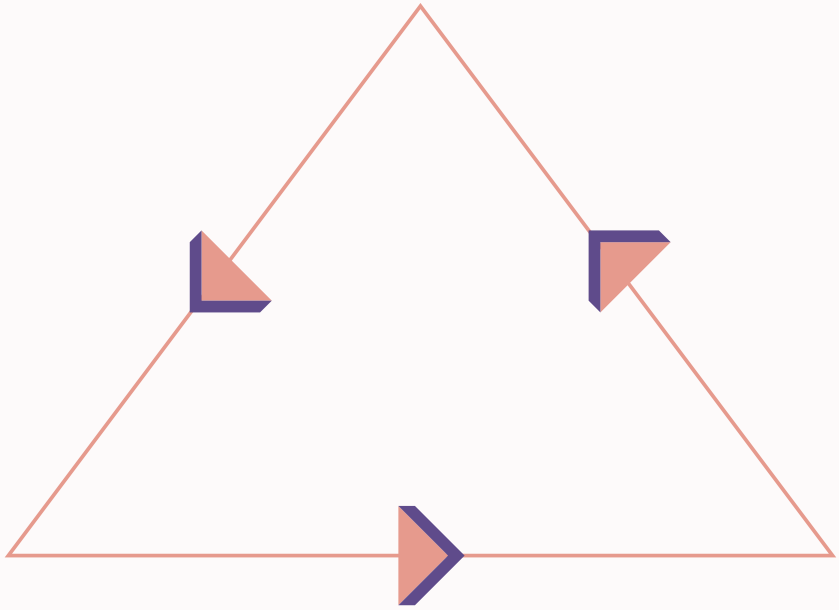
Could you tell me the time?

Securing time with NTS



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Introduction

- Hi all! My name is **Ruben Nijveld**
- I work at **Trifecta Tech Foundation**, a Dutch non-profit
- We mostly work on open infrastructure software
- My own focus is on time synchronization software
  - **ntpd-rs** (NTP)
  - **statime** (PTP)
  - **nts-pool**

Can anyone tell me the current time?

What is the current time, anyway?

- I was looking for the current time in UTC
  - but with an offset of +1 hour, because we're in Belgium right now and it is winter
- UTC is the worldwide standard for time
  - There are also TAI and UT1, but let's skip those for today
- Network Time Protocol (NTP) is the most used protocol to synchronize time over the internet

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NTP is unprotected and can be spoofed trivially

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Why do we even care if time is synchronized?

- TLS connections (minutes)
- Kerberos tickets (minutes)
- TOTP tokens (seconds)
- Database synchronization (milliseconds)
- Logging in distributed systems (milliseconds)

But also: cellular networks (5G), internet exchanges, data centers, audio/video sync, streaming, high frequency trading, congestion control, work/task scheduling, power grid load balancing, astronomy

The world depends on UTC virtually everywhere

Knowing the current time is critical for security, and yet relies on a fundamentally insecure time synchronization protocol

Network Time Security (NTS) exists!

- An extension on top of NTP that adds a security mechanism to prevent third parties from sending forged messages
- NTS adds a key exchange phase based on TLS [1]
- NTP requests and responses include NTS extension fields
- Standardized in IETF RFC 8915 since September 2020

[1] Some might notice the interesting circular dependency here

Getting NTS on more devices

Unfortunately there are lots of devices that still use NTP by default

- We don’t know of any SNTP client that support NTS
- You can switch to a full NTP client with NTS support
  - NTPsec, Chrony or ntpd-rs
- We are patching systemd-timesyncd to support NTS [1]
  - We believe many users would benefit from a full NTP client, but acknowledge the usefulness of a very simple client

[1] https://github.com/systemd/systemd/pull/39010

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Pooling NTS servers

Your NTP client configuration probably points to `pool.ntp.org` [1]

- Pooling gives us an easy address everyone can use as a default
- The NTP pool uses DNS for sharing the NTP load of hundreds of millions of NTP requests per day between some 5000 NTP servers
- But NTS uses TLS for the key exchange step
  - issuing 5000 certificates for the same domain or sharing the same certificate between 5000 servers kills security
- We need alternative approaches

[1] Canonical uses their own time servers for Ubuntu, they actually switched to NTS in Ubuntu 25.10

NTS pool proposals [1]

- **KELB**: Use a load balancing proxy
  - No client-side modifications needed
  - Server needs modifications
  - Heavier load on the pool servers themselves
- **SRV**: Use DNS SRV records
  - Needs client-side modifications
  - No server modifications needed
  - Needs DNSSEC validation otherwise SRV records can be spoofed

[1] https://trifectatech.org/blog/enabling-pools-in-nts/

NTS pool

- **We need your servers and clients**
- Supported by ICANN Grant Program
- Highly experimental
- Will move domains once more stable
- We would like the best method to become IETF standard
- Patches available for Chrony, NTPsec and ntpd-rs

experimental.ntspooltest.org

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Join us in getting NTS everywhere!

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github.com/pendulum-project/nts-pool
trifectatech.org
experimental.ntspooltest.org

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