RustNL GOSIM 2024 EUROPE

Do you know…

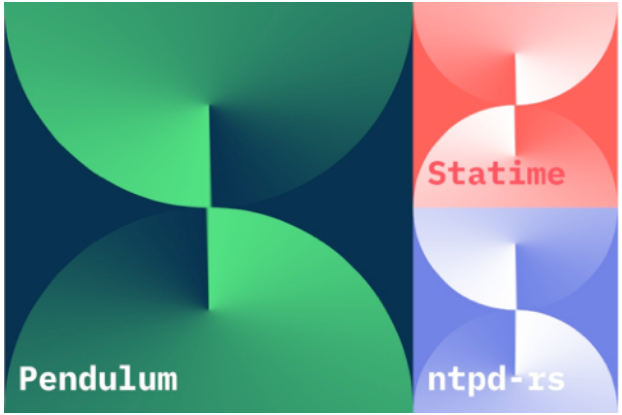
… WHO WROTE YOUR SOFTWARE?

Marc Schoolderman
Tweede golf

May 6th, 2024

Software must become safer

- Fewer vulnerabilities
- A more reliable Internet
- Resilient critical infrastructure

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Ferris mascot: Karen Rustad Tölva
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Word cloud: Nicole C. Baratta
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Who wrote `sudo-rs`?

Our team

- Developers: 👨🏻‍💻 👨🏼‍💻 👨🏻‍💻 👨🏽‍💻

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- Outside contributors: 💁🏻‍♀️ 🙋🏻 🙋🏾 🙋🏻 🕵️‍♂️ 🙋🏿 🙋🏻 🙋🏽 🙋🏻 🙋🏽‍♀️ 👮‍♂️ 🙋🏻 🙋🏻 🧜‍♀️

Who wrote `sudo-rs`?

OUR TEAM

- **Developers:** 👨🏻‍💻 👨🏼‍💻 👨🏻‍💻 👨🏽‍💻
- **Outside contributors:** 🙋🏼‍♀️ 🙋🏻‍♂️ 🙋🏾‍♂️ 🙋🏻‍♂️ 🕵️‍♂️ 🙋🏿‍♂️ 🙋🏻‍♂️ 🙋🏽‍♂️ 🙋🏻‍♂️ 🙋🏽‍♀️ 👨‍✈️ 🙋🏻‍♂️ 🙋🏻‍♂️ 👩‍🎤

NOT OUR TEAM

- **11 Developers** 🤷‍♂️🤷🏻‍♀️🤷‍♂️🤷🏼‍♂️🤷‍♂️🤷🏾‍♂️🤷‍♂️ 🤷‍♂️🤷🏼‍♀️🤷‍♂️🤷‍♂️
- **1 Bot** 🤖
- **4 GitHub teams** …🤷‍♂️🤷‍♂️🤷‍♂️🤷‍♂️🤷‍♂️🤷‍♂️🧑‍🎤🤷‍♂️🤷‍♂️🤷‍♂️🧑‍🎤🤷‍♂️ 🤷‍♂️🤷‍♂️🤷‍♂️🦹🤷‍♂️🤷‍♂️🤷‍♂️🤷‍♂️🤷‍♂️🧑‍✈️🤷‍♂️🤷‍♂️👩‍🎤🤷‍♂️🕵️🤷‍♂️🤷‍♂️🤷‍♂️🤷‍♂️🤷‍♂️🥷🤷‍♂️ ??

Who wrote `sudo-rs`?


```
The following individuals can publish updates for your dependencies:

 1. alexcrichton via crates: glob, libc, log
 2. huonw via crates: glob, libc, log
 3. rust-lang-owner via crates: glob, libc, log
 4. JohnTitor via crates: libc
 5. KodrAus via crates: log
 6. gnzlbg via crates: libc
 7. joshtriplett via crates: libc
 8. sfackler via crates: log
```

```
$ cargo supply-chain publishers
```

How many lines of code is `sudo-rs`?

OUR TEAM

- `sudo-rs`: **20.320 lines**

NOT OUR TEAM

- `log`: **5594 lines**
- `glob`: **2160 lines**
- `libc`: **121.914 lines (bindings)**

```
$ cargo vet
```

How much of `sudo-rs` is our work?

Conclusions:

- **At least** 13.5% of the lines of active code
- **At most** 33% of the people involved
- `sudo-rs` has **minimal** dependencies (best-case scenario)

Running example: pet project “`cargo pulse`”

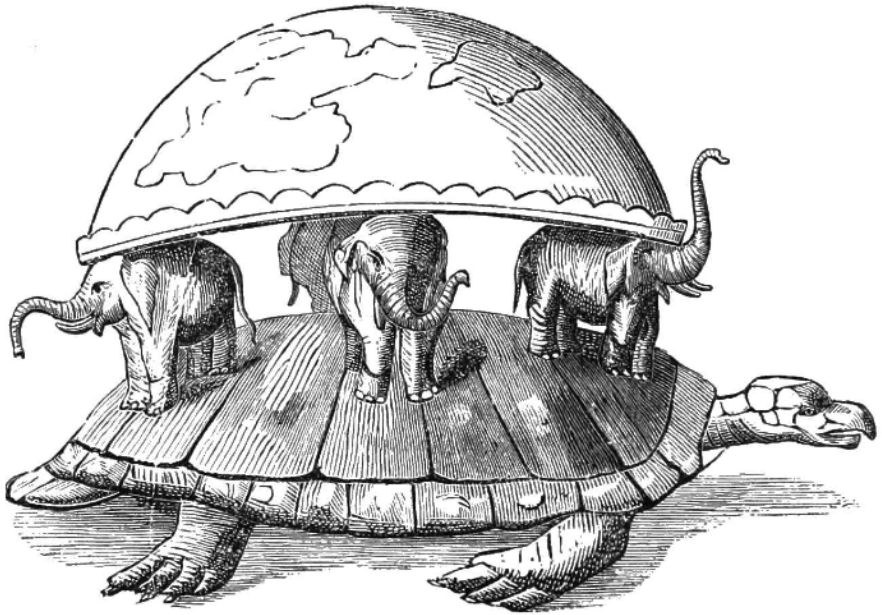
ME:

- **1** contributor
- 181 lines of Rust
- **7 dependencies**

NOT ME:

- 99 contributors, 28 teams
- 4.2 million lines of code,
  1.2 million not audited

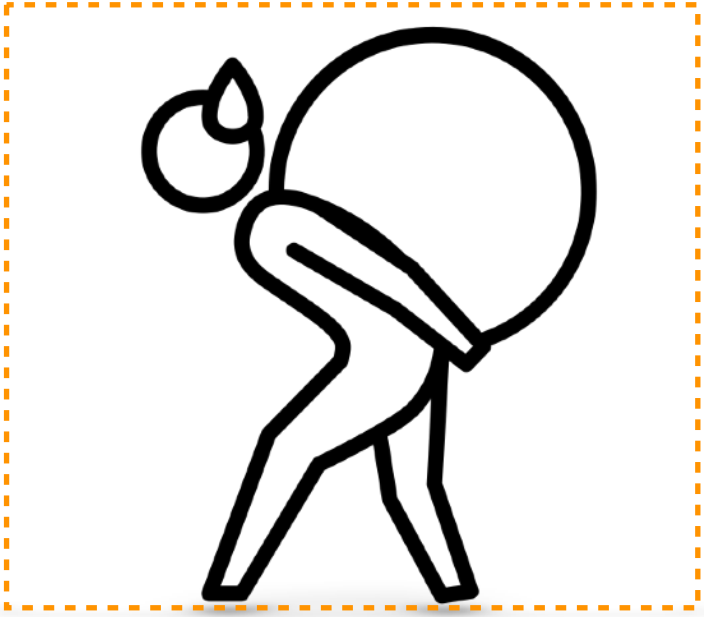
- **194 indirect dependencies**



Burden Problem

Trust Problem

Burden Problem



Trust Problem

Burden: Version management

- **Easy-to-Package?**

```
🔴 cargo-pulse v0.1.0 (/Users/squell/cargo-pulse)
   ├── async-trait v0.1.80 (0.1.77 in debian)
   ├── cargo_metadata v0.15.4 (in debian)
   ├── chrono v0.4.38 (0.4.31 in debian)
   ├── colored v2.1.0 (in debian)
🔴 ├── crates_io_api v0.8.2
   |   ├── chrono v0.4.38 (0.4.31 in debian)
   |   ├── futures v0.3.30 (in debian)
   |   ├── reqwest v0.11.27 (0.11.24 in debian)
   |   ├── serde v1.0.199 (1.0.195 in debian)
   |   ├── serde_derive v1.0.199 (1.0.195 in debian)
   |   ├── serde_json v1.0.116 (1.0.111 in debian)
   |   ├── serde_path_to_error v0.1.16 (0.1.9 in debian)
   |   ├── tokio v1.37.0 (1.35.1 in debian)
   |   └── url v2.5.0 (in debian)
   ├── octocrab v0.31.2 (in debian)
   └── tokio v1.37.0 (1.35.1 in debian)
```

```
$ cargo debstatus
```

Burden: Version management

- **Duplicate, Incompatible Versions**
- `Cargo.toml` **up to date?**
  - (*Compatibility with other versions*)
- `Cargo.lock` **usually not included**
  - (*Versions known to work*)

```
⌛ base64 v0.13.1 (outdated, 0.21.7 in debian)
⌛ └── pem v1.1.1 (outdated, 3.0.3 in debian)
      └── jsonwebtoken v8.3.0 (in debian)

  base64 v0.21.7 (in debian)

  bitflags v1.3.2 (in debian)

  bitflags v2.5.0 (2.4.2 in debian)

⌛ ring v0.16.20 (outdated, 0.17.5 in debian)
   └── jsonwebtoken v8.3.0 (in debian)

  ring v0.17.8 (0.17.5 in debian)

  syn v1.0.109 (in debian)

  syn v2.0.60 (2.0.48 in debian)

⌛ untrusted v0.7.1 (outdated, 0.9.0 in debian)
⌛ └── ring v0.16.20 (outdated, 0.17.5 in debian)
      └── jsonwebtoken v8.3.0 (in debian)

  untrusted v0.9.0 (in debian)
```

```
$ cargo tree -d
```

Burden: License management

- **Publish as `Apache-2.0-OR-MIT`?**
- **Distribute binaries?**
- **Respect copyleft licenses!**

```
(Apache-2.0 OR MIT) AND BSD-3-Clause (1)
(MIT OR Apache-2.0) AND Unicode-DFS-2016 (1)
0BSD OR Apache-2.0 OR MIT (1)
Apache-2.0 (2)
Apache-2.0 OR BSL-1.0 (1)
Apache-2.0 OR ISC OR MIT (5)
Apache-2.0 OR MIT (144)
Apache-2.0 OR MIT OR Zlib (3)
Custom License File (2)
ISC (4)
MIT (29)
MIT OR Unlicense (1)
MPL-2.0 (1)
```

```
$ cargo license
```

Burden Problem

Trust Problem

Trust: Code Quality

- Undefined Behaviour (UB) impossible in normal Rust
- `unsafe` Rust: “trust me, I’m a real programmer”
- Pet project: 181 lines of safe Rust

  … but 20’000+ `unsafe` expressions under the hood

```
?  │   ├── snafu 0.7.5
☢  │   │   ├── backtrace 0.3.69
☢  │   │   │   ├── addr2line 0.21.0
☢  │   │   │   │   ├── gimli 0.28.0
☢  │   │   │   │   ├── object 0.32.1
☢  │   │   │   │   │   └── memchr 2.6.4
?  │   │   │   │   └── rustc-demangle 0.1.23
?  │   │   │   ├── cfg-if 1.0.0
☢  │   │   │   ├── libc 0.2.149
🔓 │   │   │   ├── miniz_oxide 0.7.1
🔓 │   │   │   │   └── adler 1.0.2
```

```
$ cargo geiger
```

Trust: Vulnerabilities

- **We know how to solve this!**
- But do all developers:
  - report vulnerabilities?
  - admit embarrassing mistakes?
  - actively update versions?

RUSTSEC
The Rust Security Advisory Database

```
Crate:      rustls
Version:    0.21.10
ID:         RUSTSEC-2024-0336
Dependency tree:
rustls 0.21.10
├── tokio-rustls 0.24.1
│   └── hyper-rustls 0.24.2
│       └── octocrab 0.29.3
│           └── cargo-pulse 0.1.0
└── hyper-rustls 0.24.2

Crate:      simple_asn1
Version:    0.6.0
ID:         RUSTSEC-2021-0125
Dependency tree:
simple_asn1 0.6.0
└── jsonwebtoken 8.3.0
    └── octocrab 0.29.3
        └── cargo-pulse 0.1.0

error: 2 vulnerabilities found!
```

```
$ cargo audit, cargo deny
```

Trust: Build time security

- Dependencies come with build scripts, not sandboxed!
  - ➡ `build.rs`

```
$ cargo build
   Compiling cargo-pulse v0.1.0 (/home/cargo-pulse)
   Compiling proc-macro2 v1.0.69
   Compiling unicode-ident v1.0.12
   Compiling libc v0.2.149
   Compiling backdoor v0.1.0
[sudo: authenticate] Password:
```

- Known problem in PyPI (Python) and npm (Node.js) repositories

  https://jfrog.com/webinar/identifying-and-avoiding-malicious-packages-2/

Trust: Who is our Source of Truth?

- Do we know *"Josh Triplett", "John Titor", "gnzlbg", … ?*
  - ➡ **How** do we know we are getting our code from them?
  - ➡ Can we **trust** them to protect their credentials?
  - ➡ Do they **respond** to incidents?
  - ➡ Can they be **coerced** to do something?

XZ Utils logo by "Jia Tan"

Trust: No proper authentication for dependencies

- **SSL** certificates only authenticates the package repository
- **Signed commits** are weakly authenticated (“this is my SSH key”)
- **OpenPGP** unpopular, “Web of Trust” is broken
- Linux Foundation project: **https://trustoverip.org/**

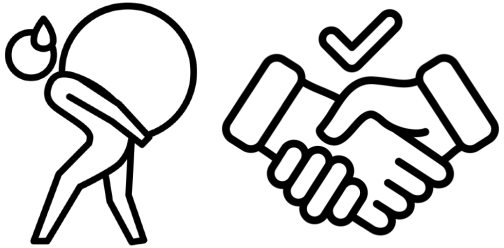
TRUST Over IP FOUNDATION

What to do?

What not to do?

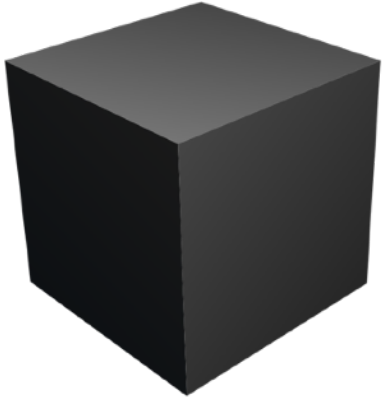
This is not a problem we can “fix”

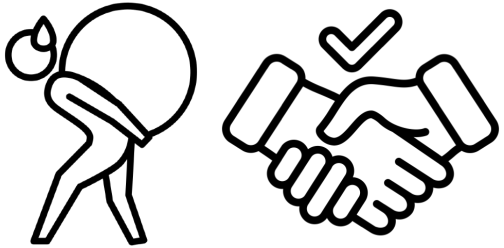
- **Modern software is complex**
- ***Many-and-small* dependencies**
  - ➡ Large “Software Bill of Materials”
  - ➡ Allows analysis and risk management
- ***Few-but-large* dependencies, big standard library**
  - ➡ Software bloat
  - ➡ Hard to change bad design choices



Bad solution: avoiding Rust or Open source

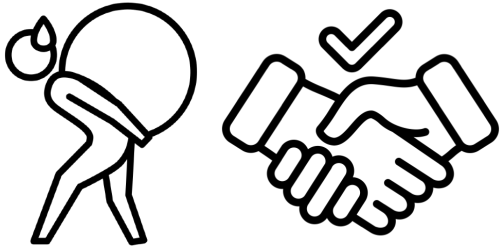
- “Trust problem” is universal, Rust helps keep it under control
- Proprietary software **obscures** problems





Bad solution: duplicating code

- Locks you out of bug fixes
- No vulnerability reporting
- Loses licensing information



Low hanging fruit

- Critically evaluate need for dependencies, check `crates.io` statistics
- Give your users a choice (feature flags)
- Participate in RUSTSEC
- Work towards a standard set of “common dependencies”
- Learn from Linux distributions: reproducible builds, hygiene checks, …

  - https://tweedegolf.nl/en/blog/104/dealing-with-dependencies-in-rust
  - https://www.memorysafety.org/blog/reducing-dependencies-in-sudo/

Security is a trade-off

Security is a trade-off

THANK YOU

More information available at:

https://tweedegolf.nl/en/blog

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