AnyTime: NTP for Catchment & Spoofing Detection

Background

Anycast

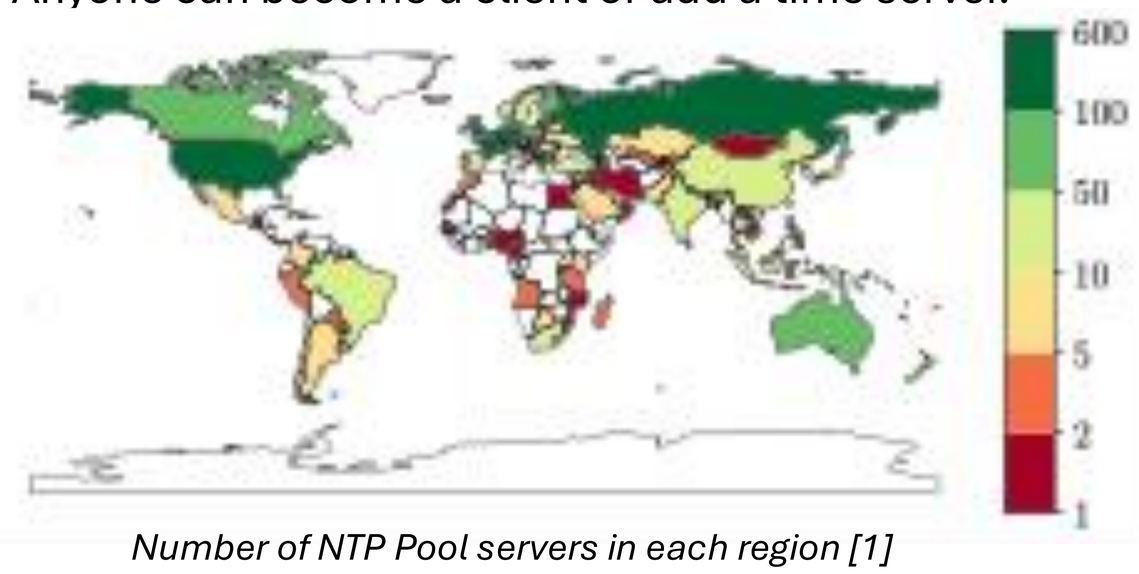
Anycast is the practice of making an IP address available at multiple locations.

Clients reach a nearby replica. The replica they reach is their 'catcher'.

Figure from cloudways.com

The NTP Pool

Volunteer-run, vastly distributed, global pool of time servers, consisting of 6k servers and hundreds of millions of clients.
Anyone can become a client or add a time server.



Number of NTP Pool servers in each region [1]

Methodology

Catchment mapping (active probing)

Measuring the 'catcher' for OKC

We use MAnycastR *[2]* to measure catchments.

- ✓ **Scalable** (Internet-wide scanning in minutes)
- ✓ **Fast** (instantaneous live measurements)
- ✓ **Comprehensive** (combines multiple probing techniques for increased coverage)

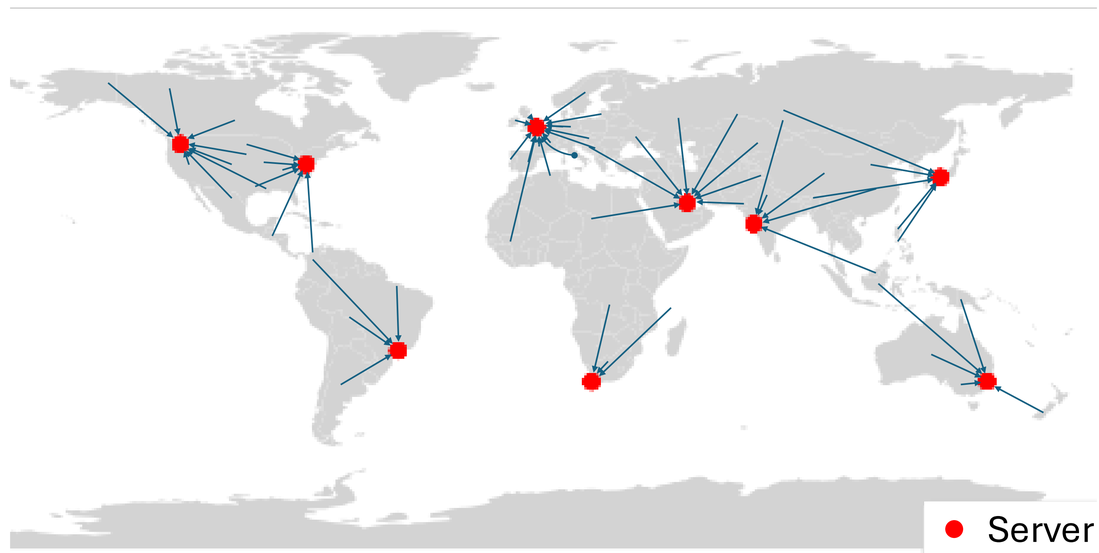
– Requires probe responsive targets

Output: mappings of (*target*, '*catcher*')

Enables spoofed traffic detection

- Spoofed packets will be 'off-catchment'

Joining the Pool (passive)



Adding our anycast deployment to the NTP Pool, we obtain traffic from networks not previously measurable.

- ✓ **Passive** (no measurement overhead)
- ✓ **Wide-ranging** (can measure ICMP-inactive hosts, even behind firewalls)
- ✓ **Detailed** (traffic contains timestamps and some details about the clients*)
- May contain spoofed traffic*

– Long-term commitment

– Active probing generally not possible

* NTP is commonly abused for DDoS attacks.

Using our methodology, we can identify spoofed IP addresses and perhaps fingerprint client devices.

Remi Hendriks
remi.hendriks@utwente.nl

Pascal Huppert
pascal.huppert@utwente.nl

[1] Moura et al. 2024. Deep Dive into NTP Pool's Popularity and Mapping. DOI 10.1145/3639041

[2] Hendriks et al. 2025. LACeS: An Open, Fast, Responsible and Efficient Longitudinal Anycast Census System. DOI 10.1145/3730567.3764484

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