RIPE NCC
RIPE NETWORK COORDINATION CENTRE

RIPE Atlas

Ethical, Security and Legal Aspects of Running an IoT Network

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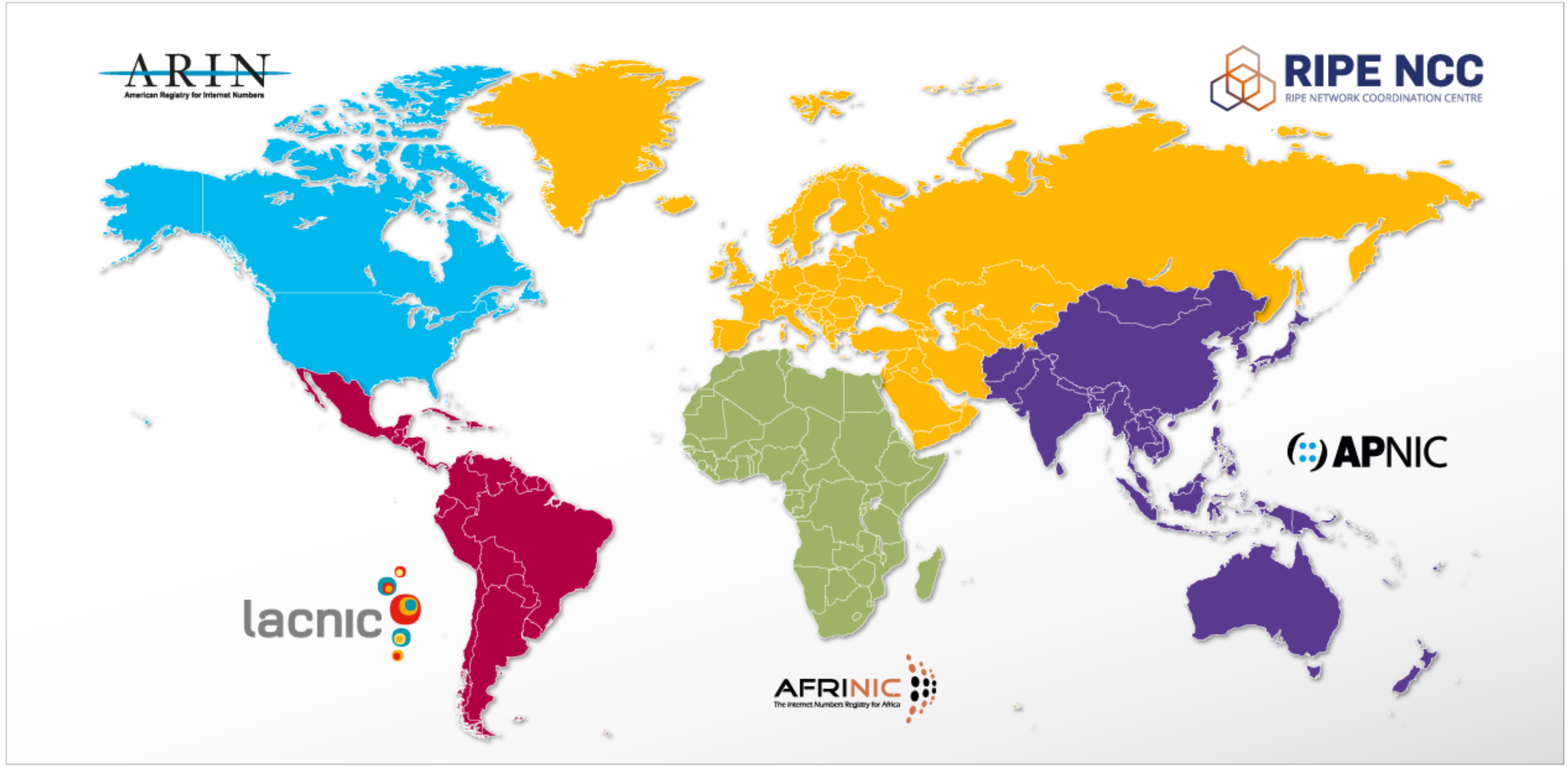
RIRs Around the World



RIPE Atlas

RIPE Atlas

RIPE Atlas is a **global, open, distributed** Internet measurement platform, consisting of thousands of measurement devices that measure **Internet connectivity** in real time. (wikipedia)

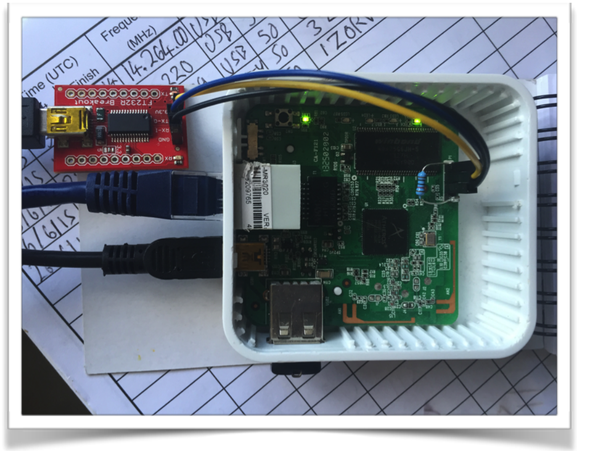
RIPE Atlas Use Cases

- **Measuring Internet access disruptions:**
  - Internet Access Disruptions in Turkey
  - Internet Access Disruption in Gambia
- **Measuring DNS censorship and hijacking:**
  - Using DNS Servers in Iran
  - DNS Censorship
- **Monitoring connectivity problems:**
  - Monitoring Game Service Connectivity
  - Measuring Cloud Connectivity
  - Debugging Network Connectivity Problems

RIPE Atlas in Numbers

- 10,000 probes and 400 anchors connected worldwide
- 5.6% IPv4 ASes and 9% IPv6 ASes covered
- 181 countries covered
- 7,000 measurements per second

Design Principles



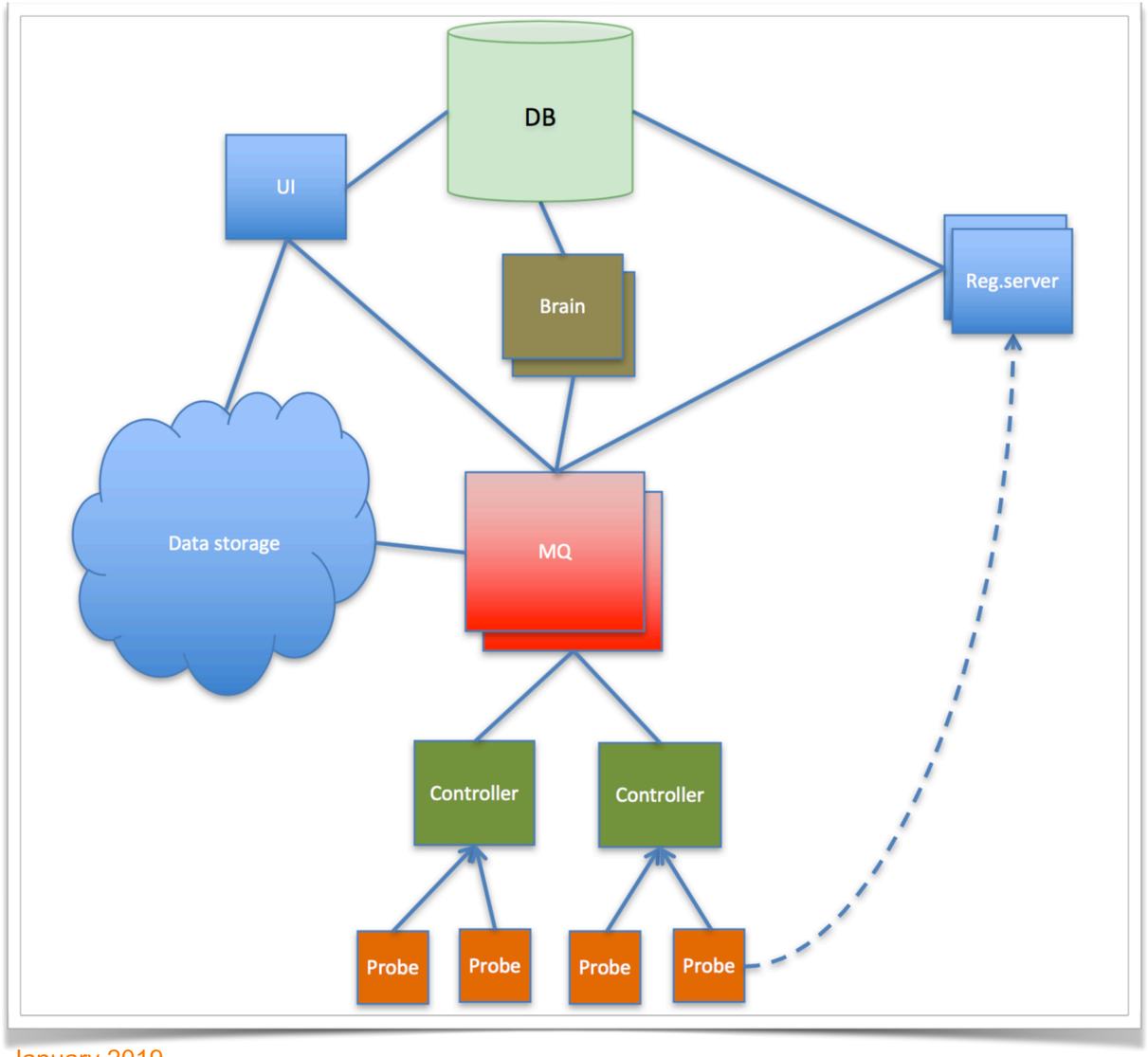
- **Low, cheap barrier of entry**
- **Active measurements only**
  - Probes do not observe user traffic
- **Data, API, tools, source code: FREE and OPEN**
- **Set of measurement types limited**
  - Ping, trace route, SSL/TLS, NTP, HTTP (limited)
- **Strong community involvement from the start**

Ethical Considerations

- **No bandwidth measurement**
  - Other platforms provide that service
- **HTTP measurements only towards RIPE Atlas anchors because otherwise:**
  - It would rely on the hosts' bandwidth
  - Might put volunteer hosts at risk
- **Encourage our users to think about ethical consequences**
  - https://labs.ripe.net/Members/kistel/ethics-of-ripe-atlas-measurements

Securing RIPE Atlas

RIPE Atlas Architecture



Limiting Consequences (1/2)

- **Prevent re-use and re-purposing of probes**
  - Decided against Trusted Platform Model (TPM)
  - Instead, we use cheap devices and discourage reusing them
  - Accepting possible loss of probes
- **Initialisation procedure before distribution**
  - Off-the-shelf firmware gets replaced with RIPE Atlas firmware
  - Generating and registering individual keys
  - Testing

Limiting Consequences (2/2)

- **Trust anchors installed on all probes**
  - Two-way authentication; unique SSH key for probes used for identification
- **Regular firmware updates**
  - All firmware updates are signed
  - Pre-installed public keys to verify firmware signature before upgrading
- **Mechanisms to detect unwanted behaviour**
  - Outliers or protocol violations
- **No direct services to host or network**
  - No local configuration possible; reduces network-based attack surface

Firmware Upgrades

- **Done in a “lazy fashion”**
  - Upgraded next time they connect to RIPE Atlas infrastructure
  - We have means to force them to upgrade faster
- **Each upgrade is cryptographically verified**

Legal Aspects of RIPE Atlas

Legal Considerations (1/2)

- **Radio Equipment Directive (2014/53/EU)**
- **Mandatory requirements for everything that has a radio**
  - Basis in health and safety, together with interoperability
  - Also applies when you communicate via other means (e.g. WiFI, GPS, Bluetooth)
- **Self-assessment on compliance**
  - Using CE mark to indicate you're safe
  - Ex-post compliance testing in (external) labs by regulator
  - Non-compliance can result in EU-wide recall

Legal Considerations (2/2)

- **Directive has a few “optional” requirements**
  - 3.3.d: Do not harm the network or misuse network resources
  - 3.3.e: Protection of personal data and privacy
  - 3.3.f: Protection from fraud
  - 3.3.i: Only compliant software can be loaded
- **Can be activated by means of a Delegated Act**
  - Decision by European Commission

Best Current Practices

- IETF draft document: BCP for Securing IoT Devices

https://tools.ietf.org/html/draft-moore-iot-security-bcp-01

- RIPE Atlas: https://atlas.ripe.net

https://labs.ripe.net/Members/kistel/ripe-atlas-probes-as-iot-devices

https://labs.ripe.net/Members/kistel/ripe-atlas-architecture-how-we-manage-our-probes