Rust And Research

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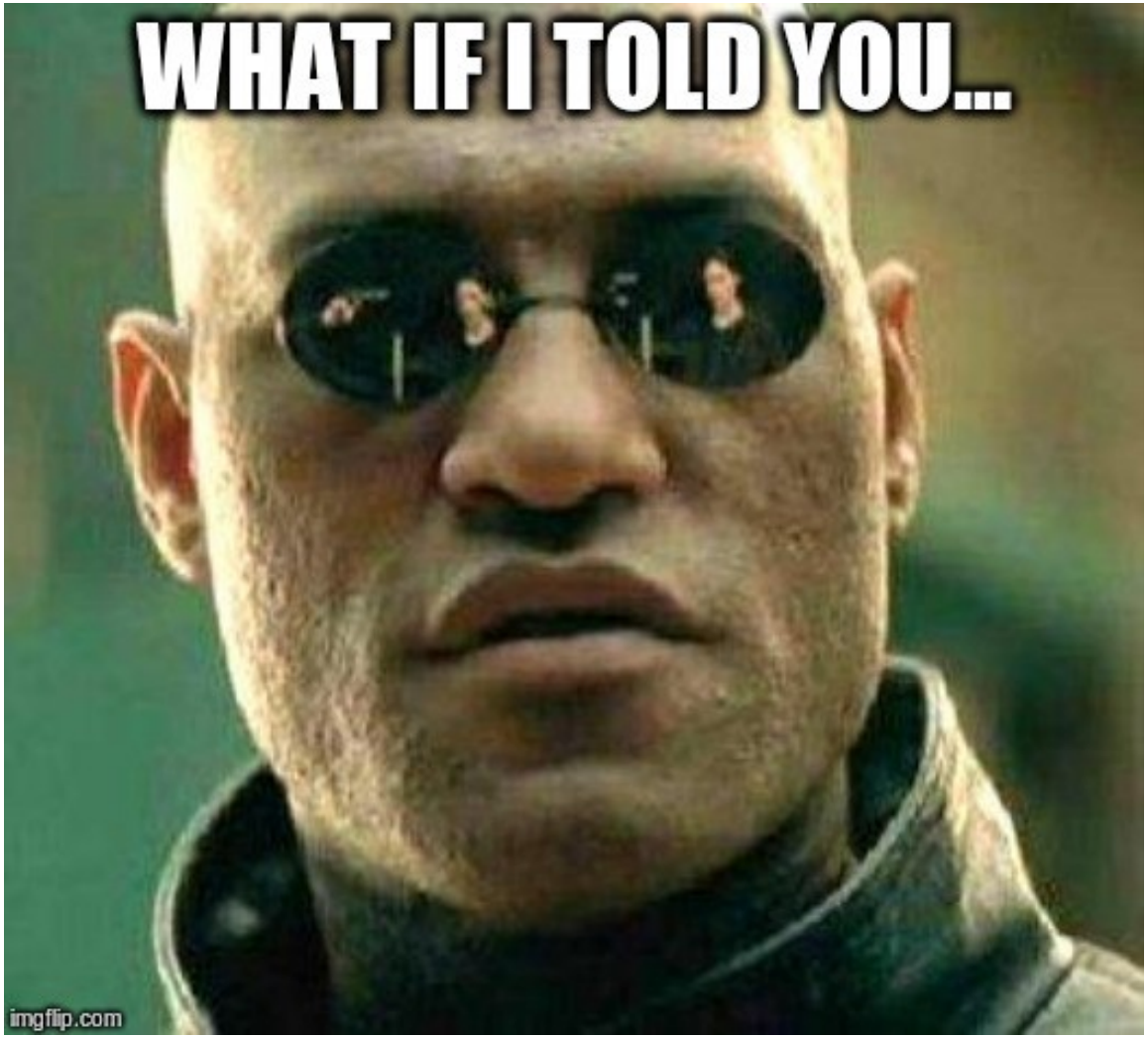
WHAT IF I TOLD YOU...
imgflip.com

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Tight restrictions on aliasing
Affine types (e.g. supports “session types”)

Sounds like a crazy research project!

Would normal developers be interested in using such a language?

Could it possibly scale to large systems in practice?

Top 15 languages by Github PRs

JavaScript: 1736476
Python: 804790
Java: 703649
Ruby: 560430
PHP: 359040
C++: 319324
TypeScript: 311229
Go: 258131
C#: 246513
CSS: 236795
Shell: 168301
C: 160889
Swift: 67664
Scala: 67188
Rust: 52936

Amazon - Building tools in Rust.

Atlassian (makers of Jira) - Using Rust in the backend.

Dropbox - Using Rust in both the frontend and backend.

Facebook - Tools for source control.

Google - As part of the Fuchsia project.

Microsoft - Using Rust in part of their new Azure IoT work.

npm - Using Rust in some of the npm core services.

Red Hat - Creating a new storage system

Reddit - Using Rust in its comment processing

Twitter - As part of the build team support for Twitter.

Some Rust core principles

Ownership and move semantics

```
let x: T = T::new();
let y = x;
```

Borrowed references with lifetimes

```
fn f<'a>(x: &'a T) → &'a U { &x.field }
```

Read-only references can be **shared** and the data is **immutable**

Mutable references are **exclusive**

- No other reference to that data is in scope

Research problems solved

Memory safety without GC ✔

Data race freedom ✔

Practical affine types ✔

Working in practice at scale!!! ✔✔✔

New research problems

What sort of static analyses benefit Rust?

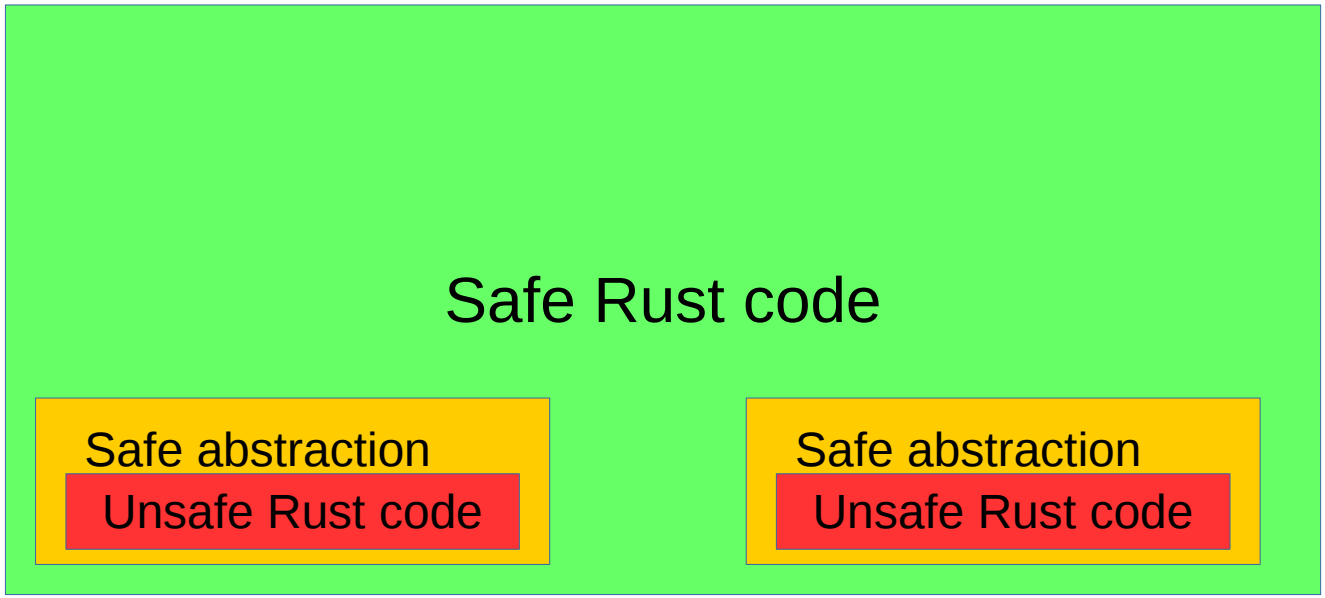
Null pointer deref → `Option::unwrap()`

New research problems

Can static analyses leverage Rust invariants?

E.g. mutable references can’t alias other references

New research problems



Formal semantics and verification of unsafe Rust

Rustbelt project (Derek Dreyer et al., MPI-SWS)

Conclusions

Rust has raised the bar for systems programming languages

Expect Rust and Rust-like languages to be increasingly used for systems/embedded/safety critical systems

Consider targeting problems relevant to these languages and taking advantage of their features/ restrictions