Roto

A fast and safe scripting language for Rust

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NLnet Labs

Non-profit organization

Been around for 25 years

DNS and routing

E.g. NSD, Unbound, Routinator, etc.

NLnet Labs

Historically all in C

All *new* projects are in Rust

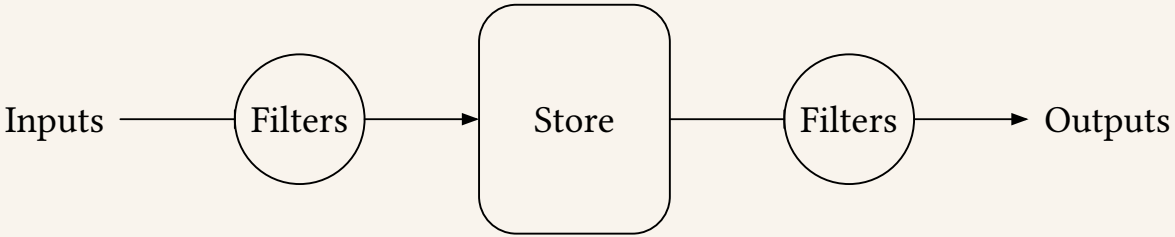
E.g. Cascade, Krill, Routinator, Rotonda and more

Rotonda

A BGP collector written in Rust

read: specialized database

Rotonda: simplified



Solution: scripting language?

Too constrained

Too slow

Dynamically typed

So, being the completely sane developers that we are…

...we made our own

Enter: **Roto**

Roto in a nutshell

Embedded in Rust applications

Statically typed

Friendly error messages

JIT compiled to machine code

How? Cranelift!

Roto compiles to Cranelift IR

Cranelift does the rest!

The unsafest unsafe makes it fast

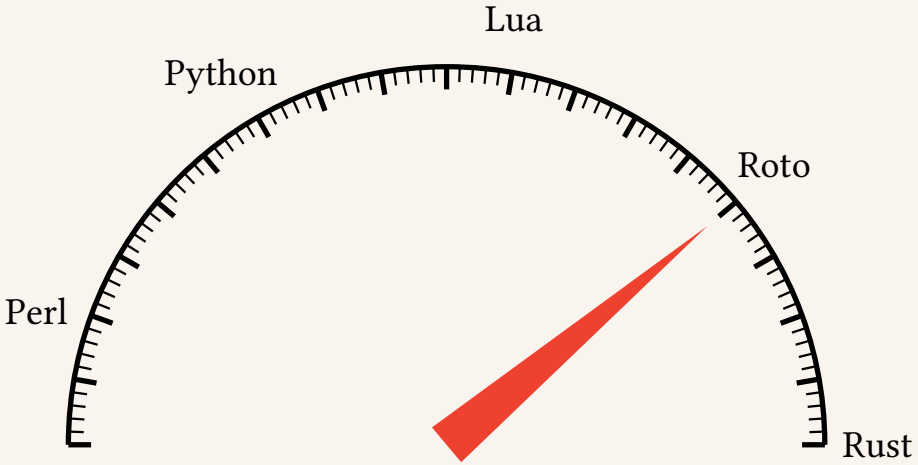
Cranelift gives us just a pointer and a buffer of code.

Transmute `*const u8` to a function pointer

Super-duper unsafe!

Mitigation: Valgrind

Handwavy speed expectations



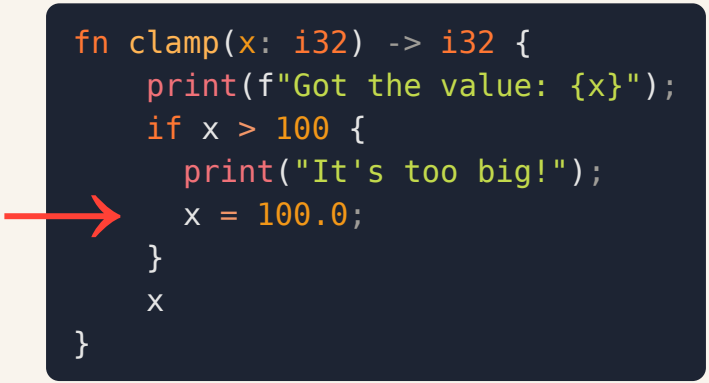
Example: A simple script

```
fn clamp(x: i32) -> i32 {
    print(f"Got the value: {x}");
    if x > 100 {
      print("It's too big!");
      x = 100;
    }
    x
}
```

Example: compiling a script

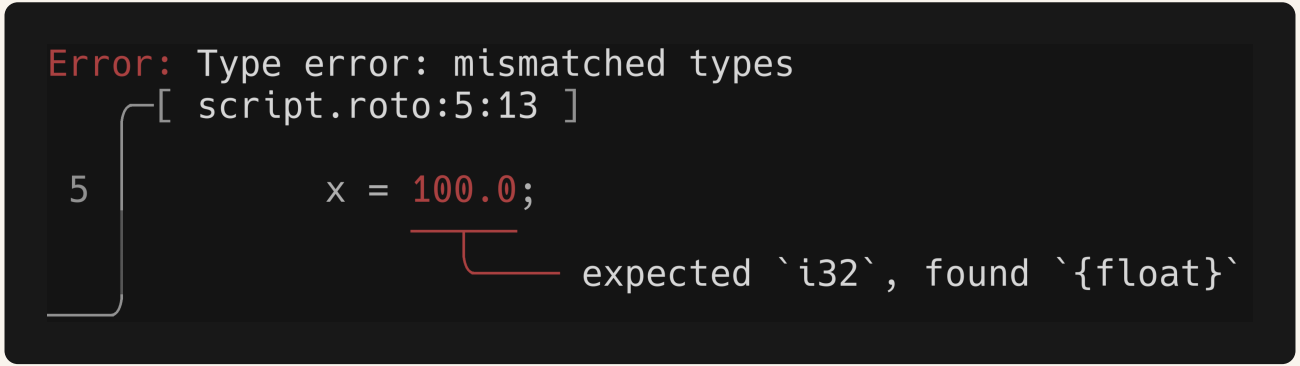
```
let rt = roto::Runtime::new();
let mut pkg = rt.compile("script.roto")?;
let f = pkg.get_function::<fn(i32) -> i32>("clamp")?;
let y = f.call(10);
```

Example: Error messages



```
fn clamp(x: i32) -> i32 {
    print(f"Got the value: {x}");
    if x > 100 {
      print("It's too big!");
      x = 100.0;
    }
    x
}
```

Example: Error messages

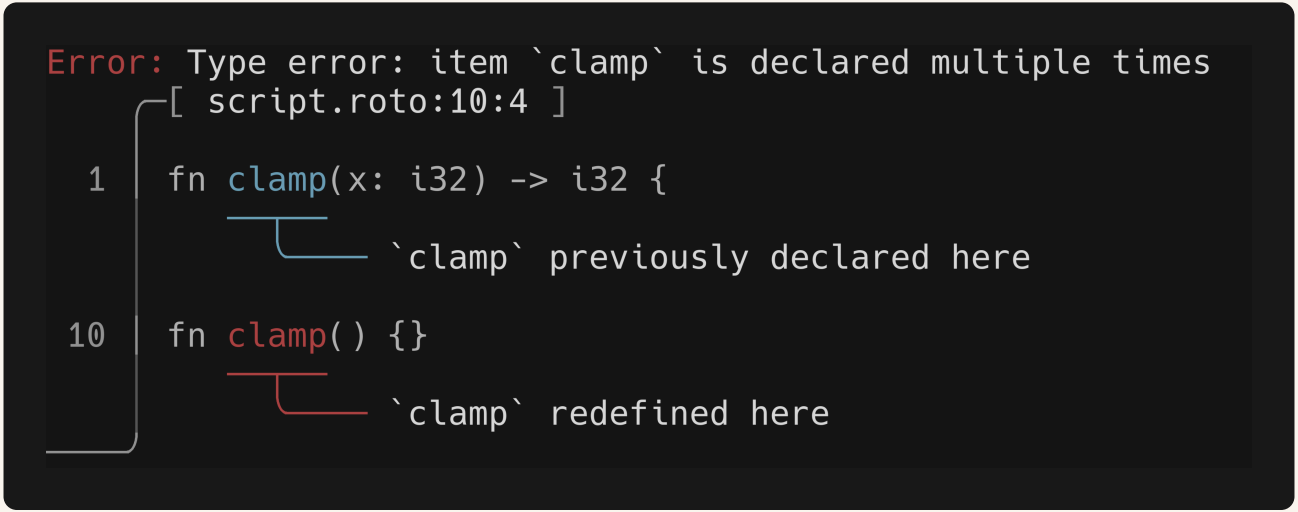


Example: Error messages 2

```
fn clamp(x: i32) -> i32 {
    print(f"Got the value: {x}");
    if x > 100 {
      print("It's too big!");
      x = 100;
    }
    x
}

fn clamp() {}
```

Example: Error messages



Example: Registration

```
use glam::Vec3; // just some random type
use roto::{Runtime, Val, library};

let lib = library! {
    #[copy] type Vec3 = Val<Vec3>;

    impl Val<Vec3> {
        fn x(self) -> f32 {
            self.x
        }
    }
};

let rt = Runtime::from_lib(lib)?;
```

Example: Registration

```
fn add_x_components(a: Vec3, b: Vec3) -> f32 {
    a.x() + b.x()
}
```

Example: Registration

```
let mut pkg = rt.compile("script.roto")?;
let f = pkg.get_function("add_x_components")?;

let a = Vec3::new(3.0, 0.0, 0.0);
let b = Vec3::new(5.0, 0.0, 0.0);
let out = f.call(Val(a), Val(b));
// out == 8.0 (roughly)
```

Registration restrictions

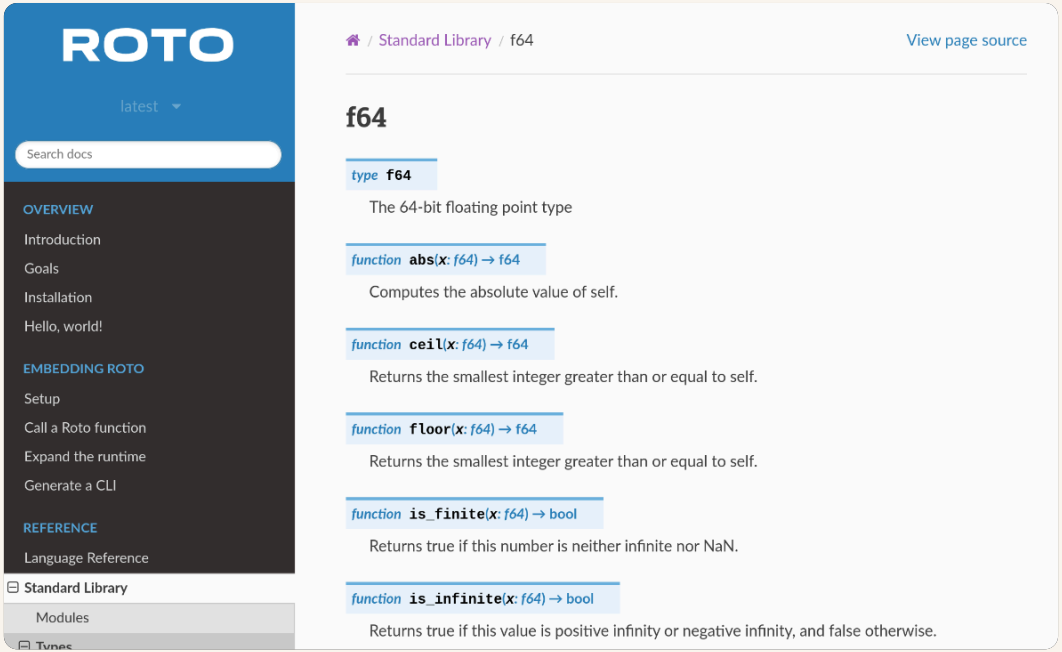
`'static` & `Clone`

Otherwise: `Rc` or `Arc`

No serialization necessary!

[INSERT DEMO HERE]

Documentation website & generator



Current limitations

- No lists
- No `for` loops (only `while`)
- No generics
- No stability guarantees yet

We take this thing seriously!

Backed by a non-profit organization

Integral part of a major product

Free and open source forever

Join us for RustWeek 2026!

May 18-23, 2026 – Utrecht, The Netherlands

See rustweek.org

Links

More about Roto

- github.com/NLnetLabs/roto
- roto.docs.nlnetlabs.nl

Find me online

- terts.dev
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Feel free to come up and talk to me!

Slides made with Typst.

Slides, recording & links:

https://terts.dev/talks/roto-eurorust25