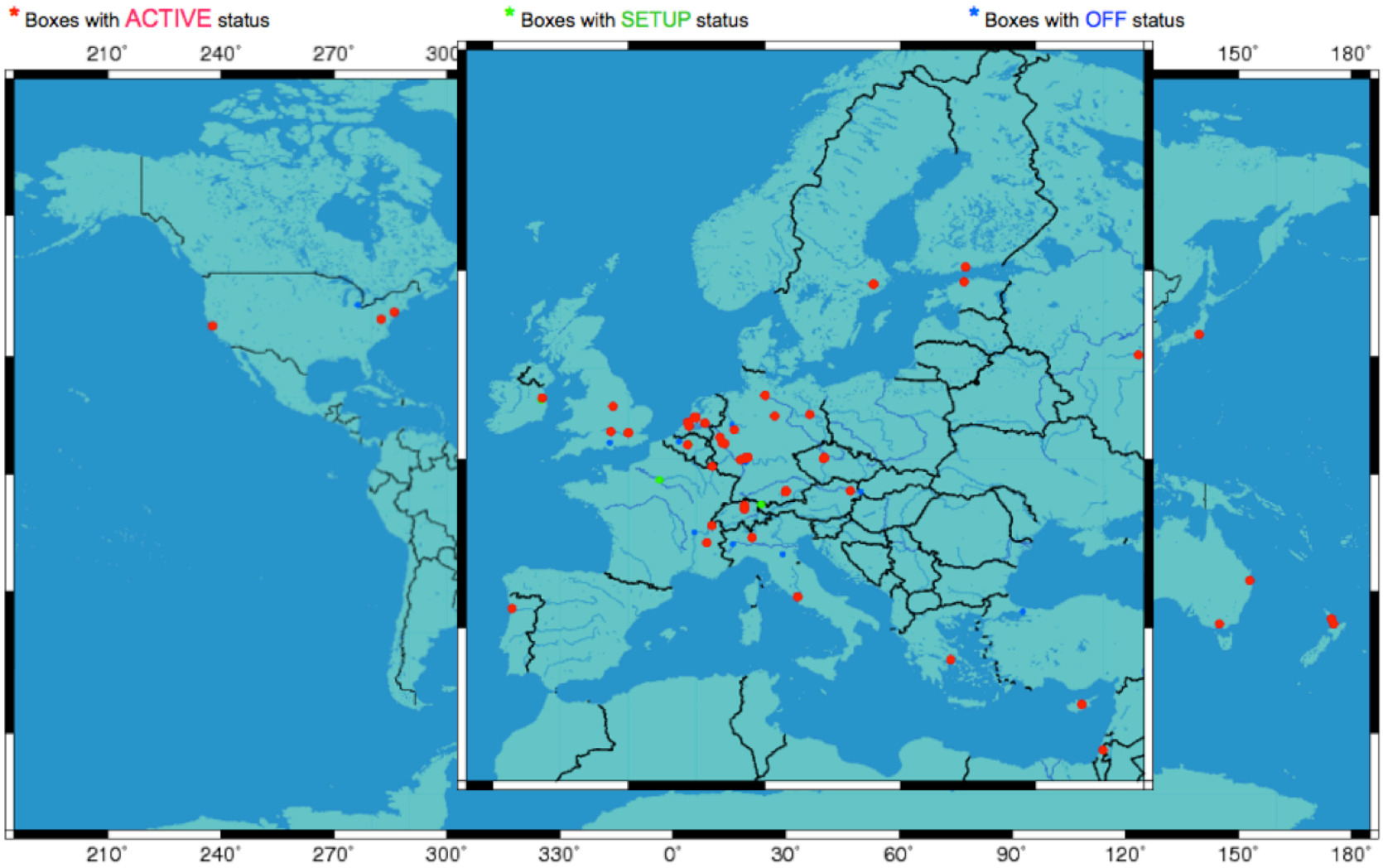
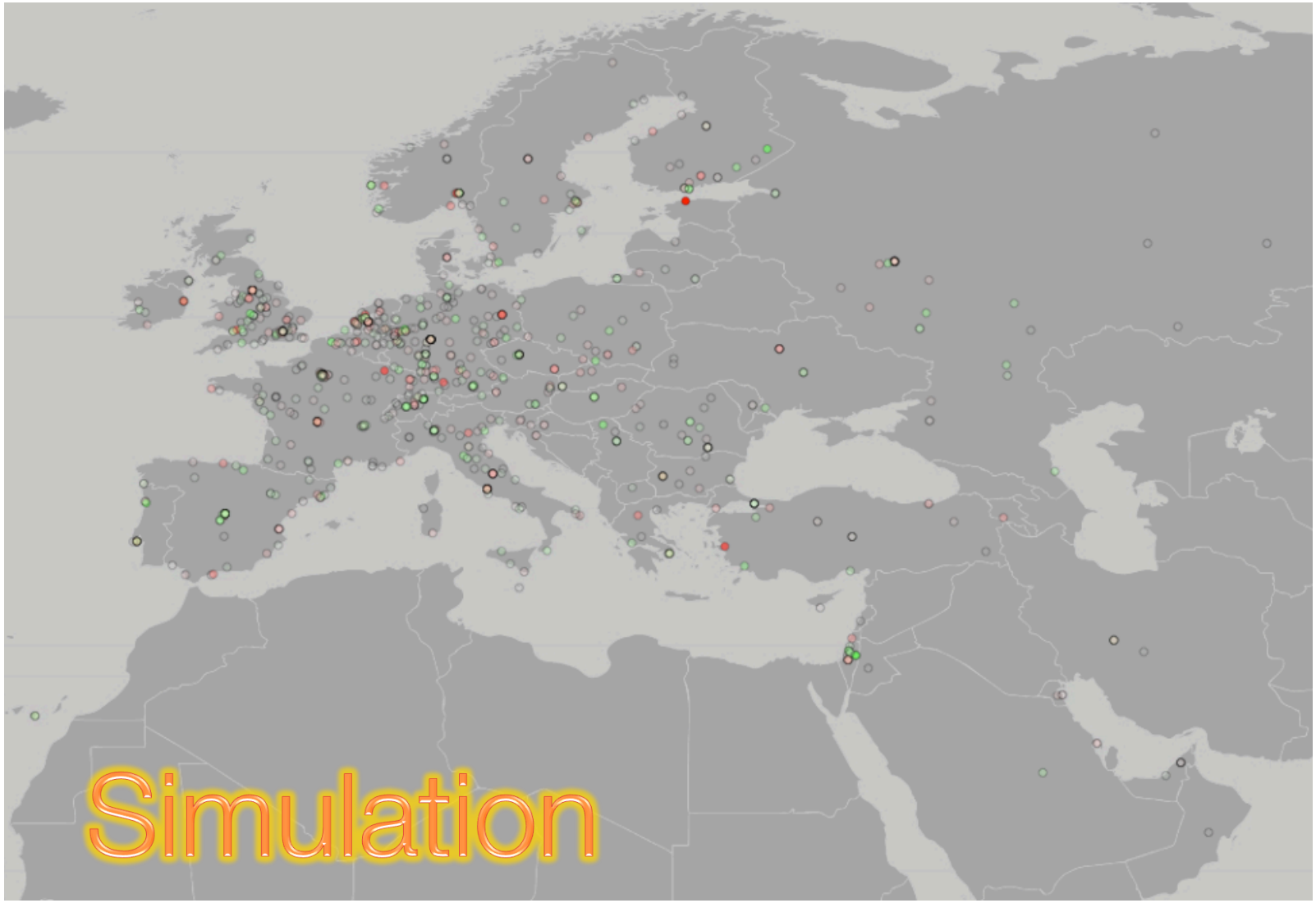
RIPE NCC

RIPE TTM

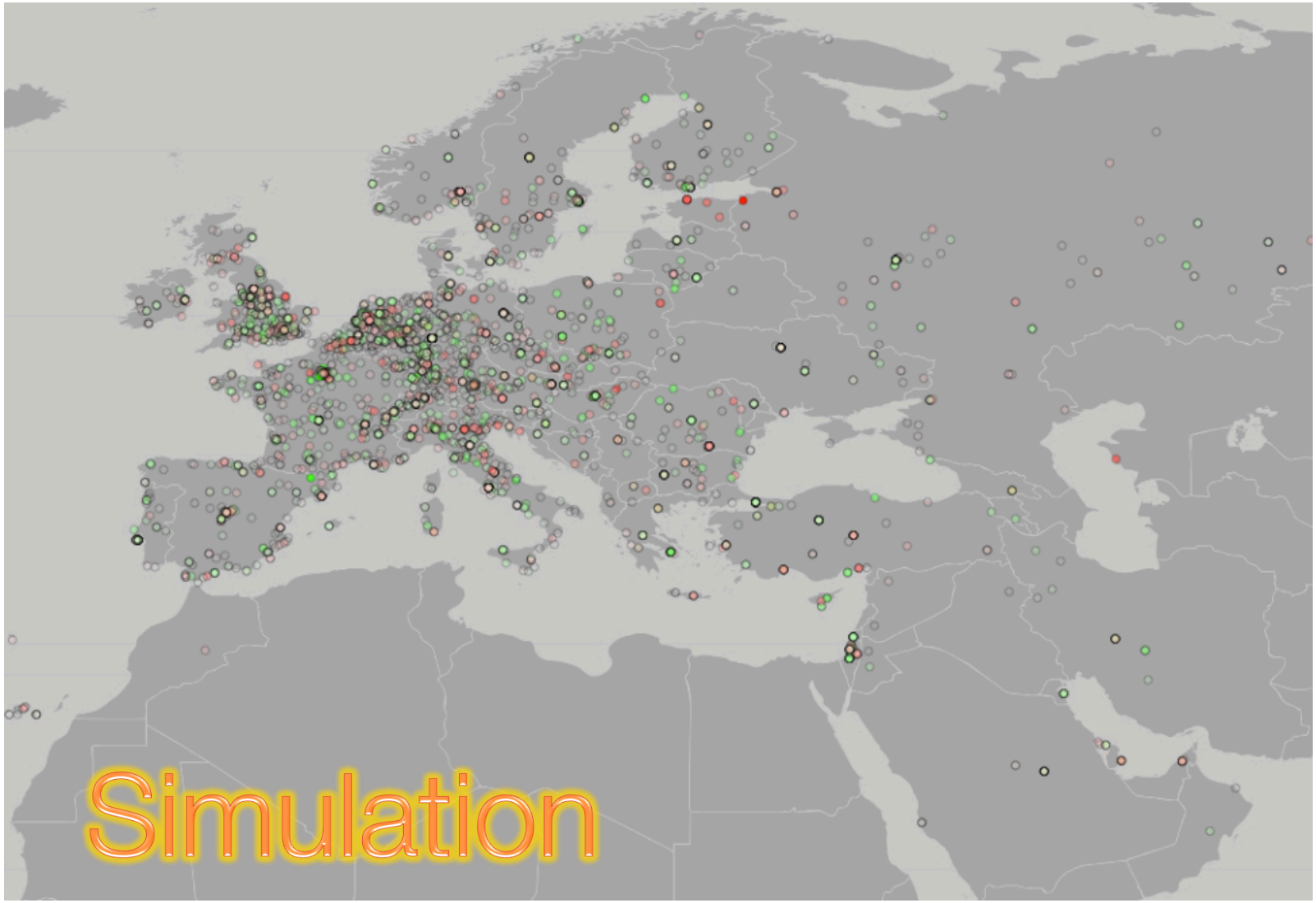

* Boxes with ACTIVE status
* Boxes with SETUP status
* Boxes with OFF status
210°
240°
270°
300°
330°
0°
30°
60°
90°
120°
150°
180°

Light Map

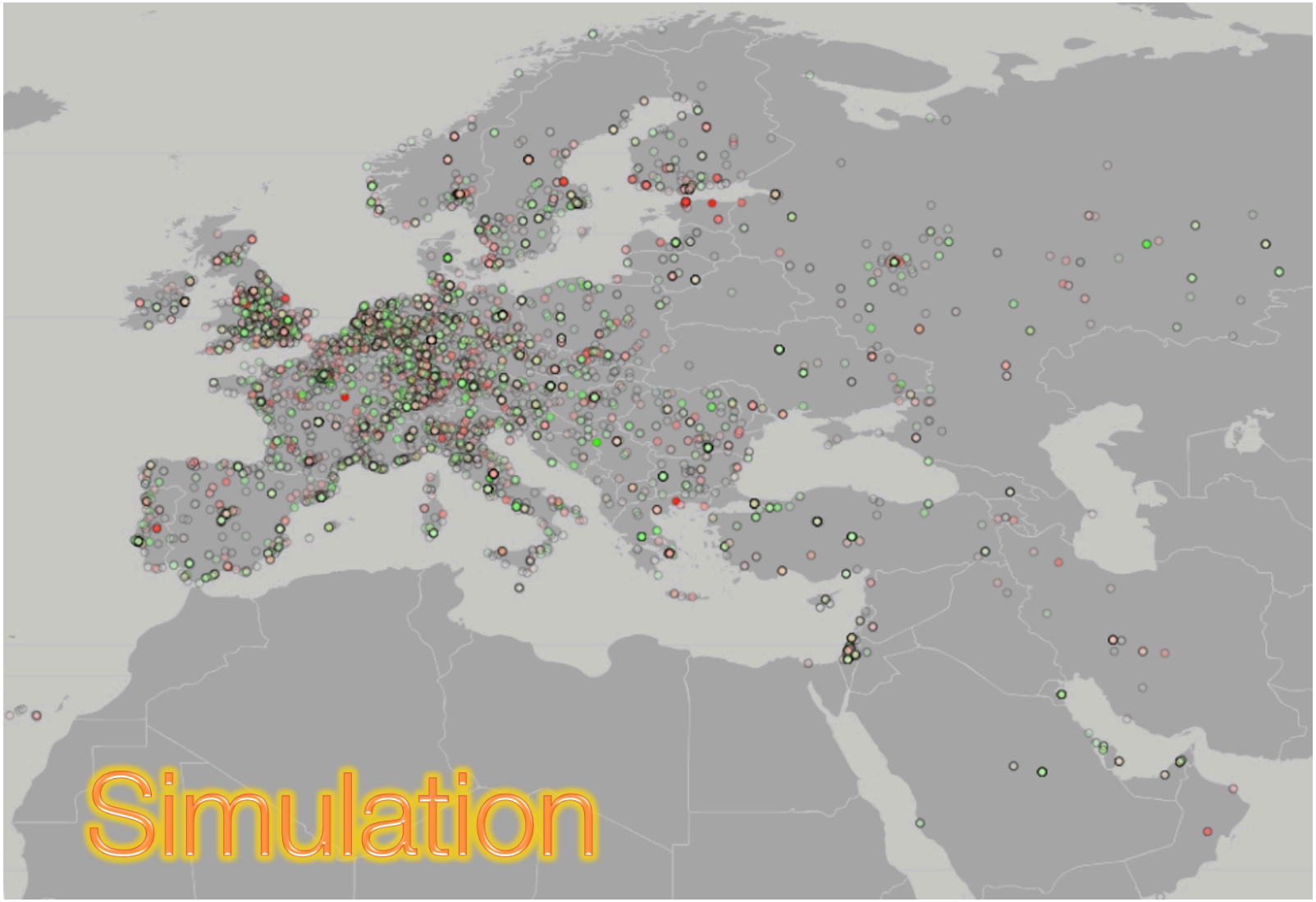
Intuition: 1000 Probes



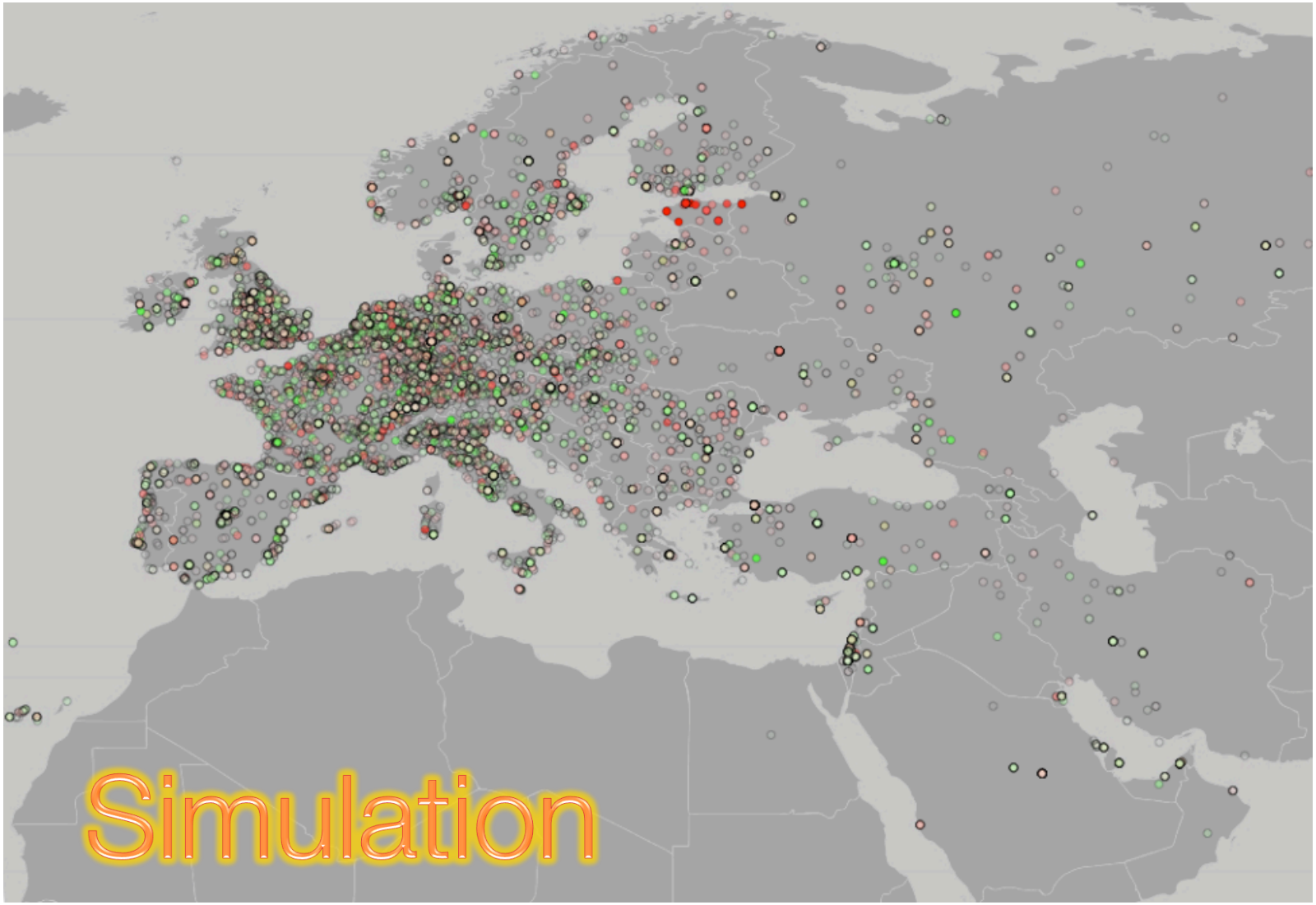
Intuition: 5000 Probes



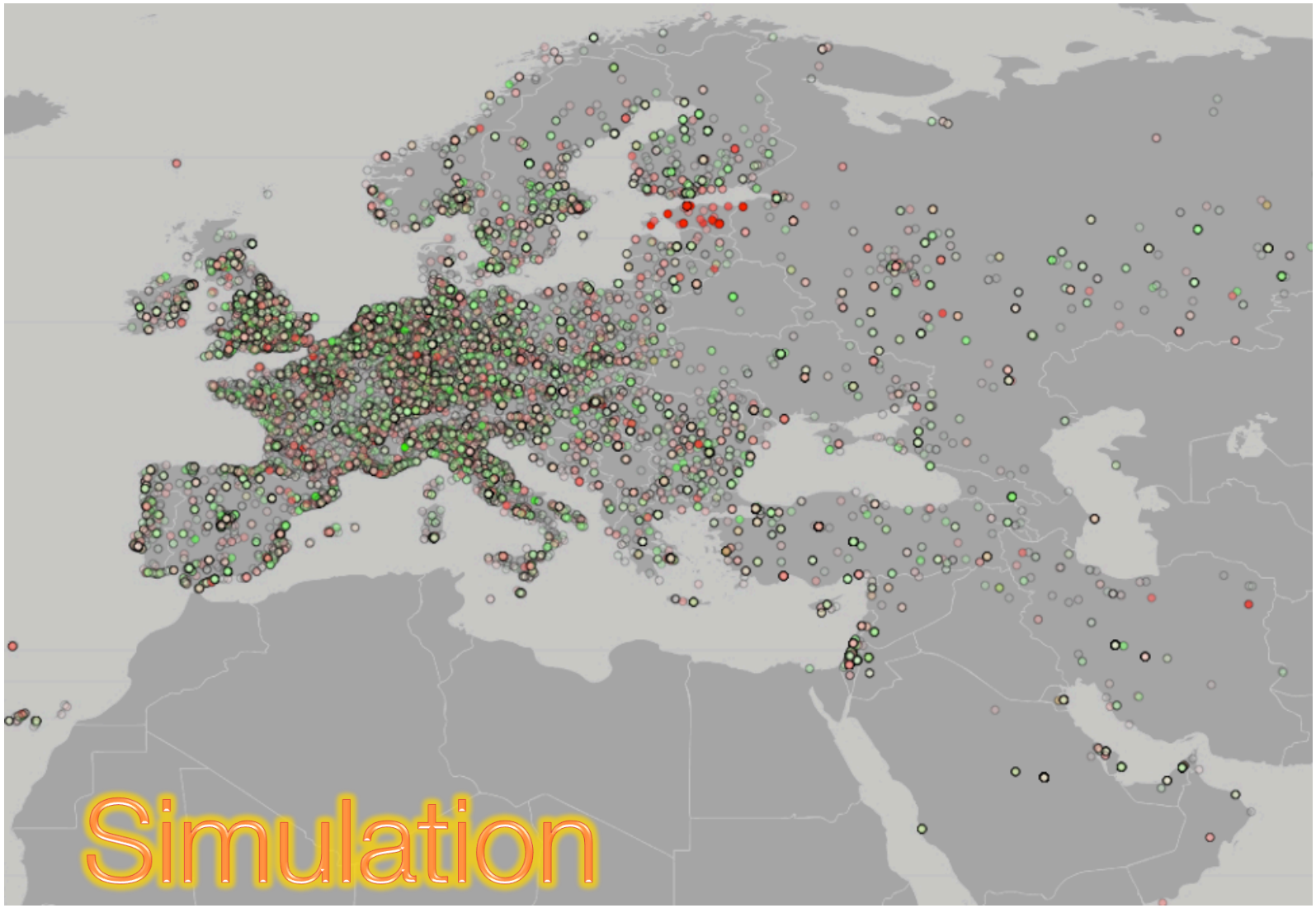
Intuition: 10k Probes



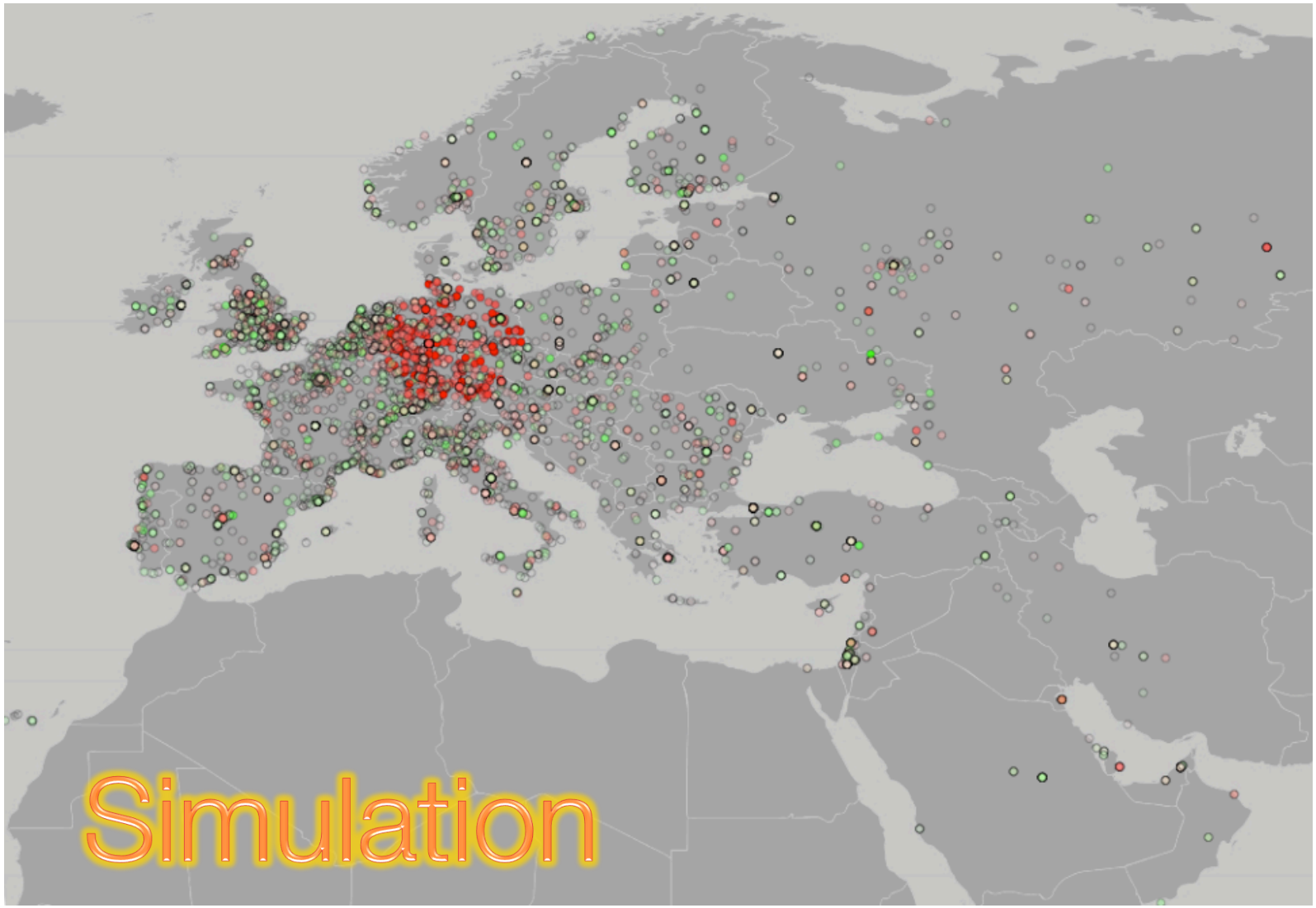
Intuition: 20k Probes



Intuition: 50k Probes



Intuition: 10k Probes & 1 AS



Ambitious Community Effort

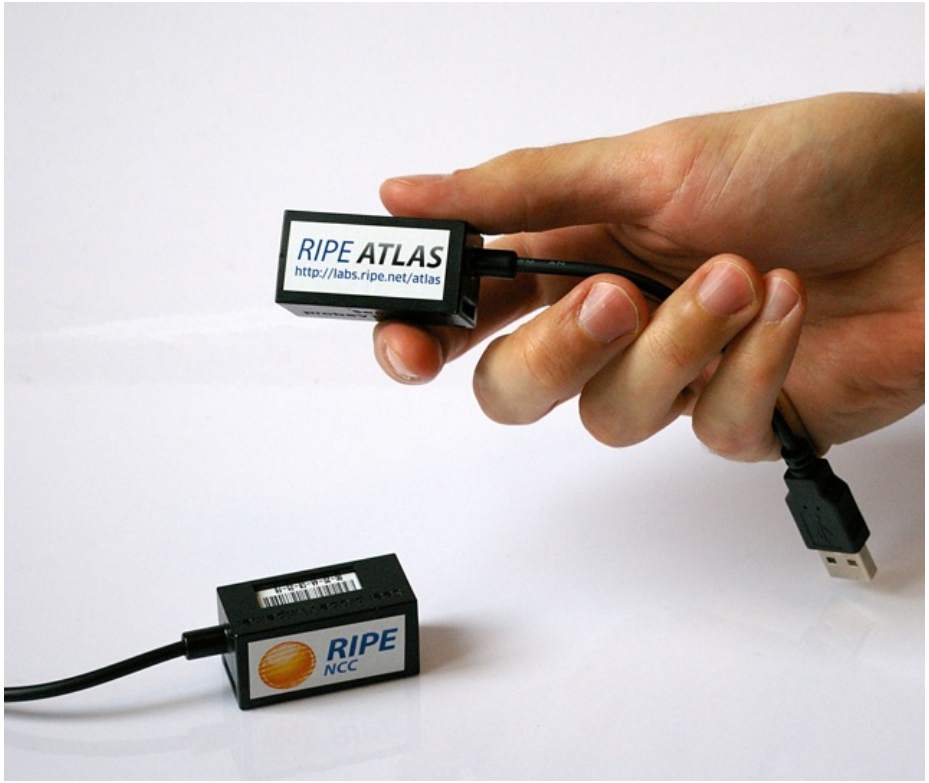
Instead of building small, separate, individual & private infrastructures, build a huge common infrastructure that serves ***both*** the private goals ***and*** the community goals.

Ambitious Community Effort

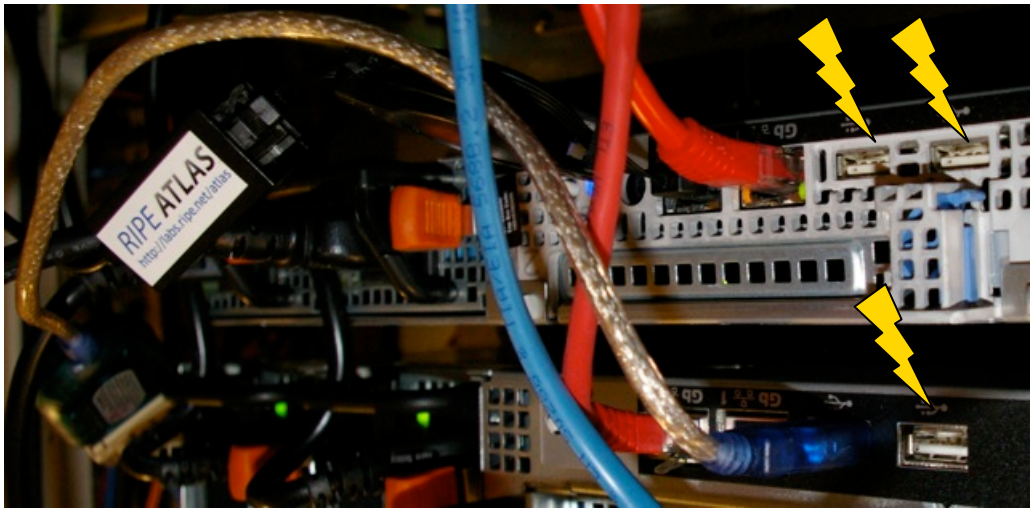
- Individual Benefits
  - Less expensive than rolling your own
  - More vantage points available
  - More data available
- Community Benefits
  - Unprecedented situational awareness
  - Wealth of data, …

Intuition -> Plan

- For accurate maps we need more probes
- Deploying very many TTM boxes too expensive
- Smaller probes
- Easily deployable
- USB powered
- 24 x 365 capable



Probe Deployments



Probe Capabilities

- Version 0
  - Ping to fixed targets (IPv4 & IPv6) ✔
  - Traceroute to 1st two upstream hops ✔
- Version 1
  - Ping & Traceroute to variable targets
  - DNS queries to variable targets
- Version 2
  - Your ideas ?
- Upgrades are automatic

Hosting = Credits = Measurements

- We cannot “be” everywhere without your help

Become a probe host !

- Donate a fraction of your bandwidth
- Donate a very small amount of electricity

You get:

- Recognition
- Access to fixed measurements from probe now
- Credits = Measurements from any probe (Q2/11)

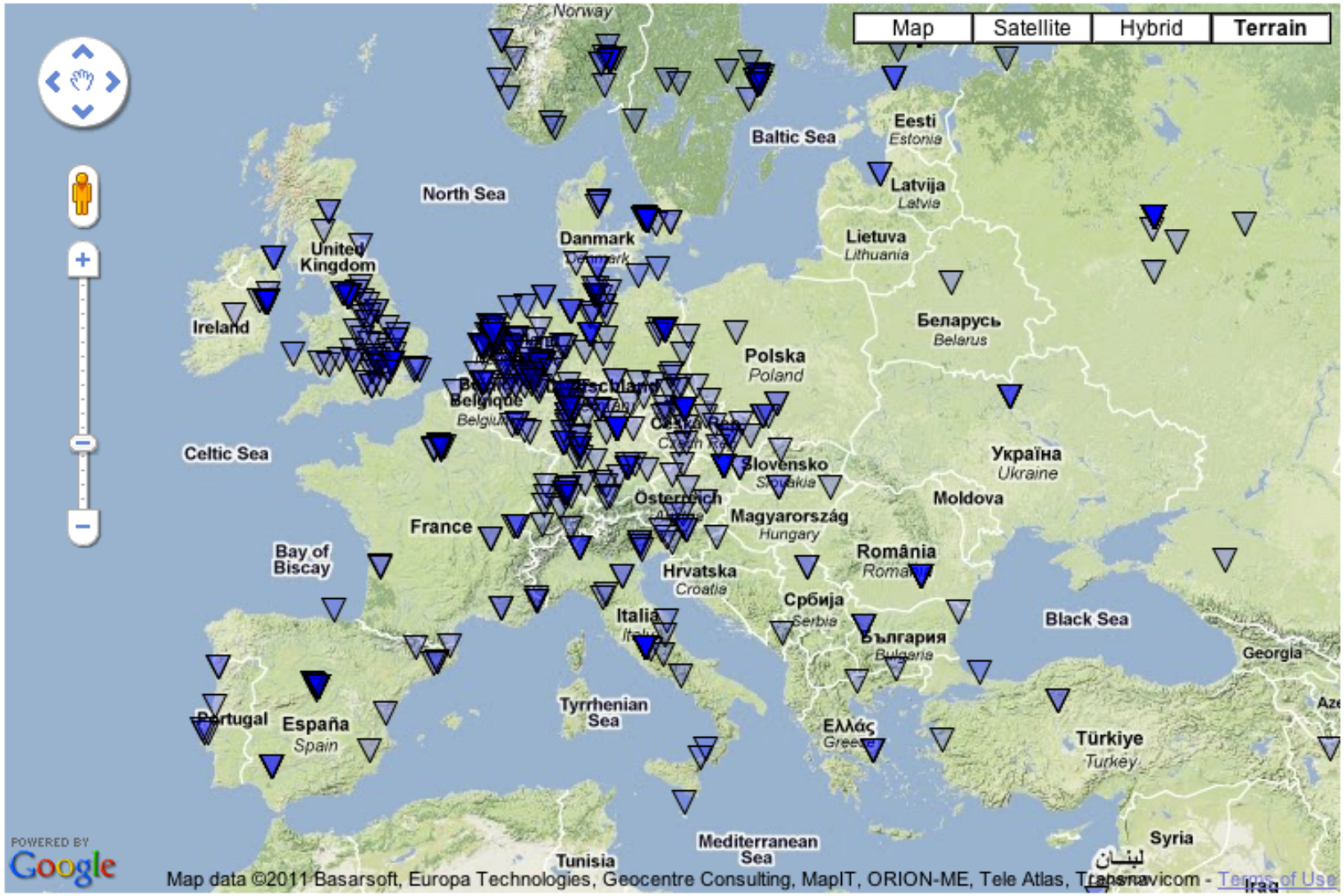
Hosting = Credits = Measurements

NOT a Simulation

Hosting = Credits = Measurements

NOT a Simulation

Hosting = Credits = Measurements



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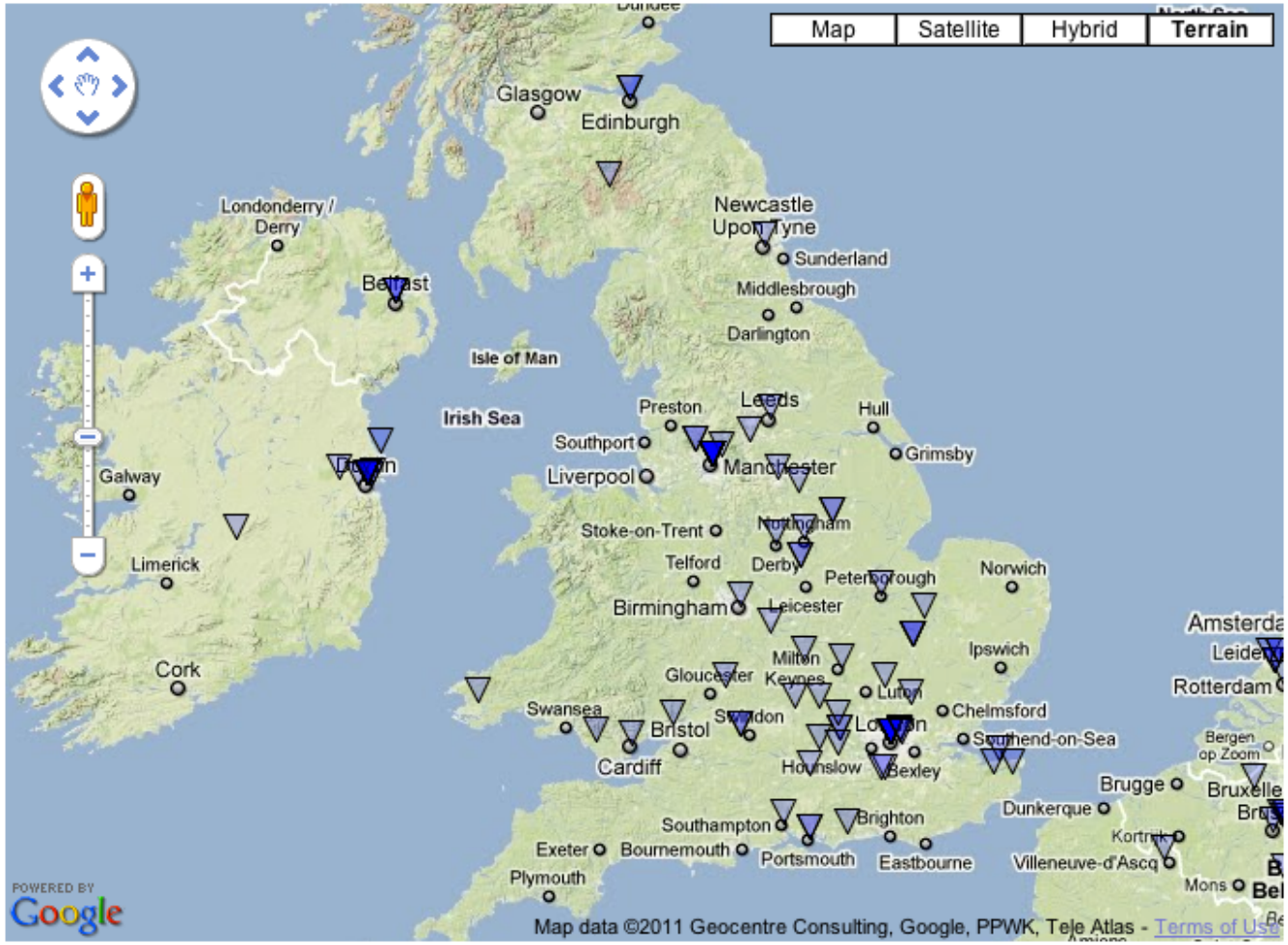

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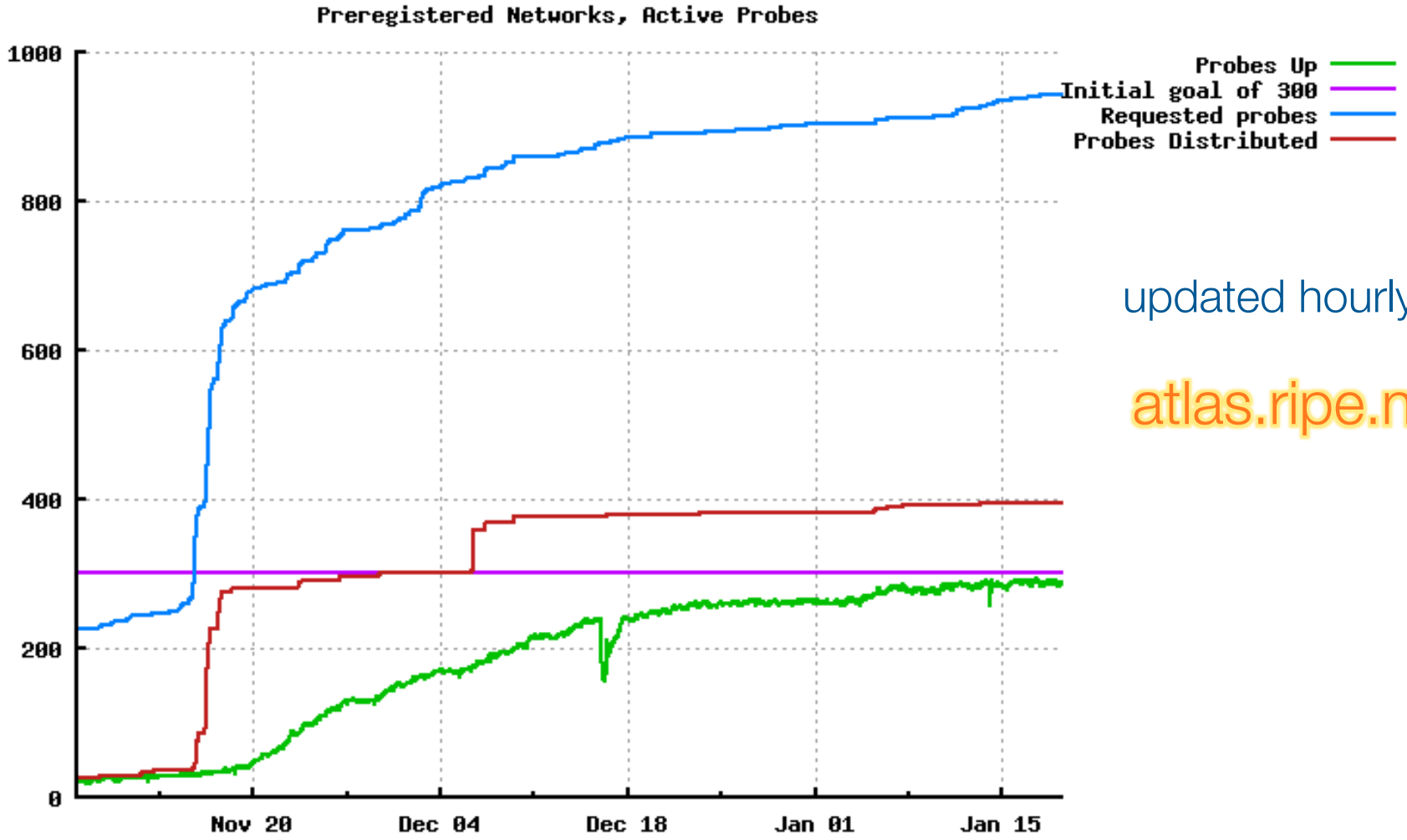


updated hourly on

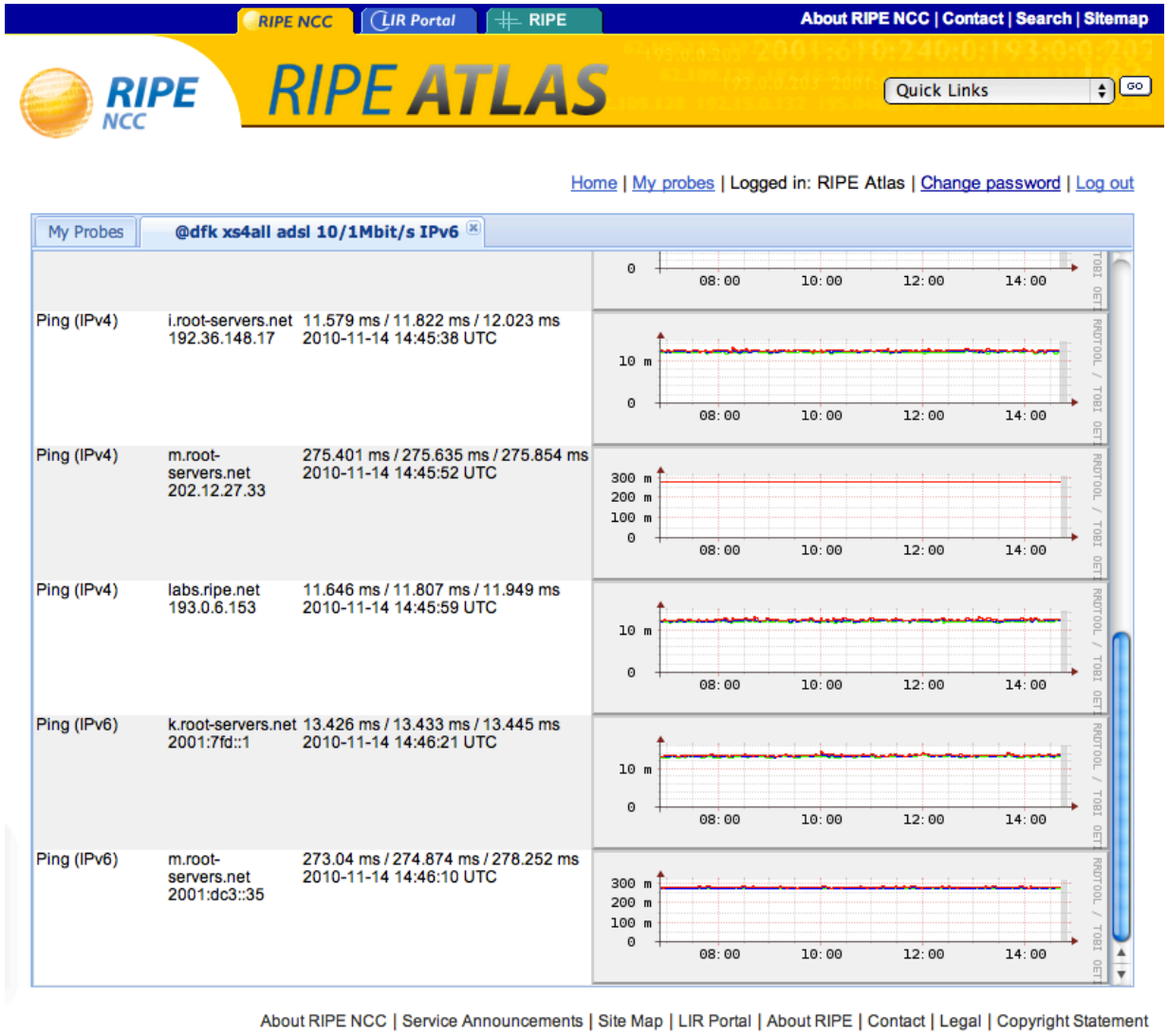
atlas.ripe.net

NOT a Simulation

Hosting = Credits = Measurements

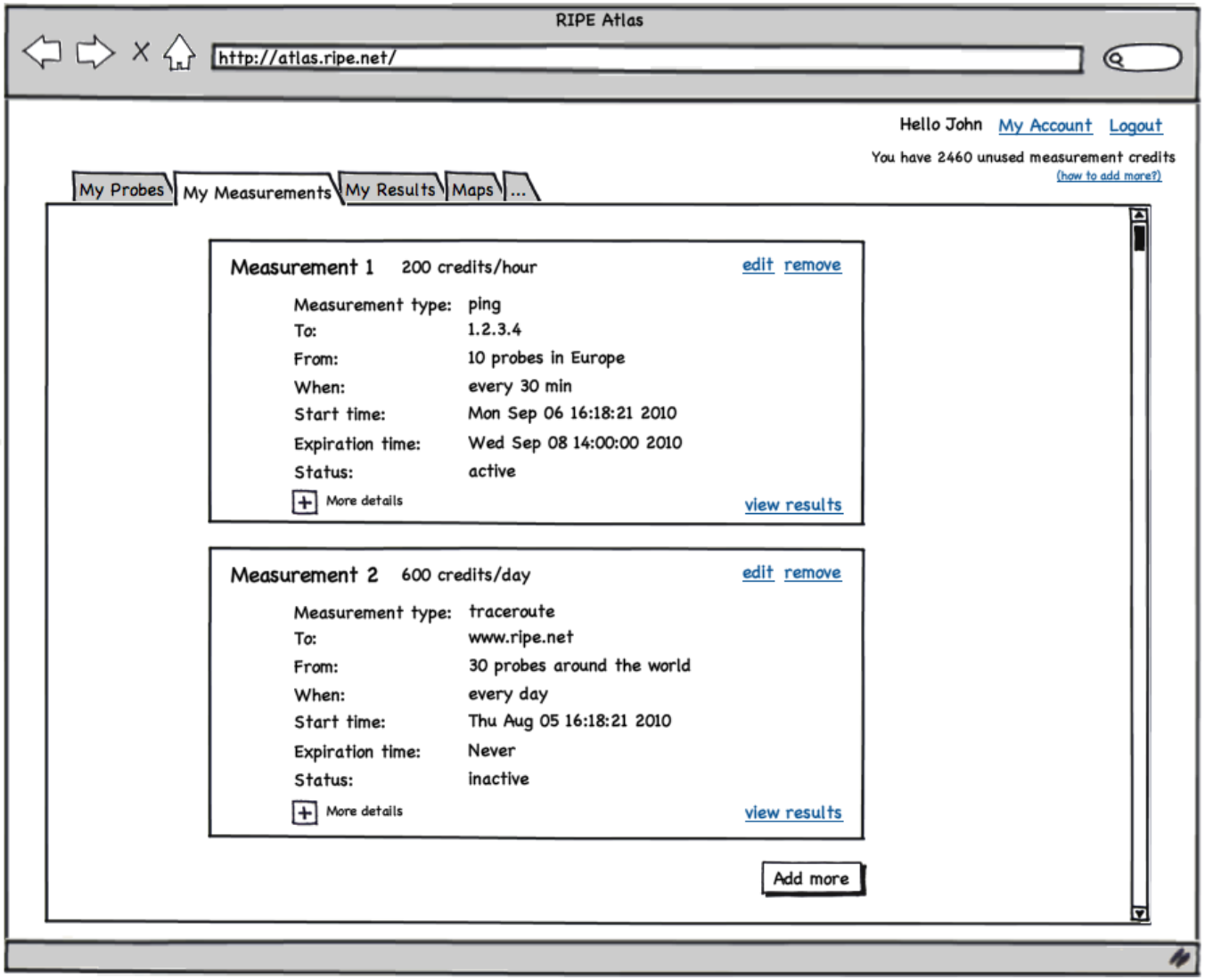
- More probes expected in Q1 2011
- Apply for one on atlas.ripe.net

Hosting = Credits = Measurements



NOT a Simulation

Hosting = Credits = Measurements



Sponsorship = Credits = Measurements

- 50k probes too expensive for RIPE NCC alone
- Sponsorship Plans:

2K €		8 probes
4K €		16 probes
…		…
64K €		256 probes

- Recognition and many more credits
- Access to fixed measurements from probes now
- Credits = Measurements from any probe (Q2/11)

Sponsorship = Credits = Measurements

- 50k probes too expensive for RIPE NCC alone
- Sponsorship Plans:

that is 2048€	2K €	8 probes
	4K €	16 probes
geek compatible pricing℠		…
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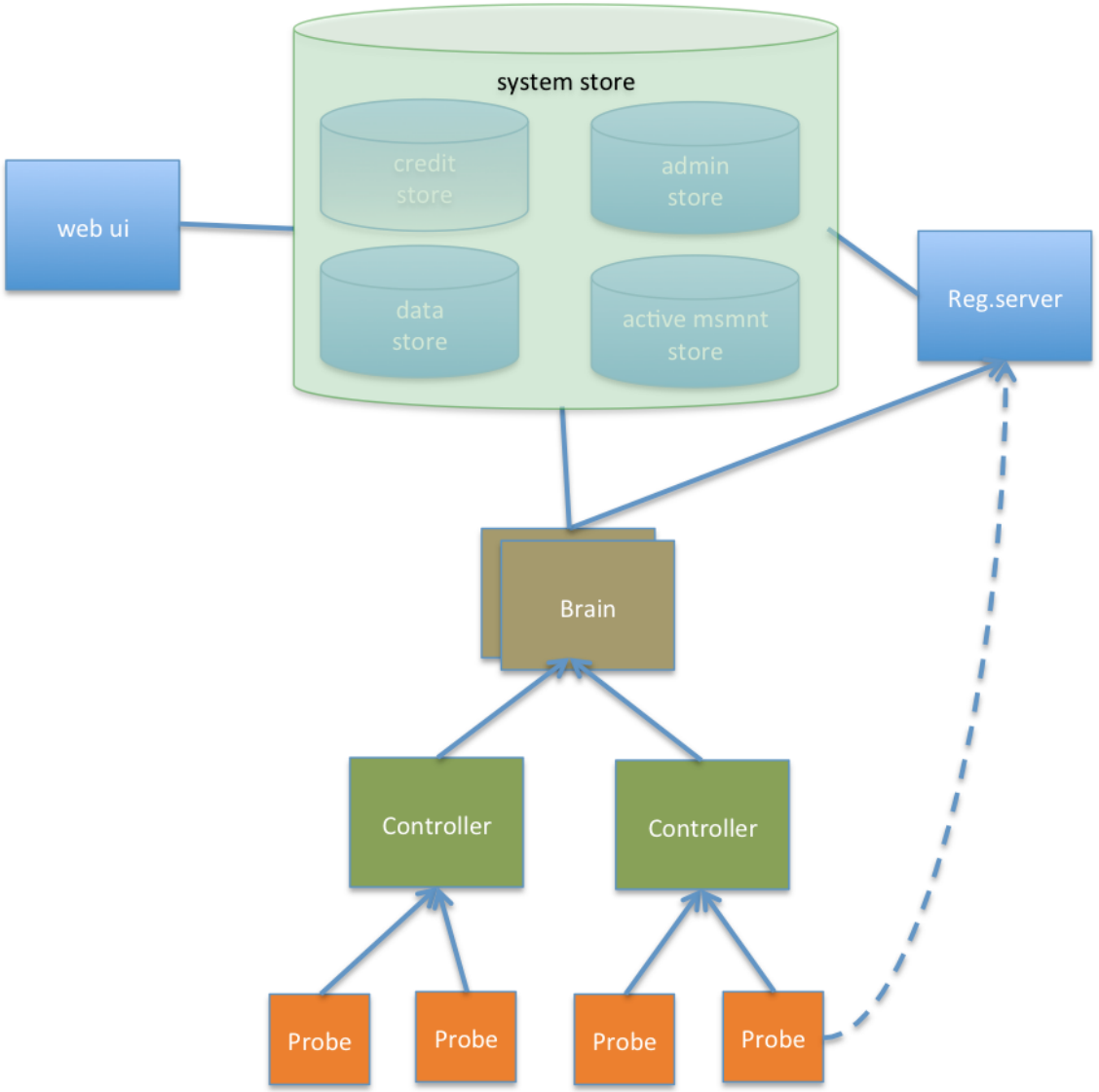
Technicalities

RIPE Atlas - Overall Architecture

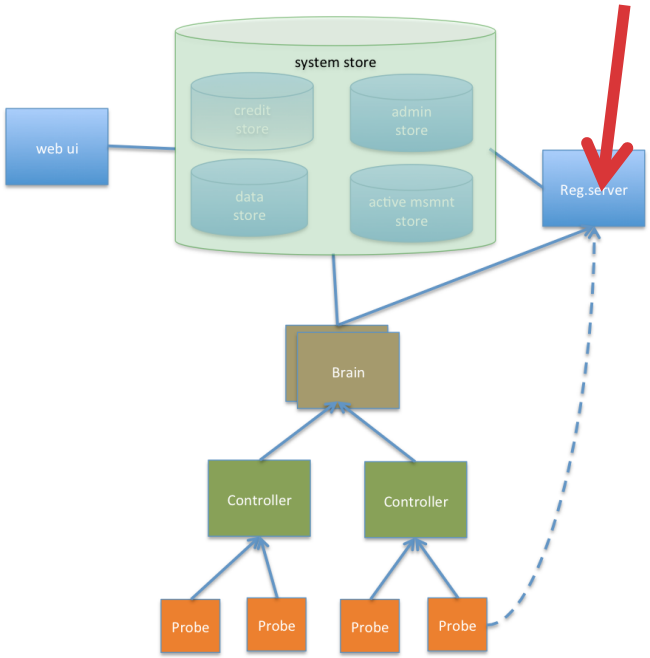


RIPE Atlas - Overall Architecture

- All components in the hierarchy maintain their connections using secure channels with mutual authentication.
- Theoretically, any component can be scaled up independently from the others
- Hierarchy allows for data aggregation
- In order to be scalable, data flow is based on “need to know”

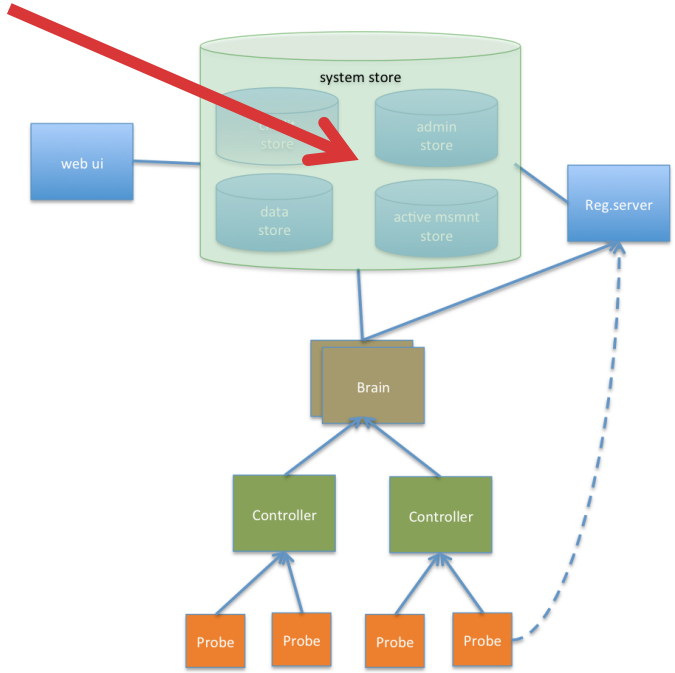
RIPE Atlas - Overall Architecture

- Registration Server:
  - The (only) trusted entry point for Probes
  - Welcomes all Probes and directs them to a suitable Controller:
    - As close as possible to the Probe
    - Not too busy
  - It has a high level overview on the current state of the system



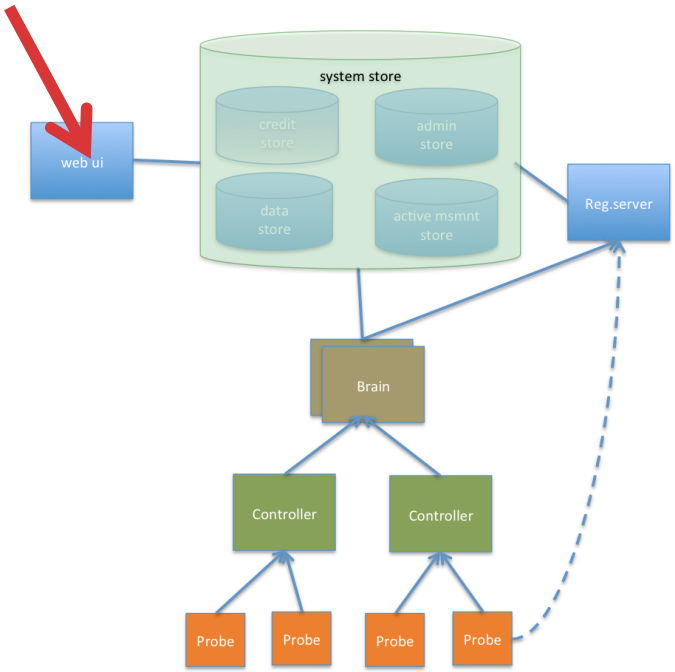
RIPE Atlas - Overall Architecture

- Central database:
  - Administrative store
  - Measurement store (active store)
  - Data store
  - Credit store



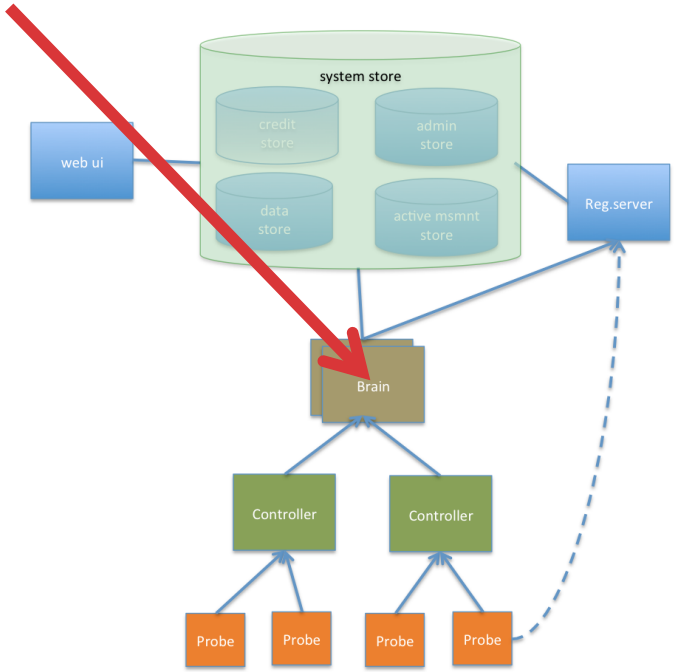
RIPE Atlas - Overall Architecture

- User Interface
  - Allows the users to actually use the service and look at:
    - Probe statuses
    - Measurement results
    - Community aspects



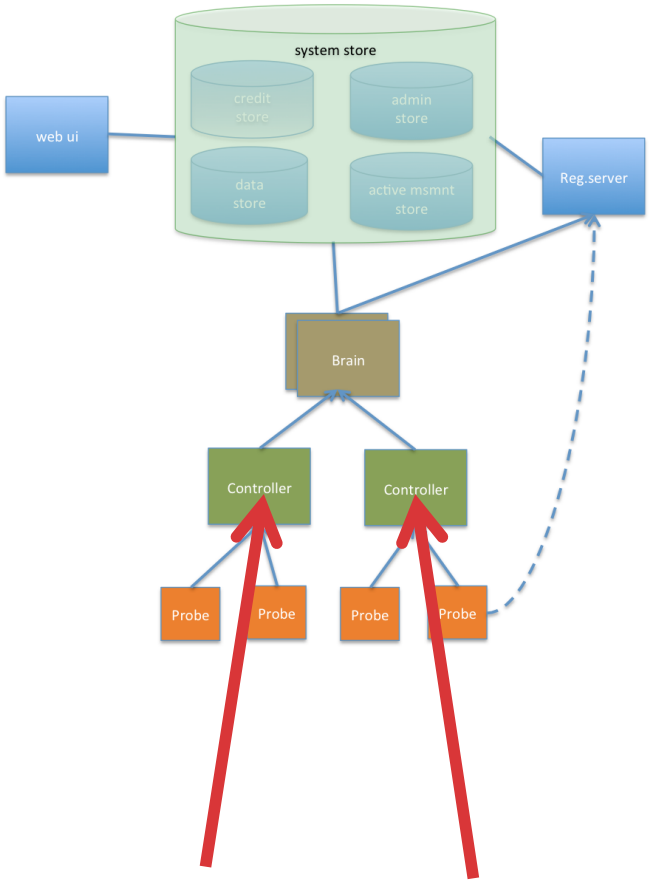
RIPE Atlas - Overall Architecture

- Brain:
  - Responsible for higher order functions:
    - Coordinate measurements
    - Process ultimate results
    - Draw conclusions, maybe even act on them
    - Incorporate other sources of information, like BGP



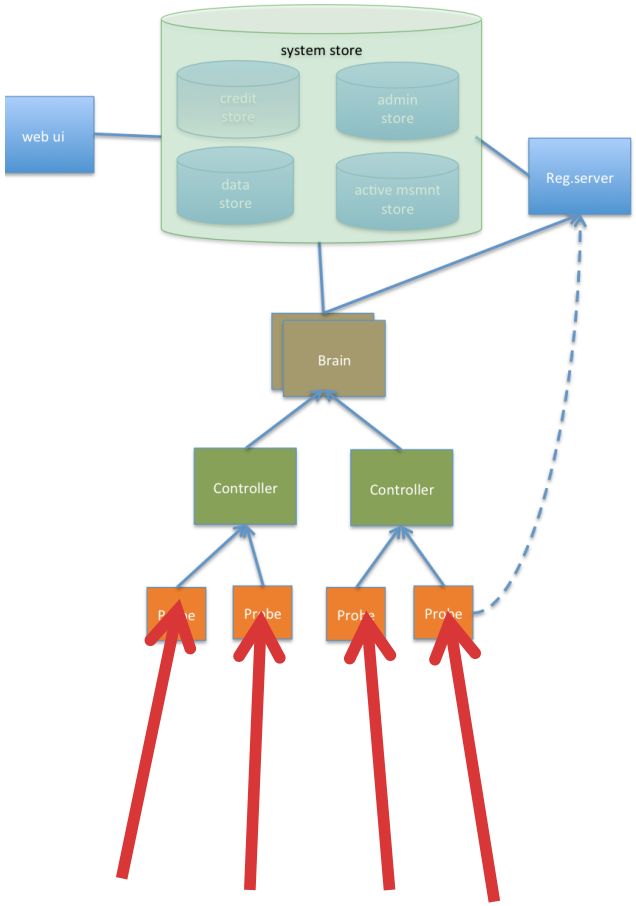
RIPE Atlas - Overall Architecture

- Controller:
  - Responsible to talk to Probes
  - Assigns Probes to requested measurements based on:
    - Available Probe capacity
    - Probe locations
  - Collects intermediate results and aggregates if needed
  - Regularly reports to Brain

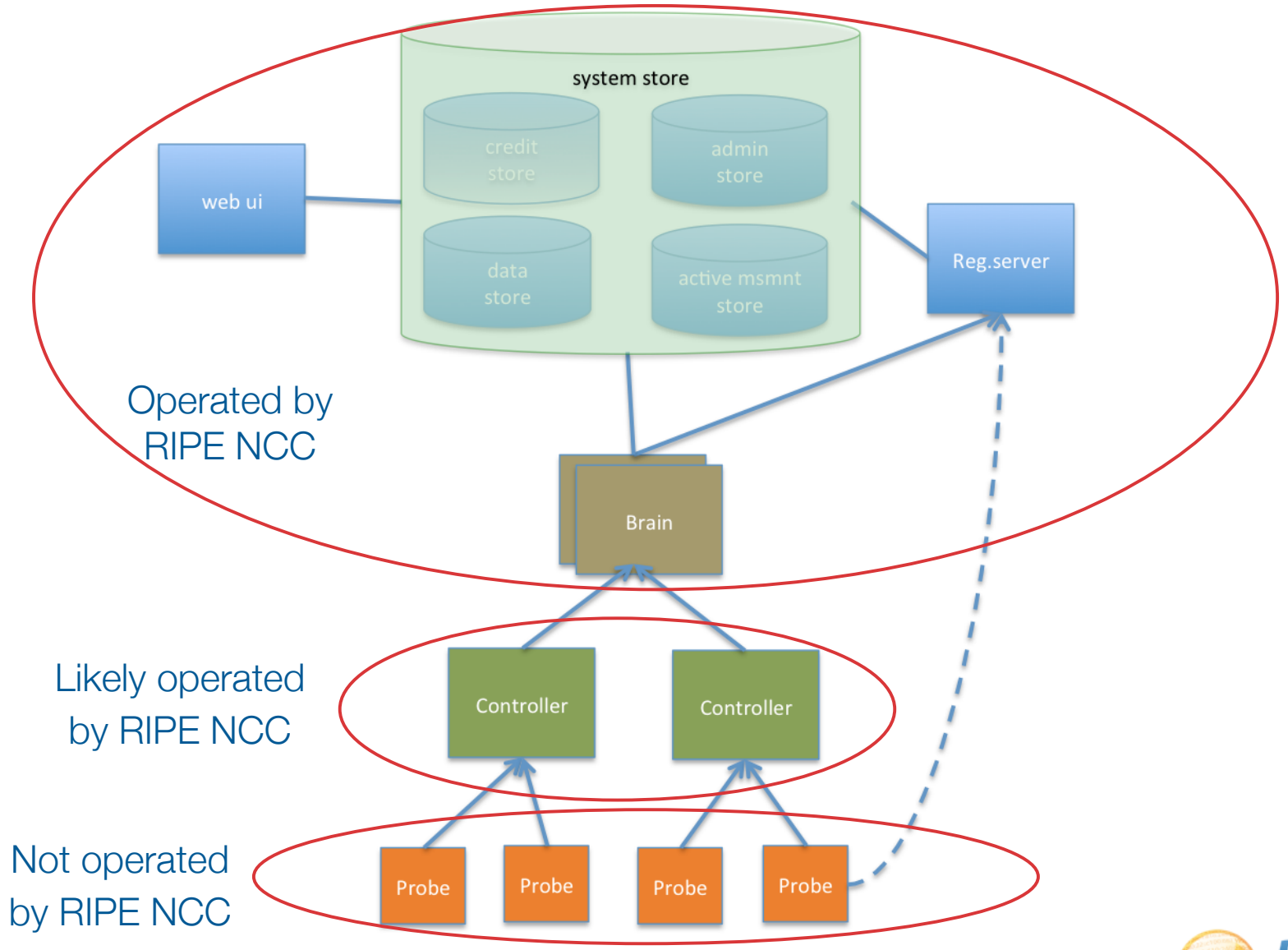


RIPE Atlas - Overall Architecture

- Probe:
  - Listens to measurement commands from Controllers
  - Executes built-in and dynamic measurements
  - Reports results to Controller
  - Other:
    - Self-upgrades if needed
    - Maintains state as much as possible



RIPE Atlas - Overall Architecture



RIPE Atlas - Probes

- Probe (v1 / generation 1):
  - Lantronix XPortPro
  - Very low power usage
  - 8MB RAM, 16MB flash
  - Runs uClinux
  - No FPU, no MMU
  - A reboot costs <15 seconds
  - An SSH connection costs ~30 seconds
  - We can remotely update the firmware

RIPE Atlas - Security aspects

- All components in the hierarchy maintain their connections using secure channels with mutual authentication.
- All information exchanges happen via channels inside a single (secure) connection.

RIPE Atlas - Security aspects

- Probes have hardwired trust material (registration server addresses / keys)
  - Upon registration, the registration server informs the probe about its future controller, and vice versa
- The probes don't have any open ports
  - They only initiate connections
    - This works fine with NATs too

RIPE Atlas - Security aspects

- Probes don't listen to local traffic, there are no passive measurements running
  - There's no snooping around
- We suspect we'll lose some probes because of "deep interest in how they really work". That is:
  - Some will be disassembled
  - Some will be hacked locally, modified and used for something else
  - But there is no shared key material on the Probes…

RIPE Atlas - Other Bits and Pieces

- IPv6 support:
  - The system in general supports IPv6
    - We already do IPv6 measurements
  - However, only RA is supported, so no DNS in v6 only mode yet :-(

RIPE Atlas - Other Bits and Pieces

- The Probe has no direct user interface to configure anything on it
  - So DHCP is a must for IPv4, RA is needed for IPv6
  - Deployment in places without DHCP is not yet supported
  - But we do have ideas on how to solve this

Questions?

atlas.ripe.net

RIPE NCC

Spare Slides

Why Hardware and not Software Probe ?

- Comparable and Reliable Measurements
  - Known and uniform environment
  - Tamper resistant
- 24 x 365
  - Install and Forget
  - Not dependent on host system, needs little power
- Security
  - Not attractive nor easy target for botnet herders
  - Not introducing potential weakness in host systems

Is this the RIPE Botnet ?

- No
- Architecture is security conscious -> MAT WG
- Probes do not offer services, no open ports
- Probes are not interesting targets
  - Very special environment
  - Not really powerful either
- Infrastructure is designed with security in mind
- Measurements will be rate limited ….

Private Measurements ?

- We are not offering this as a service for private and confidential measurements
- All results should benefit the community, also those of individually configured measurements
  - Modalities to be discussed -> MAT WG
  - Embargo periods
  - Aggregation
  - Anonymisation
- If you want to keep it very secret, run your own.