Matthias Endler

RUST IN PRODUCTION

corrode

WHAT IS RUST?

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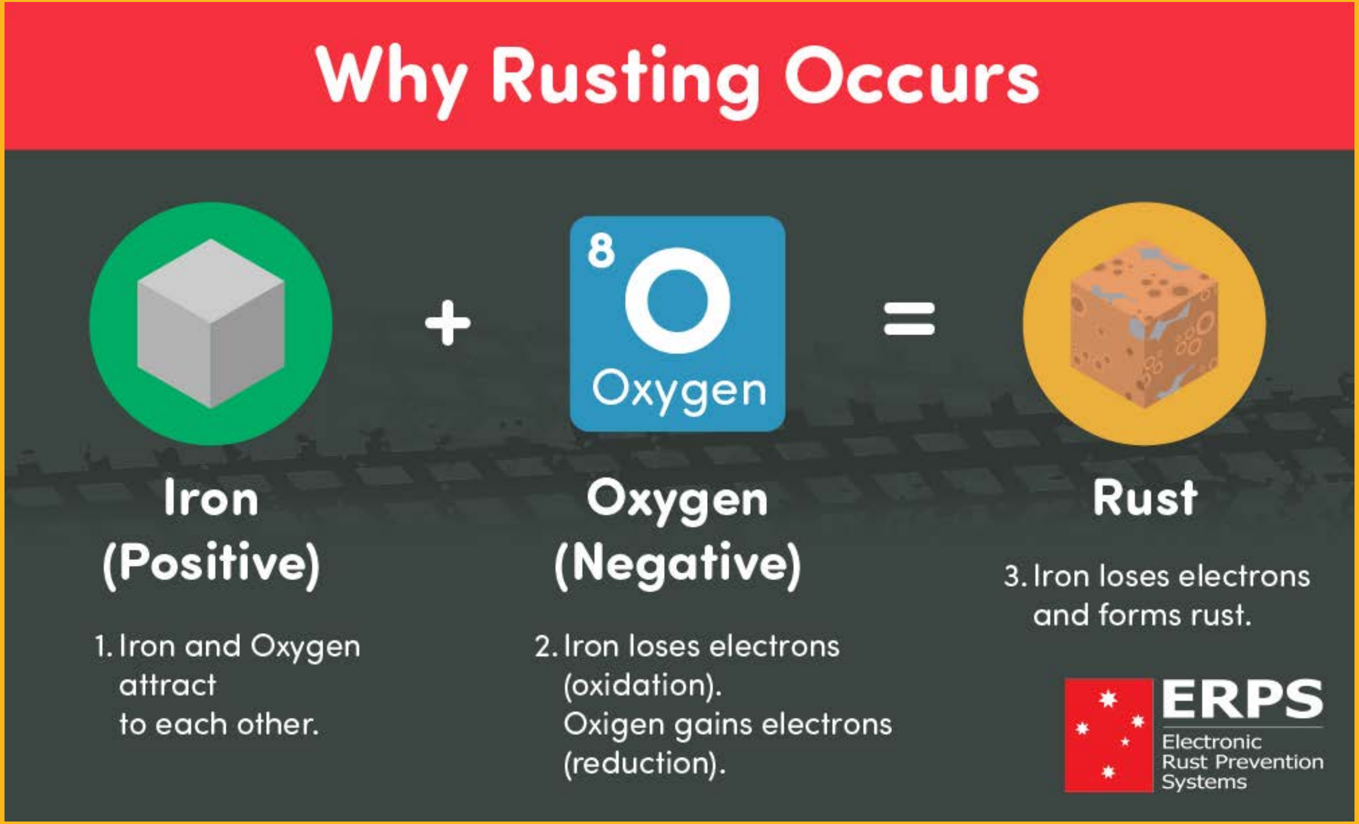
Why Rusting Occurs
8
O
Oxygen
Iron
(Positive)
1. Iron and Oxygen attract to each other.
Oxygen
(Negative)
2. Iron loses electrons (oxidation). Oxigen gains electrons (reduction).
Rust
3. Iron loses electrons and forms rust.
ERPS
Electronic Rust Prevention Systems

https://www.erps.com.au/what-is-rust

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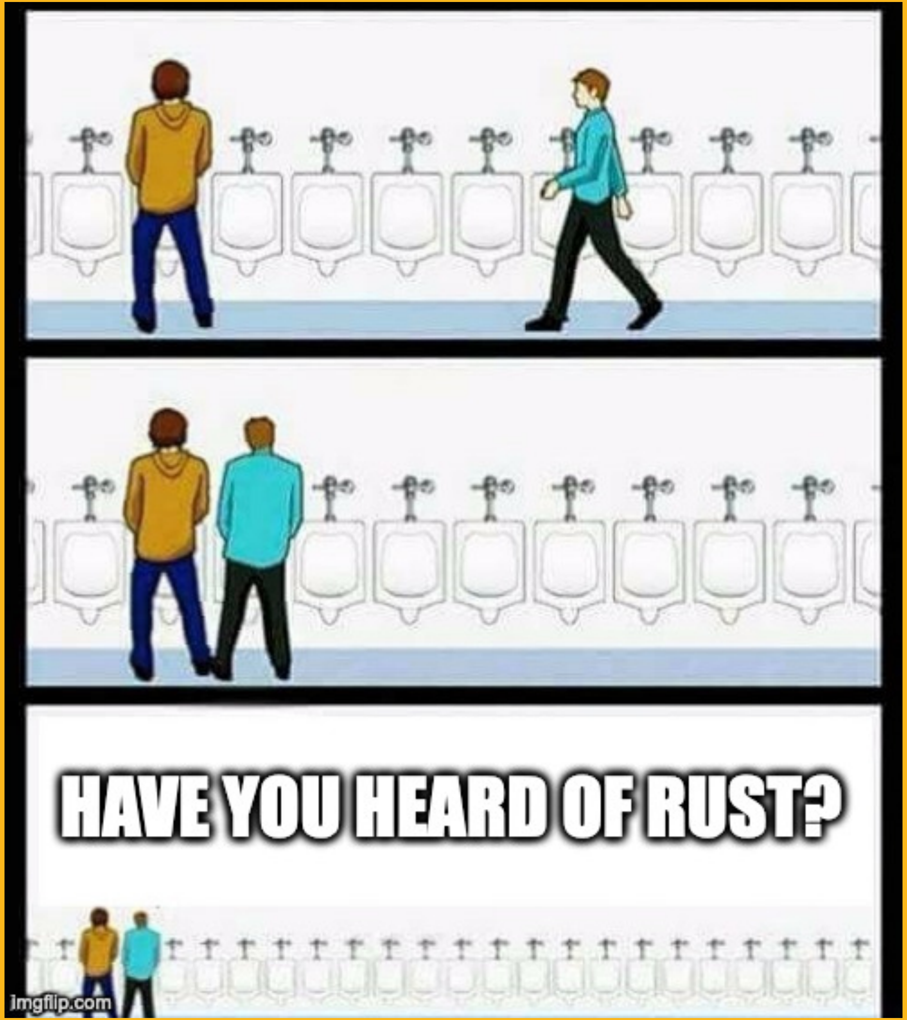

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```rust
use std::collections::HashMap;

fn main() {
    let mut dict = HashMap::new();
    "mississippi".chars().for_each(|char| {
        let item = dict.entry(char).or_insert(0);
        *item += 1;
    });

    println!("{dict:?}");
}
```

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```rust
use std::collections::HashMap;

fn main() {
    let mut dict = HashMap::new();
    "mississippi".chars().for_each(|char| {
        let item = dict.entry(char).or_insert(0);
        *item += 1;
    });

    println!("{dict:?}");
}
```

OUTPUT:

```
{'p': 2, 's': 4, 'i': 4, 'm': 1}
```

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Me explaining Rust's ownership & borrowing, lifetimes, generics and expression syntax

You

corrode

```rust
let v = String::from("Hello Rust");
my_function(v);
```

corrode

✓

```
let v = String::from("Hello Rust");
my_function(v);
```

corrode

```rust
let v = String::from("Hello Rust");
my_function(v);
my_function(v);
```

```rust
let v = String::from("Hello Rust");
my_function(v);
my_function(v);
```

```
error[E0382]: use of moved value: `v`
```

corrode

```rust
let v = String::from("Hello Rust");
delete(v);
reuse(v) // bug
```

```
error[E0382]: use of moved value: `v`
```

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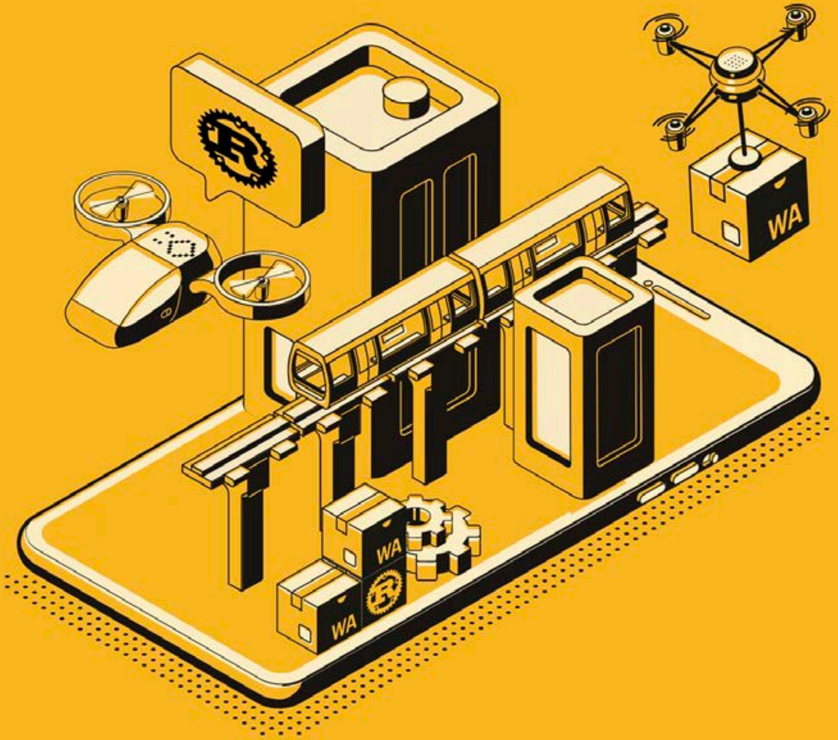
ABOUT RUST

2006	Research project at Mozilla
2015	Version 1.0
2017	First Rust code in Firefox
2021	Rust Foundation
2024	3.7 million Rust users



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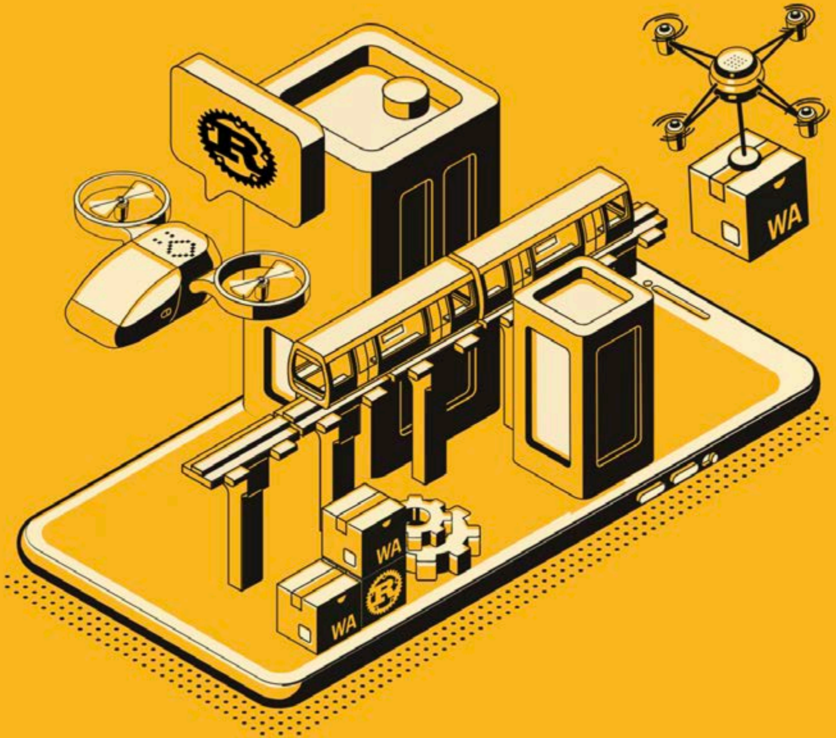
MY RUST EXPERIENCE

- Using Rust since 2015
- Rust Cologne User Group
- *"Hello Rust"* YouTube channel
- Open Source work
- Rust consultancy
- Rust in production since 2020



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WHY WAS RUST CREATED?

- C++ code in Firefox had many security issues.
- Multithreaded code is hard to write with C++ (data races).

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RUST VS OTHER LANGUAGES

Source: Jon Gjengset - Considering Rust

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VS PYTHON

Much faster.

Much lower memory use.

Multi-threading.

Algebraic data types.

Pattern matching.

Comprehensive static typing, so:

Many fewer runtime crashes.

VS C/C++

No segfaults.

No buffer overflows.

No null pointers.

No data races.

Powerful type system.

Unified build system.

Dependency management.

VS GO

No GC pauses; lower memory use.

No null pointers.

Nicer error handling.

Safe concurrency.

Stronger type system.

Zero-cost abstractions.

Dependency management.

VS JAVA

No JVM overhead or GC pauses.

Much lower memory use.

Zero-cost abstractions.

ConcurrentModificationException

Pattern matching.

Unified build system.

Dependency management.

VS JAVASCRIPT

Multi-threaded by design

Stronger typesystem

Static typing

No runtime overhead

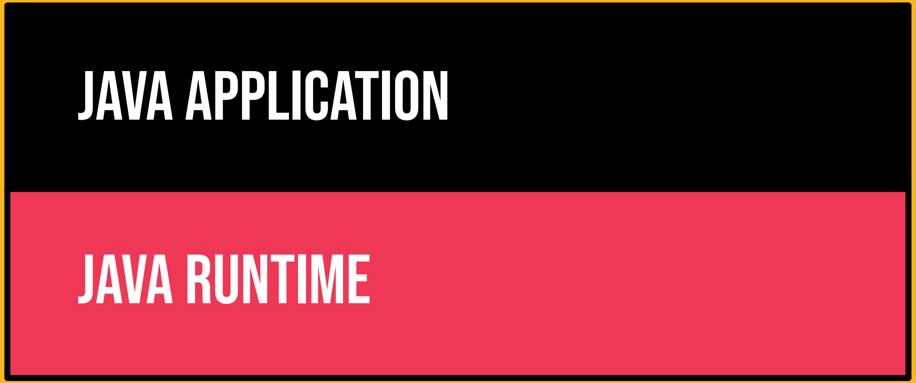
Unified build system

Zero-cost abstractions

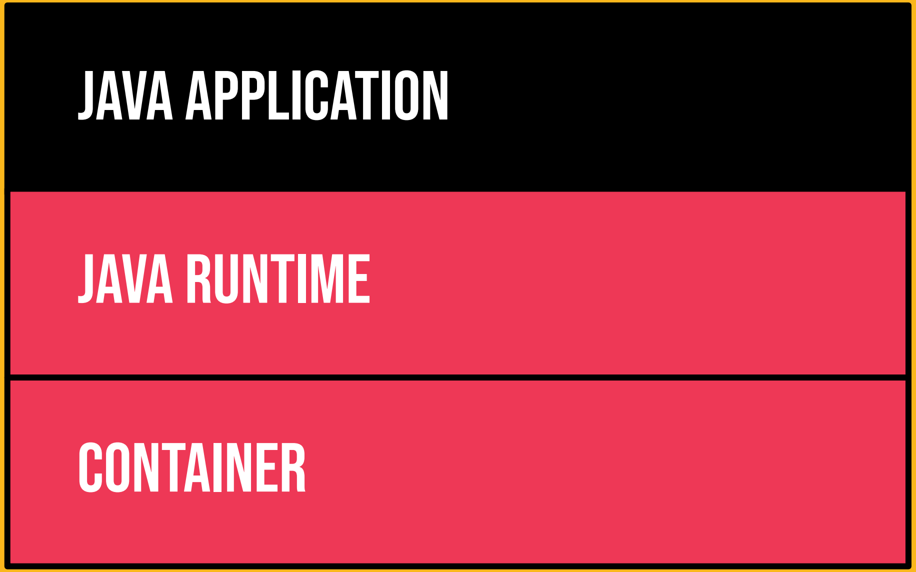
COMPARISON

	RUST	JAVA	GO	JS/TS
COMMUNITY SIZE	Small	**Large**	**Medium/Large**	**Large**
ECOSYSTEM	Small	**Large**	Medium	**Large**
OPERATIONAL COST	**Low**	High	Medium	Medium
SAFETY	**High**	Low/Medium	Low/Medium	Low/Medium
PERFORMANCE	**High**	Medium	Medium	Low
TOOLING	**Good**	Okay	Okay	Okay
COMPLEXITY	High	Medium	**Low**	**Low**

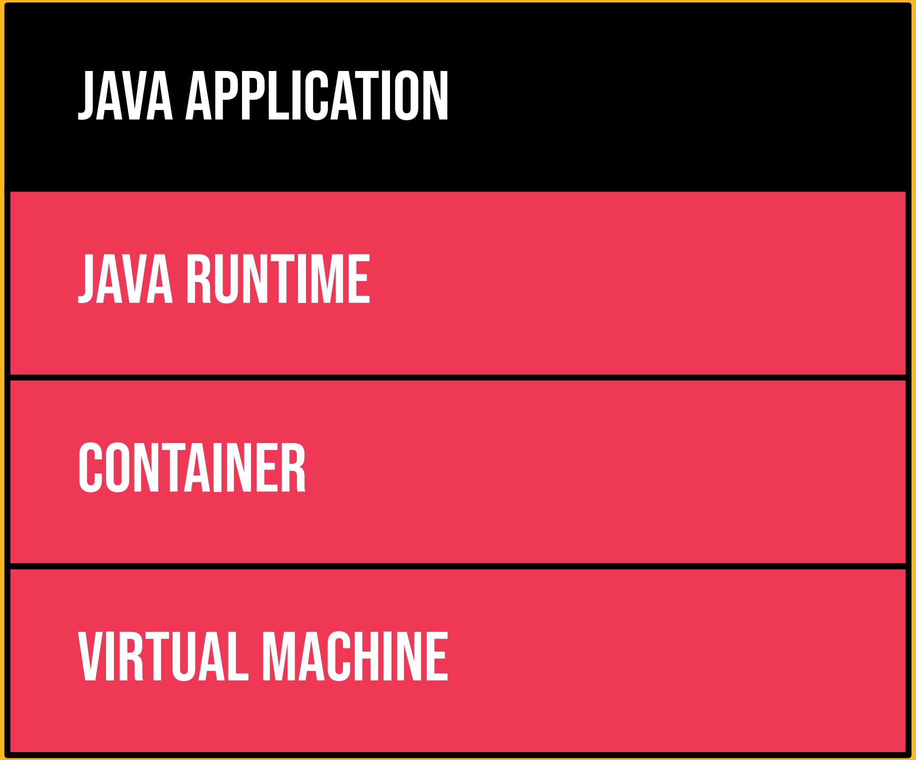
TANGENT: JAVA RUNTIME BEHAVIOR



TANGENT: JAVA RUNTIME BEHAVIOR



TANGENT: JAVA RUNTIME BEHAVIOR



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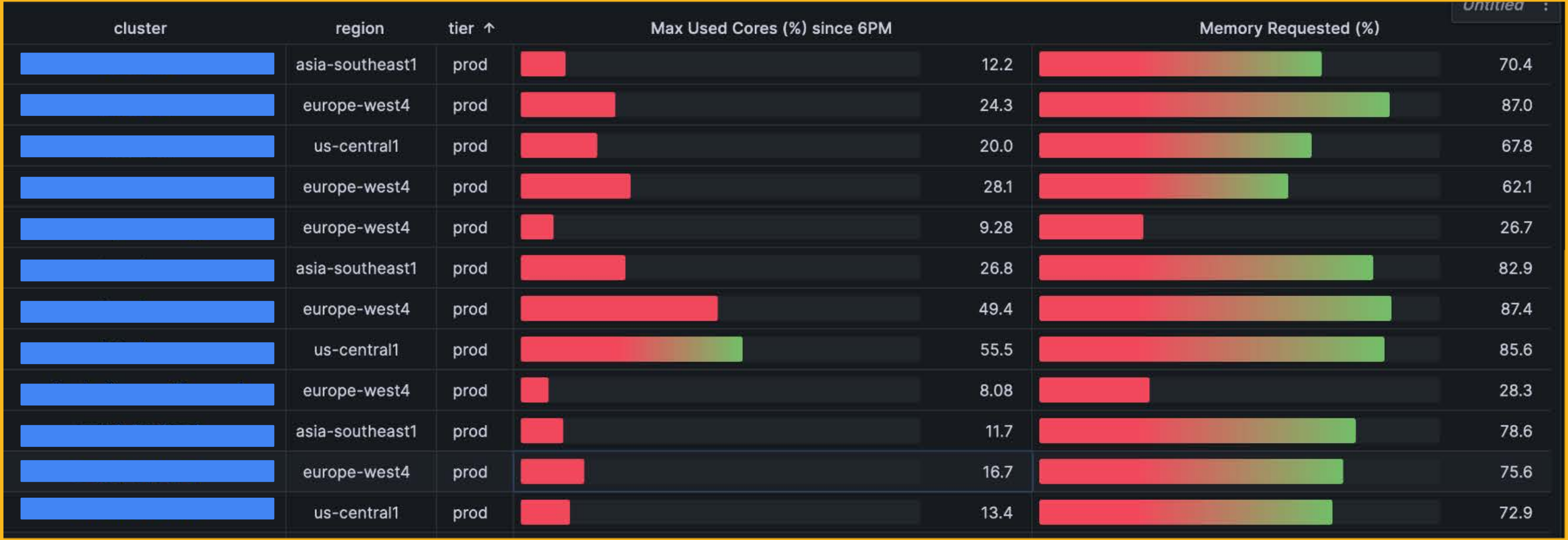
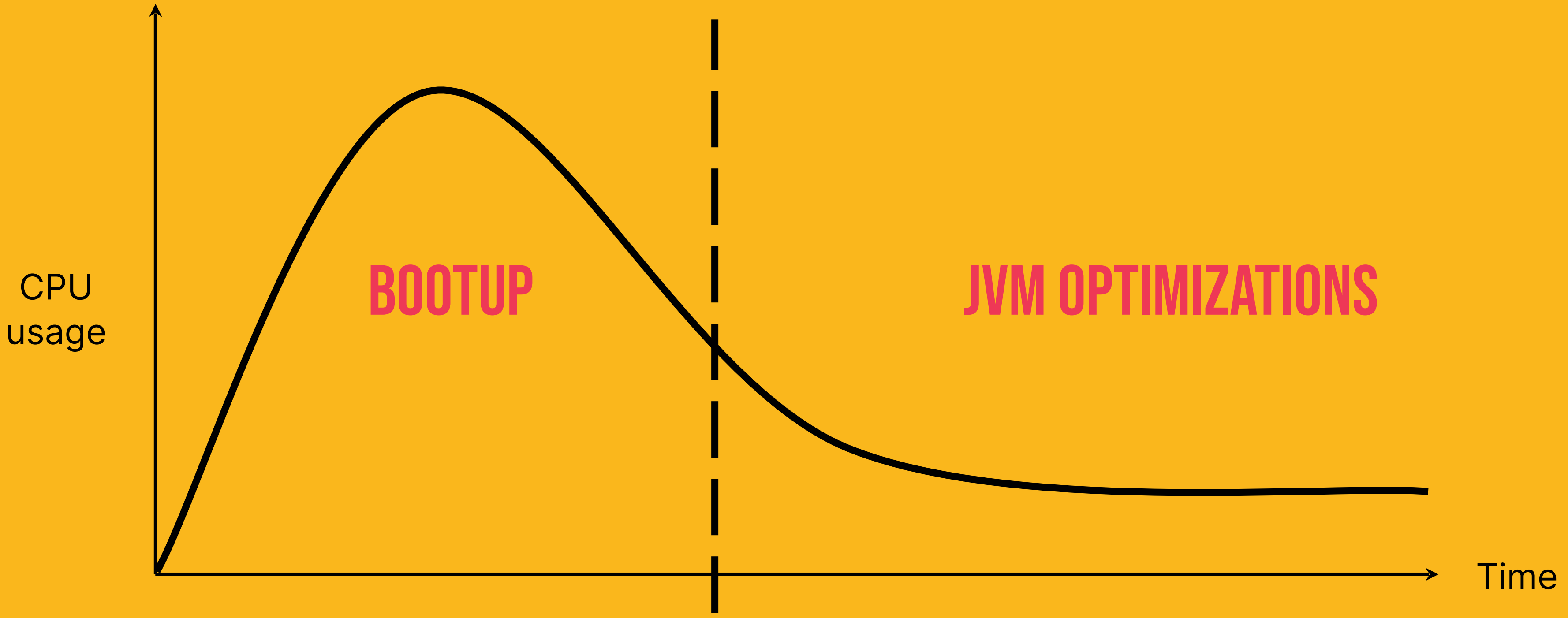
TANGENT: JAVA RUNTIME BEHAVIOR



cluster	region	tier ↑	Max Used Cores (%) since 6PM	Memory Requested (%)
[redacted]	asia-southeast1	prod	12.2	70.4
[redacted]	europe-west4	prod	24.3	87.0
[redacted]	us-central1	prod	20.0	67.8
[redacted]	europe-west4	prod	28.1	62.1
[redacted]	europe-west4	prod	9.28	26.7
[redacted]	asia-southeast1	prod	26.8	82.9
[redacted]	europe-west4	prod	49.4	87.4
[redacted]	us-central1	prod	55.5	85.6
[redacted]	europe-west4	prod	8.08	28.3
[redacted]	asia-southeast1	prod	11.7	78.6
[redacted]	europe-west4	prod	16.7	75.6
[redacted]	us-central1	prod	13.4	72.9

TANGENT: JAVA RUNTIME BEHAVIOR



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RUST'S STRENGTHS

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SAFETY
PERFORMANCE
RUST DEVELOPER
Did you just take both pills?
imgflip.com

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“

THE REASON THAT PEOPLE USE RUST IS BECAUSE ACTUALLY IT'S BETTER FOR BUILDING MORE RELIABLE SYSTEMS.

Niko Matsakis, Lead of Rust Language Design Team

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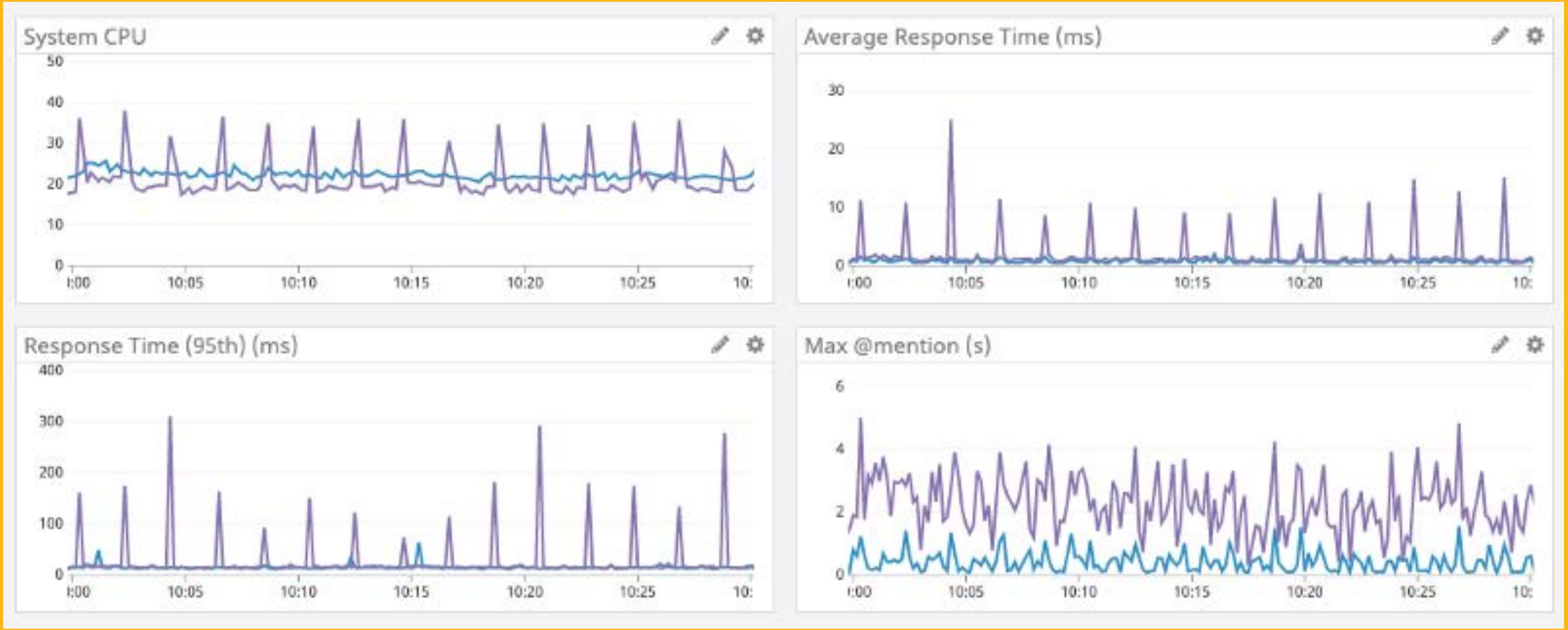
DISCORD: SWITCHING FROM GO TO RUST

● Rust ● Go



https://discord.com/blog/why-discord-is-switching-from-go-to-rust

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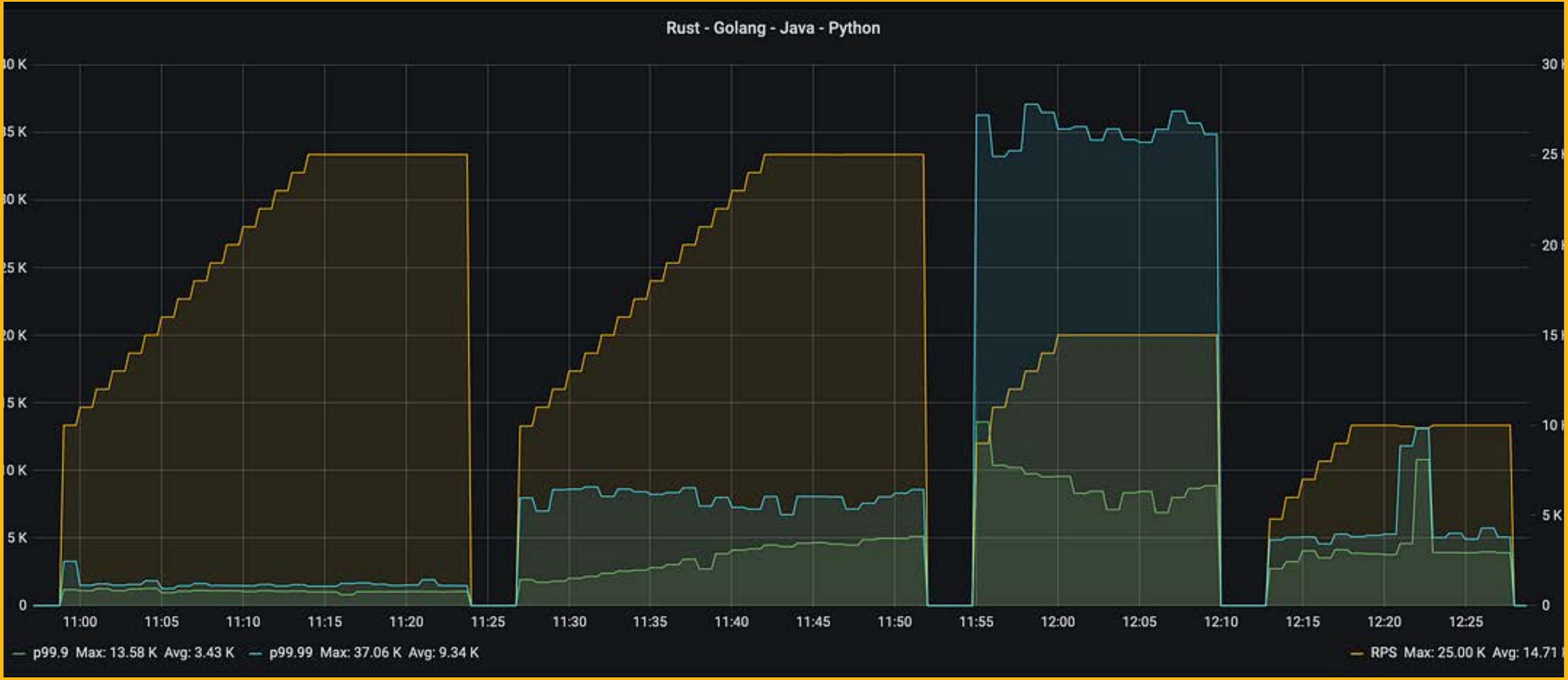
RUST VS GOLANG VS JAVA VS PYTHON



https://medium.com/star-gazers/benchmarking-low-level-i-o-c-c-rust-golang-java-python-9a0d505f85f7

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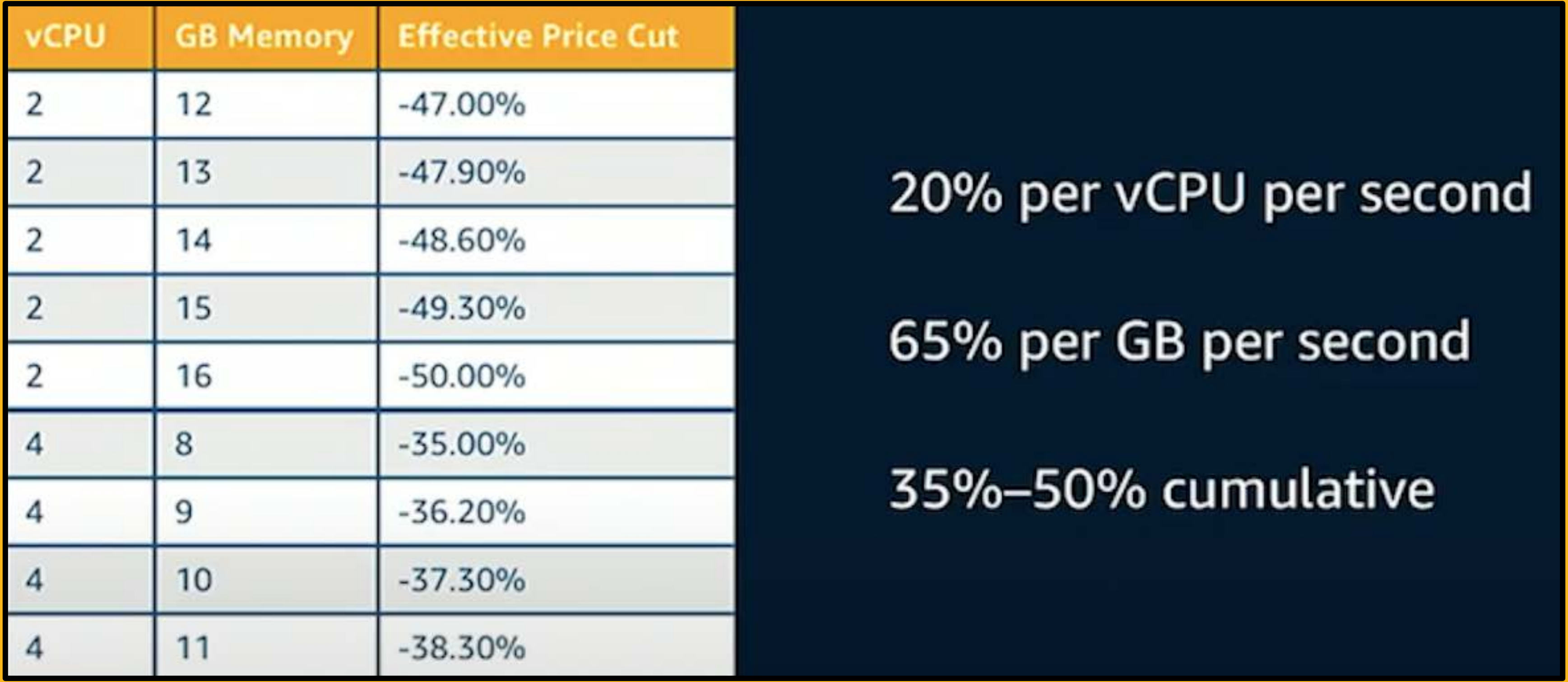
AWS: RUST'S IMPACT ON SERVERLESS PRICING



vCPU	GB Memory	Effective Price Cut
2	12	-47.00%
2	13	-47.90%
2	14	-48.60%
2	15	-49.30%
2	16	-50.00%
4	8	-35.00%
4	9	-36.20%
4	10	-37.30%
4	11	-38.30%

20% per vCPU per second

65% per GB per second

35%–50% cumulative

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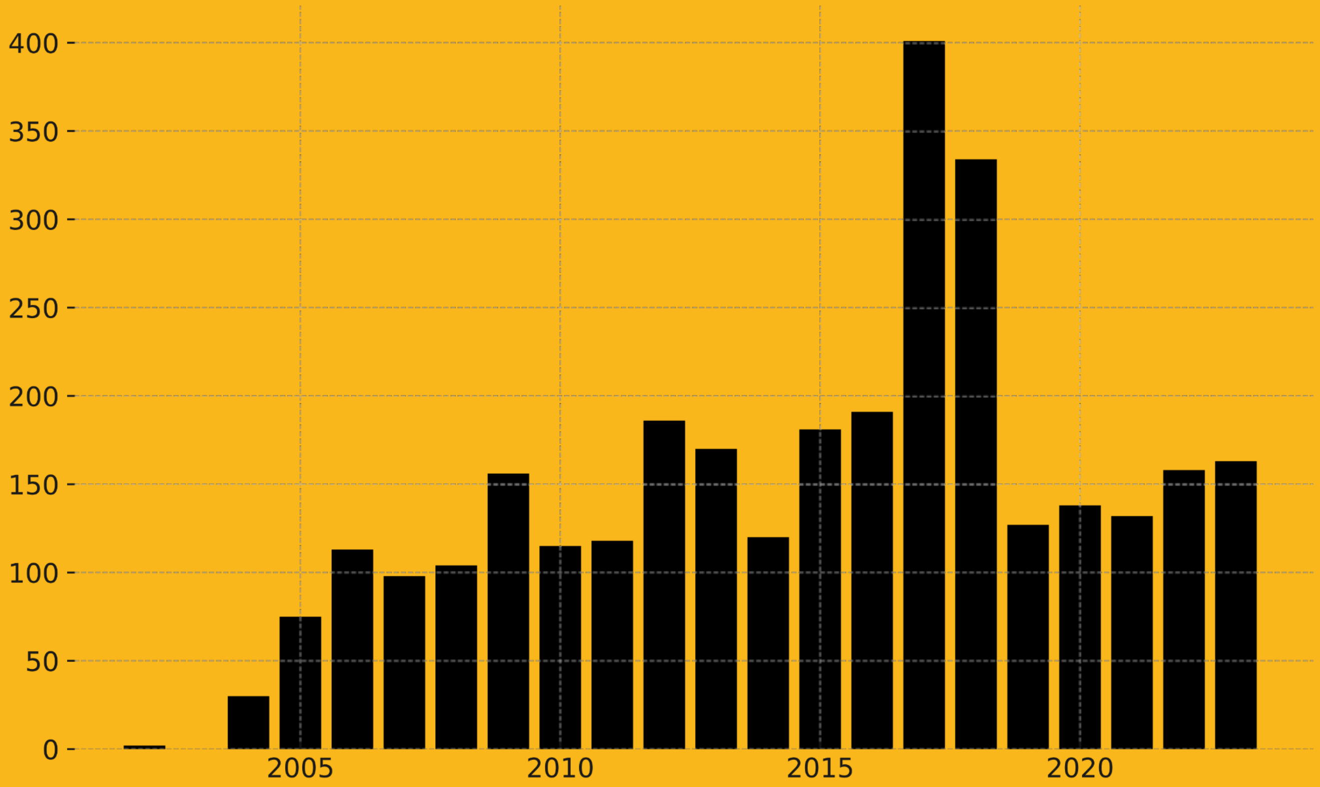
VULNERABILITIES IN FIREFOX OVER TIME



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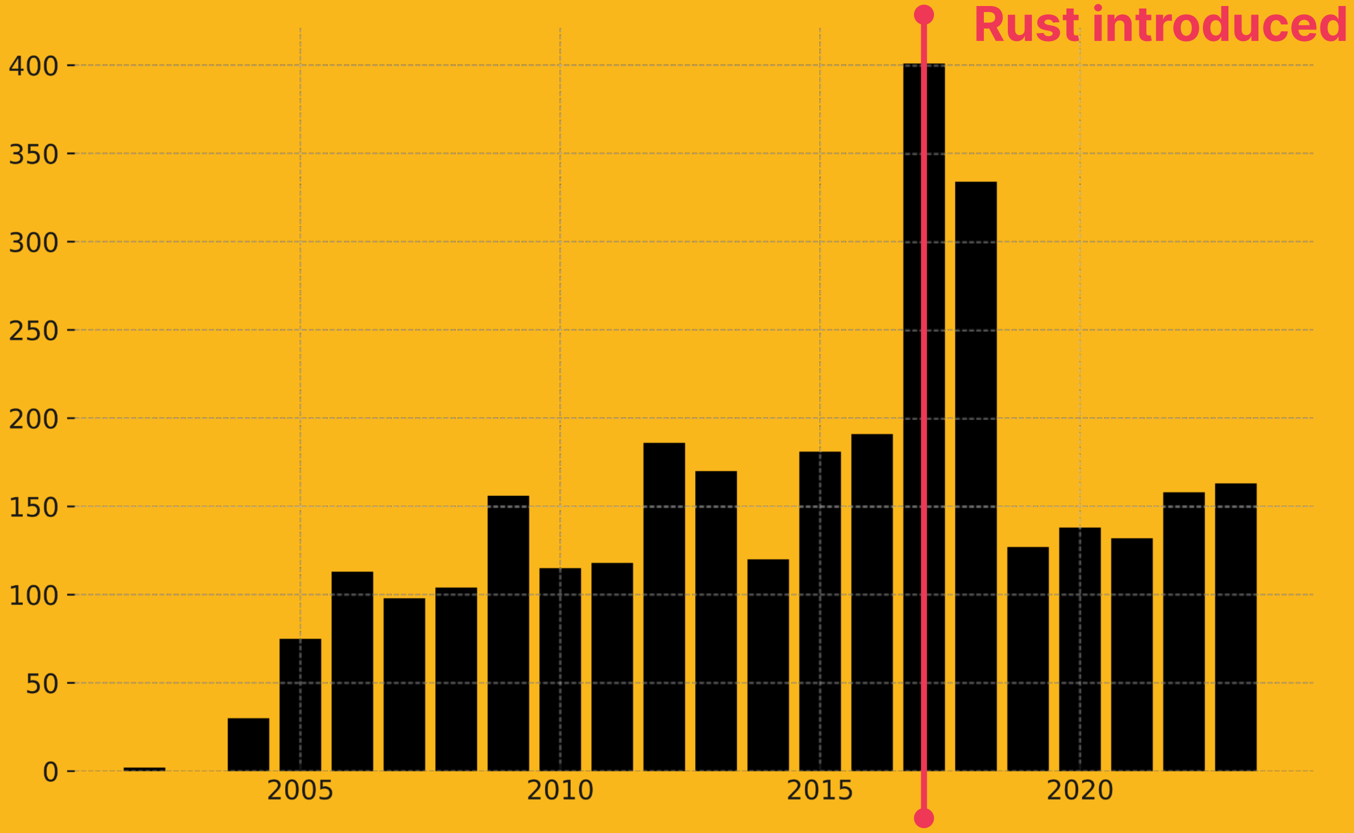
VULNERABILITIES IN FIREFOX OVER TIME



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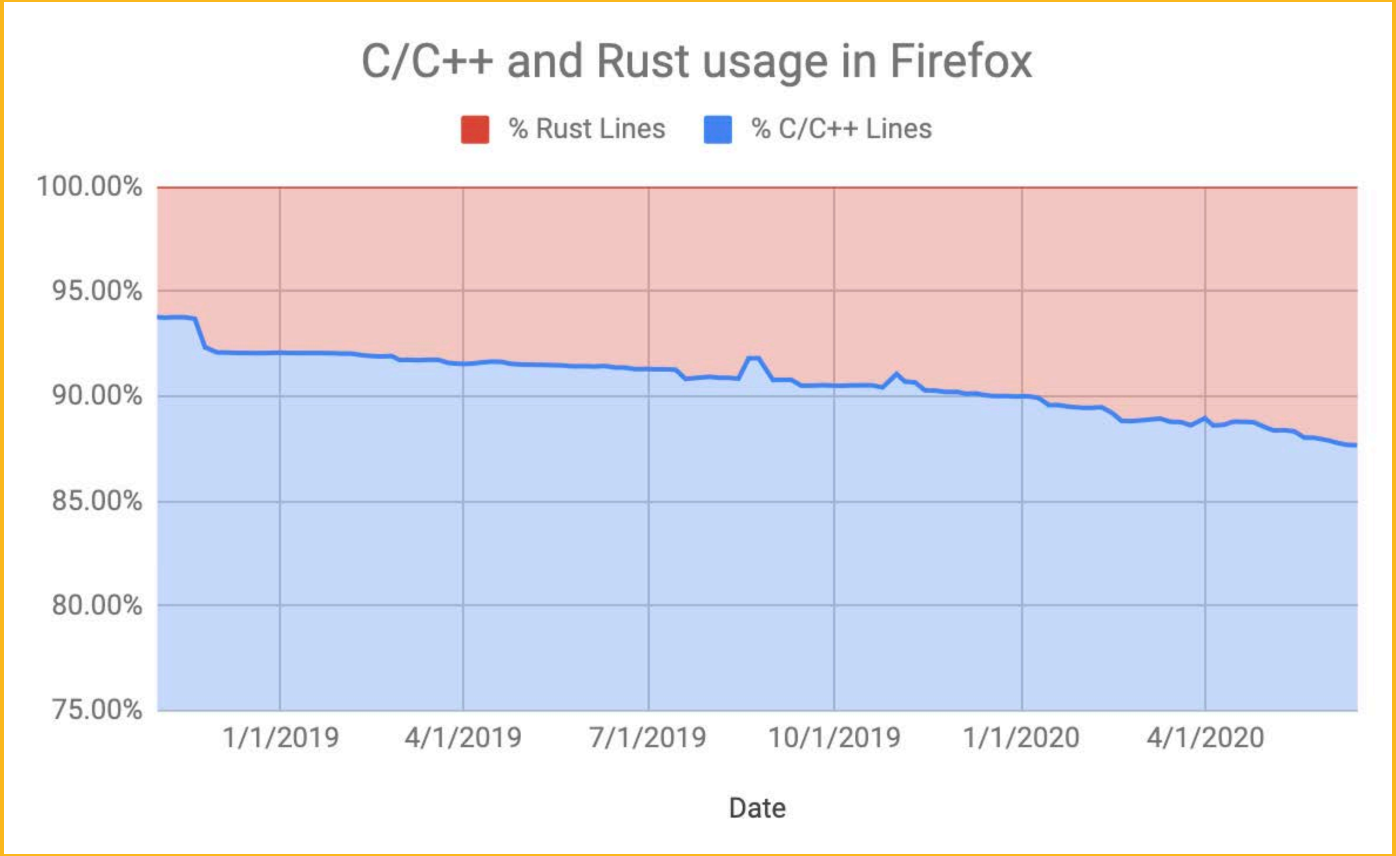

https://docs.google.com/spreadsheets/d/1flUGg6Ut4bjtyWdyH_9emD9EAN01ljTAVft2S4Dq620

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SECURITY ISSUES ARE A VERY REAL PROBLEM

- Google
  - Chromium project finds that around 70% of serious security bugs are memory safety problems
- Microsoft
  - 70% of bugs are memory safety issues
  - Each bug costs $150,000 to fix
  - >70 Million Dollars for fixing those bugs (in 2018)

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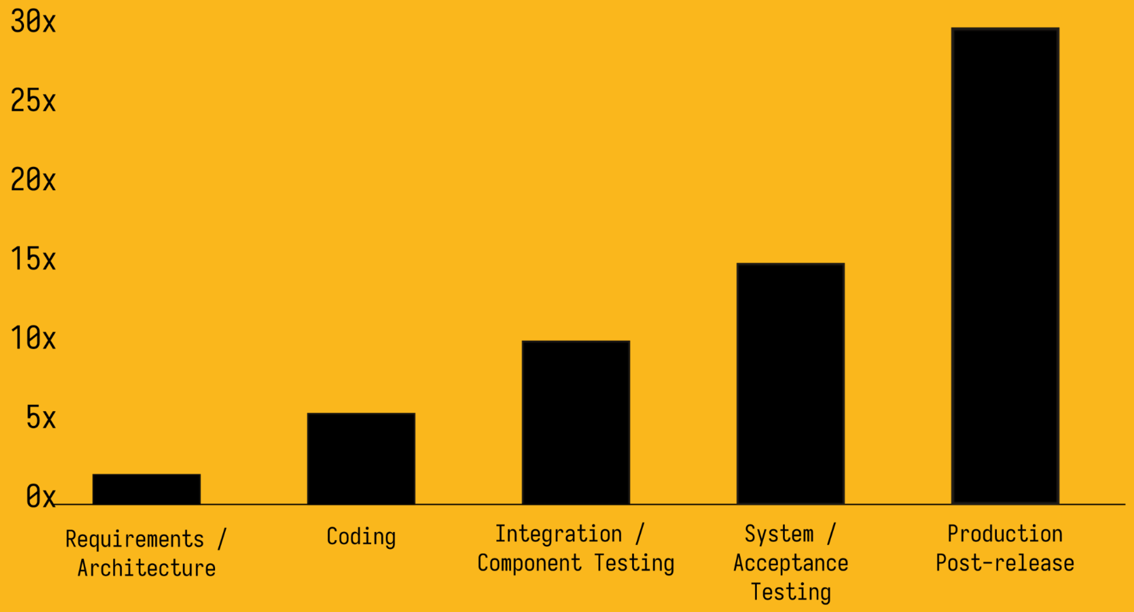
RELATIVE COST TO FIX BUGS BASED ON TIME OF DETECTION



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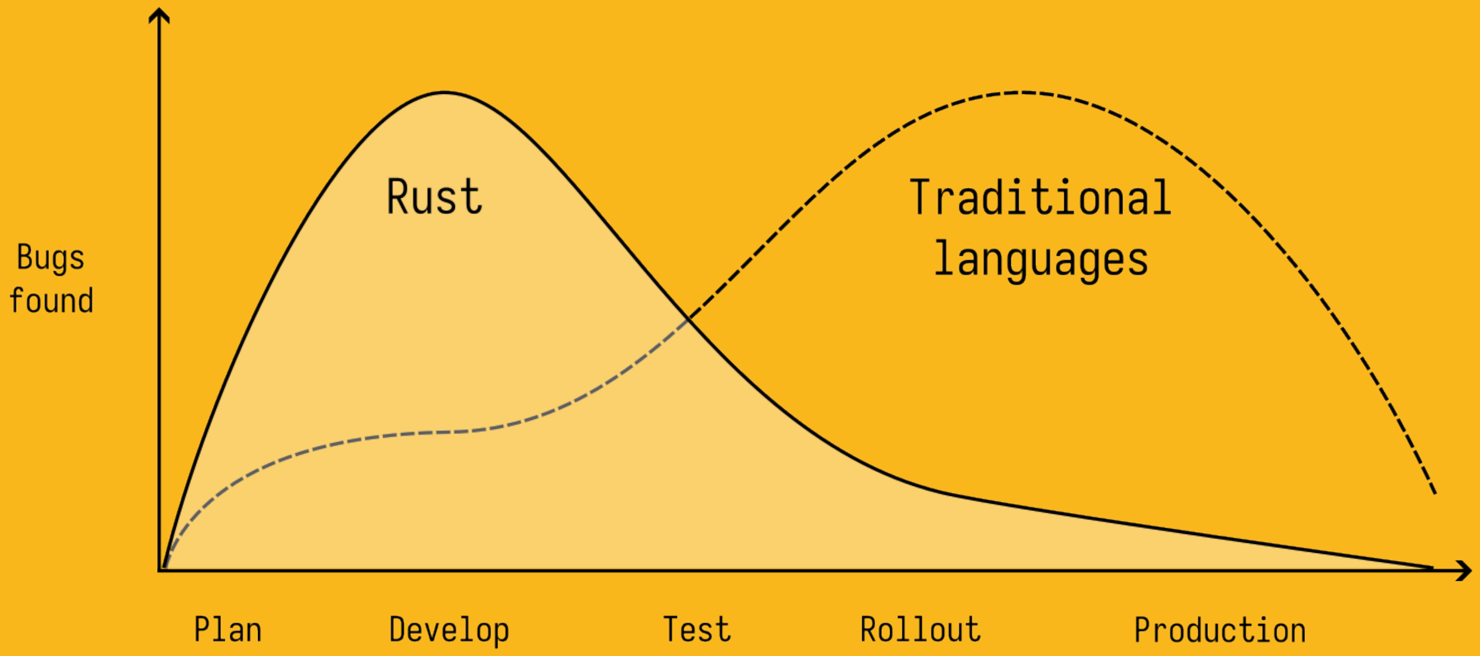
BUGS DETECTED DURING DEVELOPMENT CYCLE



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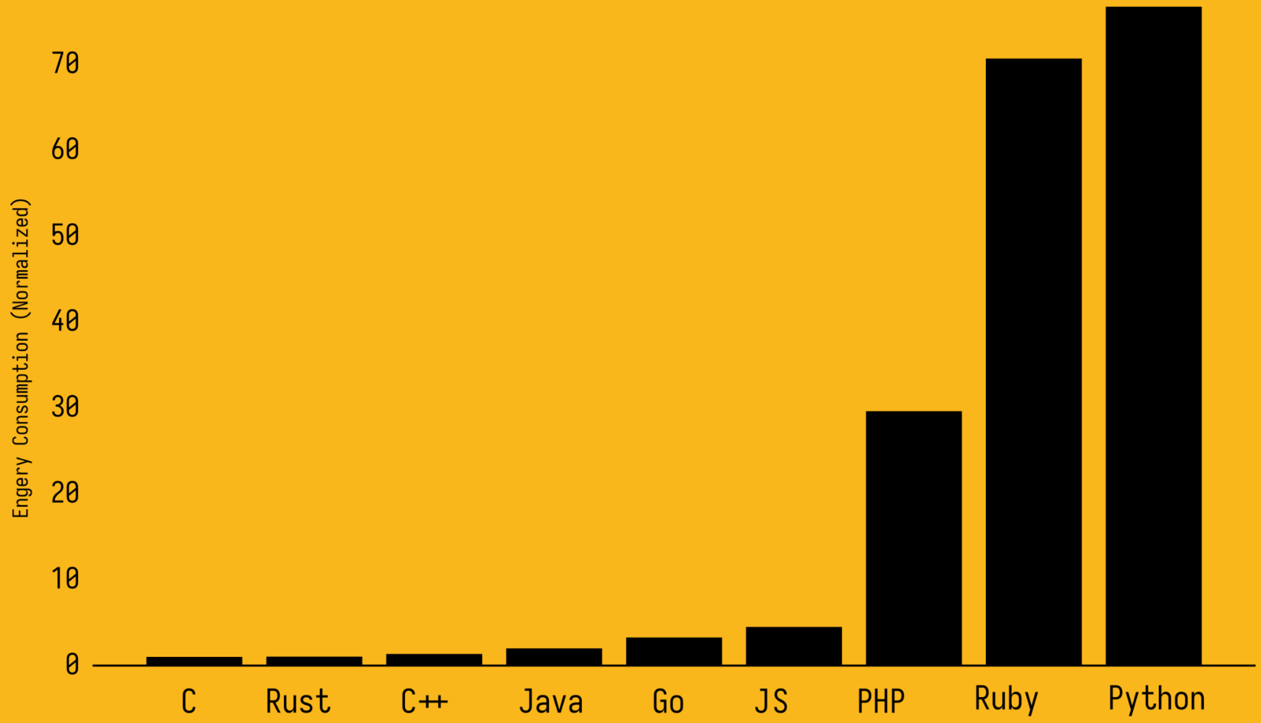
ENERGY CONSUMPTION



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RUST'S WEAKNESSES

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RUST WEAKNESSES

- Immature ecosystem
- Async/await support still very basic
- Lack of developers
- Learning curve
- Compile times

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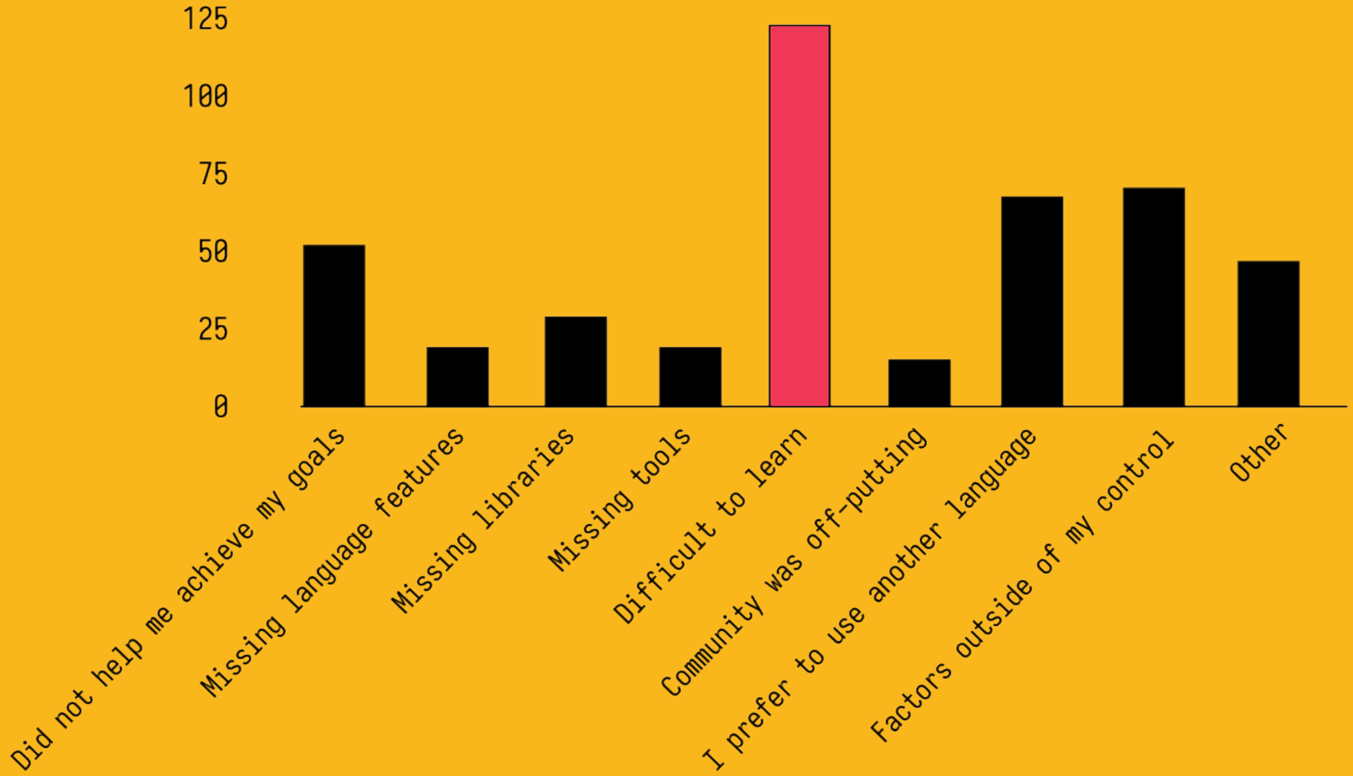
LEARNING CURVE



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“

50% OF DEVELOPERS WERE PRODUCTIVE IN RUST AFTER 4 MONTHS

Google

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“

IT TAKES
SEVERAL WEEKS
OF HARD EFFORT

Microsoft

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When your Rust program runs on the first try

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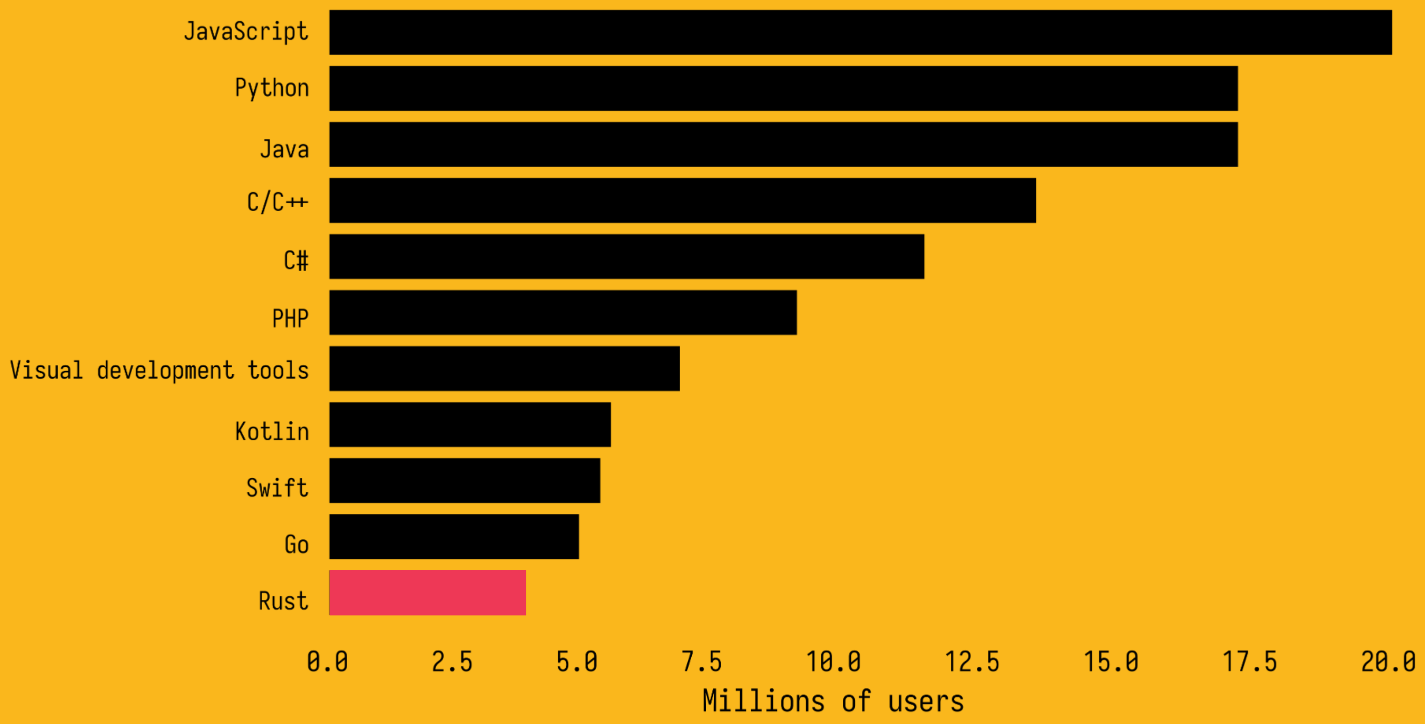
SIZE OF PROGRAMMING COMMUNITIES 2023



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RUST USERS

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MAJOR RUST USAGE

- Linux Kernel
- Windows Kernel
- AWS Firecracker
- Dropbox storage layer
- Deno
- Turbopack (Webpack)
- Figma
- Cloudflare

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MAJOR RUST USAGE

- Linux Kernel
- Windows Kernel
- AWS Firecracker
- Dropbox storage layer
- Deno
- Turbopack (Webpack)
- Figma
- Cloudflare
- Yes, and Crypto

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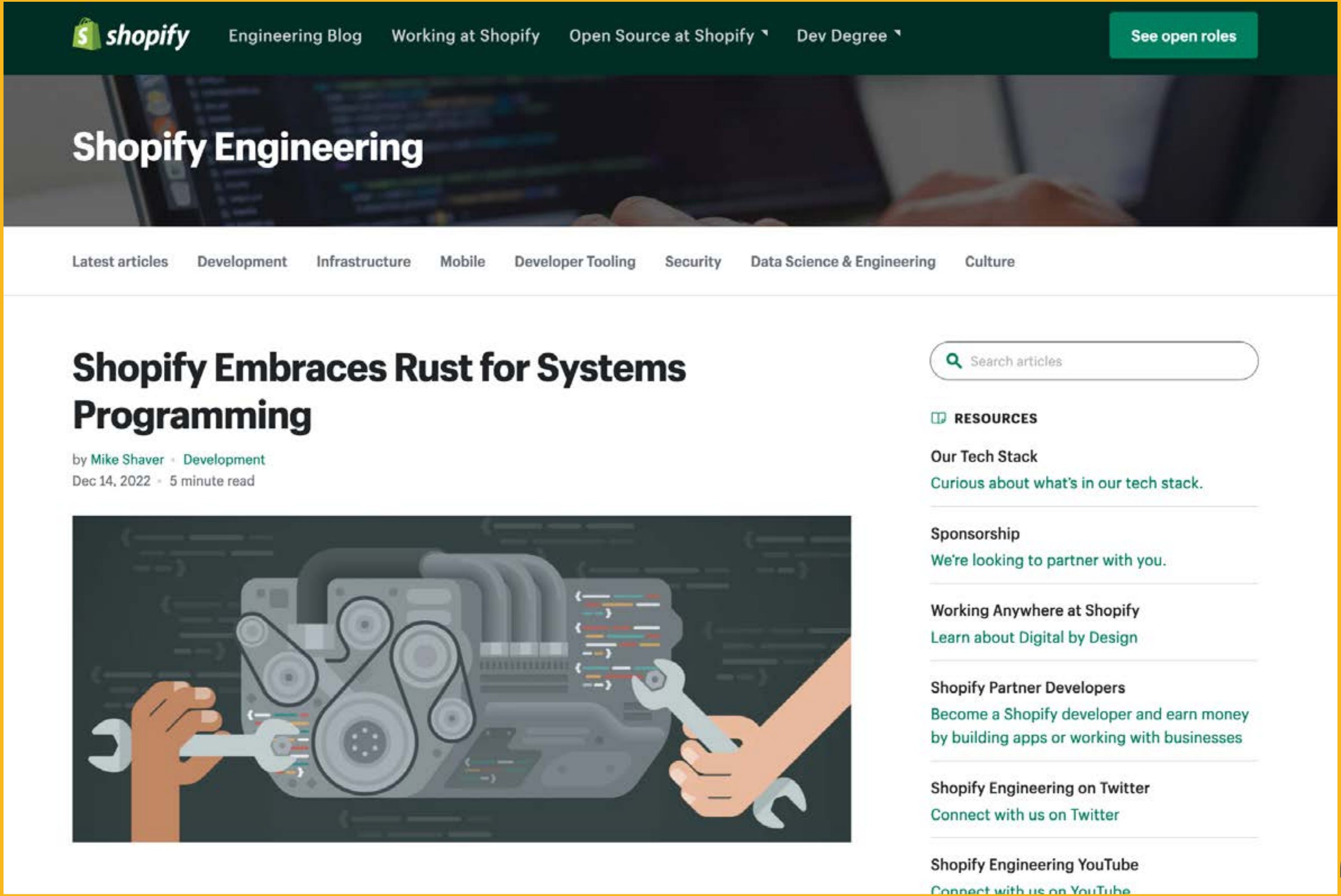

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Shopify Embraces Rust for Systems Programming

by Mike Shaver · Development
Dec 14, 2022 · 5 minute read

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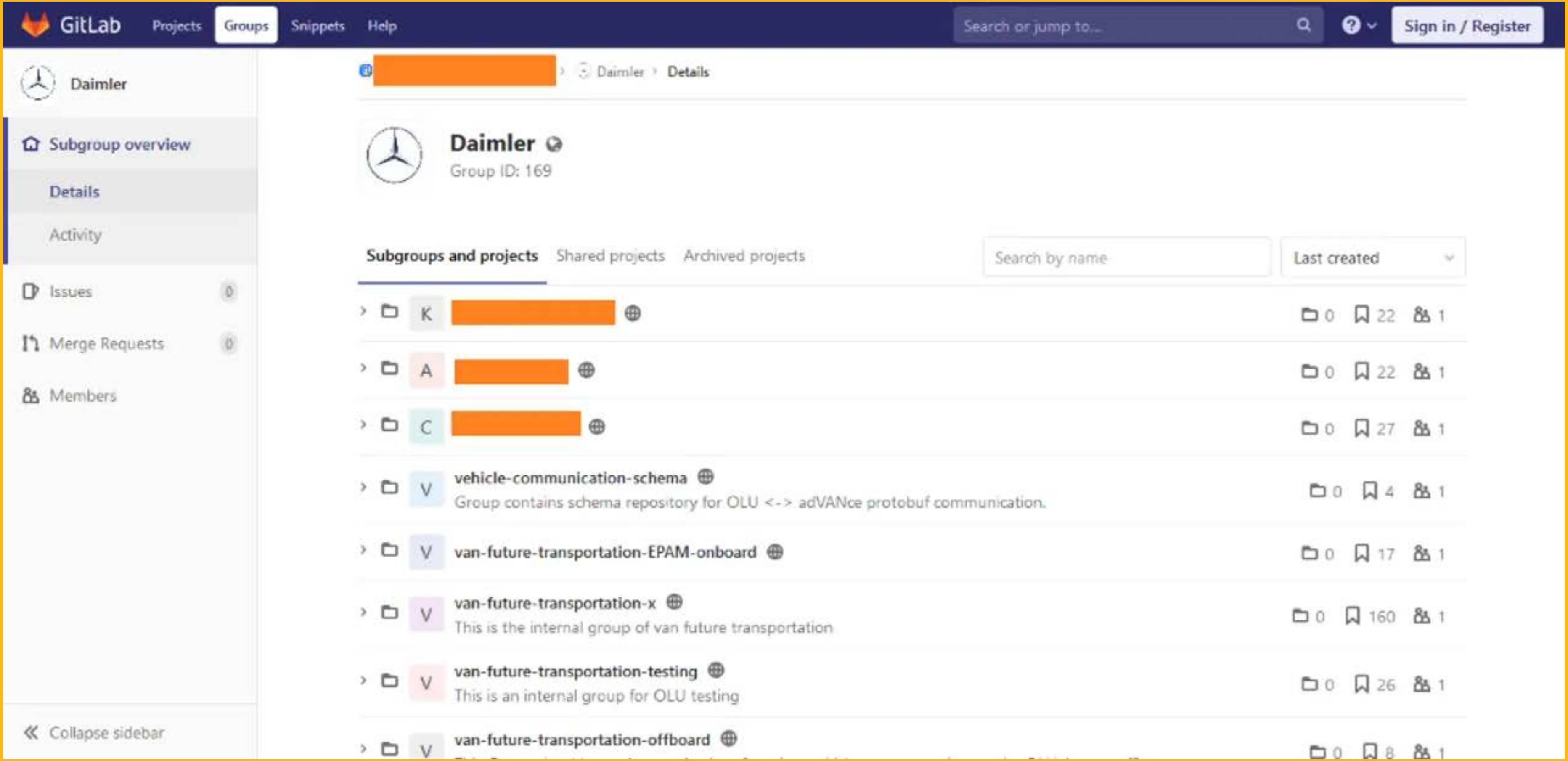

[redacted] › Daimler › Details

Daimler
Group ID: 169

Subgroups and projects | Shared projects | Archived projects

K [redacted] 0 22 1

A [redacted] 0 22 1

C [redacted] 0 27 1

V vehicle-communication-schema 0 4 1
Group contains schema repository for OLU <-> adVANce protobuf communication.

V van-future-transportation-EPAM-onboard 0 17 1

V van-future-transportation-x 0 160 1
This is the internal group of van future transportation

V van-future-transportation-testing 0 26 1
This is an internal group for OLU testing

V van-future-transportation-offboard 0 8 1

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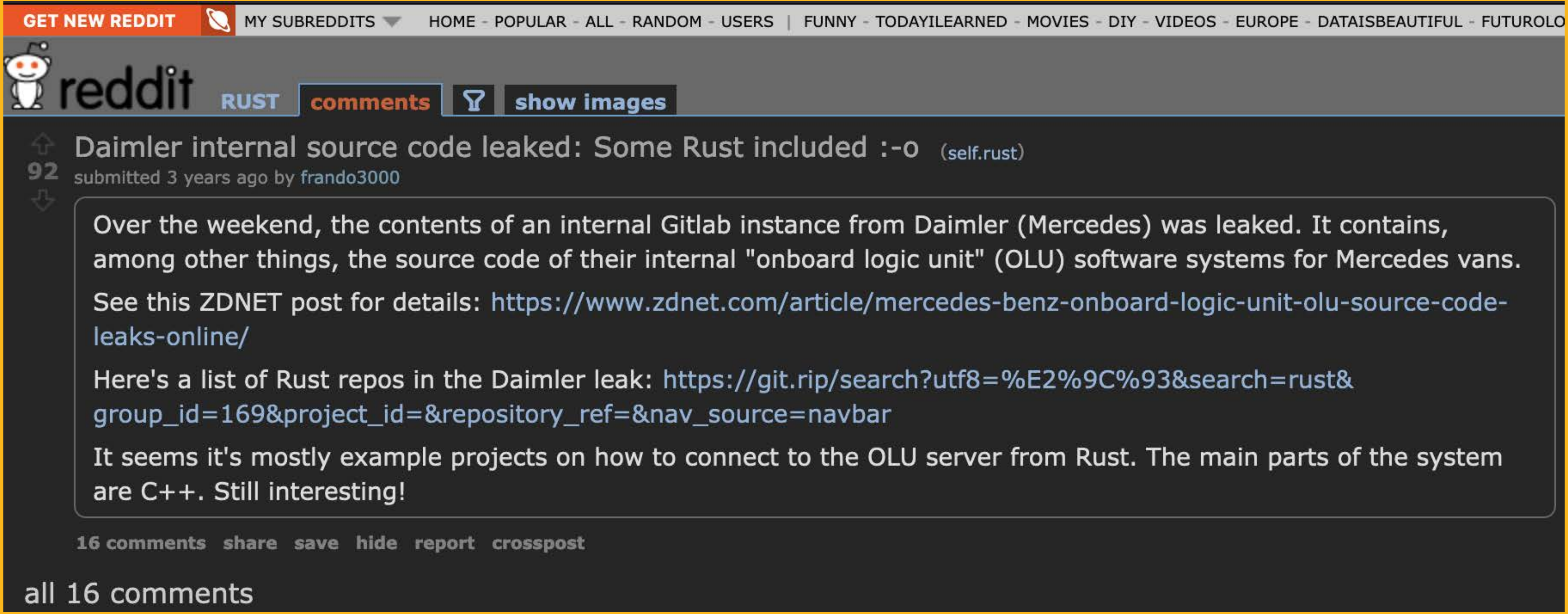
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comments
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92

Daimler internal source code leaked: Some Rust included :-o (self.rust)

submitted 3 years ago by frando3000

Over the weekend, the contents of an internal Gitlab instance from Daimler (Mercedes) was leaked. It contains, among other things, the source code of their internal "onboard logic unit" (OLU) software systems for Mercedes vans.

See this ZDNET post for details: https://www.zdnet.com/article/mercedes-benz-onboard-logic-unit-olu-source-code-leaks-online/

Here's a list of Rust repos in the Daimler leak: https://git.rip/search?utf8=%E2%9C%93&search=rust&group_id=169&project_id=&repository_ref=&nav_source=navbar

It seems it's mostly example projects on how to connect to the OLU server from Rust. The main parts of the system are C++. Still interesting!

16 comments share save hide report crosspost

all 16 comments

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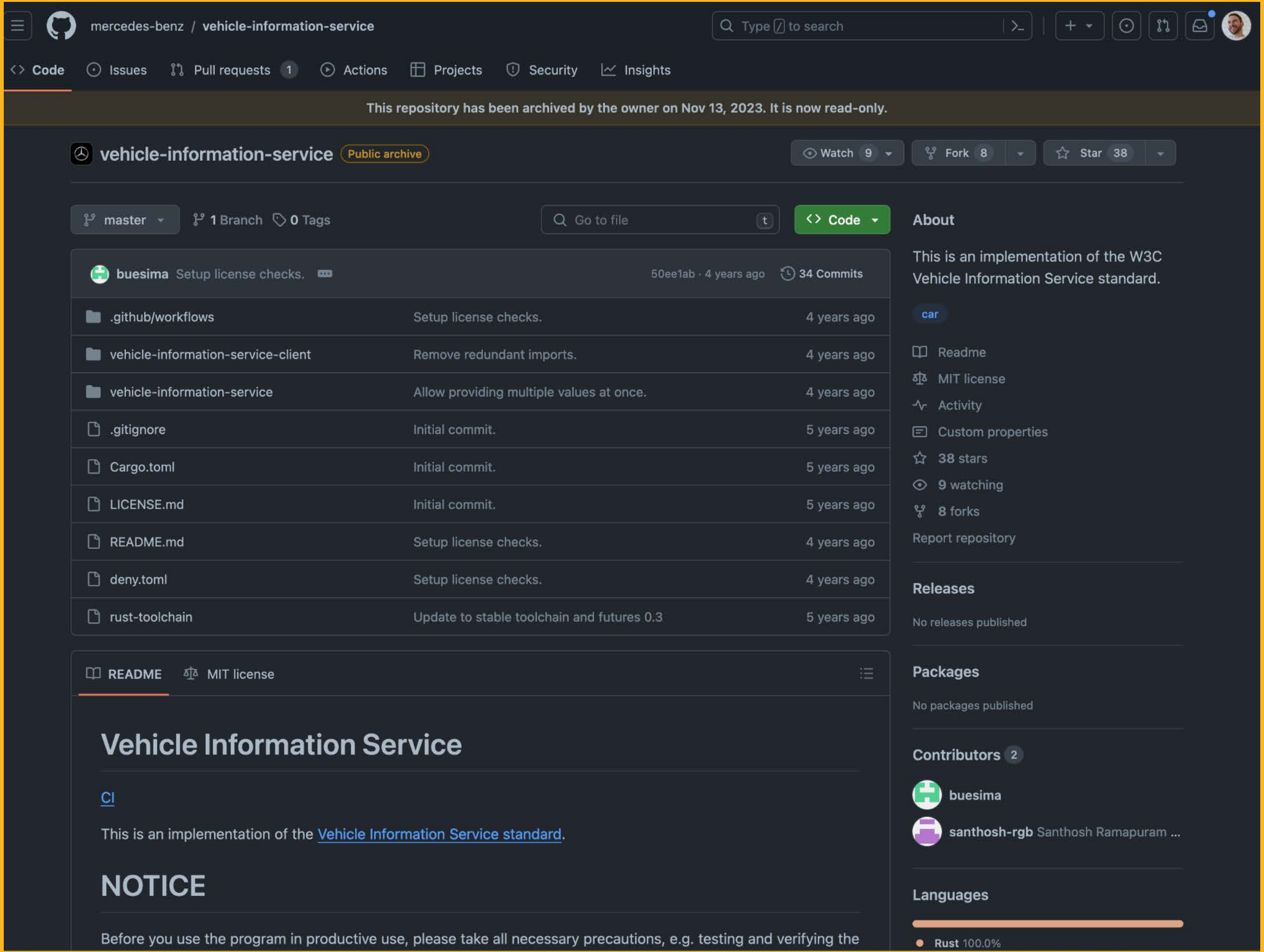
mercedes-benz / vehicle-information-service

This repository has been archived by the owner on Nov 13, 2023. It is now read-only.

vehicle-information-service Public archive

master · 1 Branch · 0 Tags

buesima Setup license checks. 50ee1ab · 4 years ago · 34 Commits

.github/workflows	Setup license checks.	4 years ago
vehicle-information-service-client	Remove redundant imports.	4 years ago
vehicle-information-service	Allow providing multiple values at once.	4 years ago
.gitignore	Initial commit.	5 years ago
Cargo.toml	Initial commit.	5 years ago
LICENSE.md	Initial commit.	5 years ago
README.md	Setup license checks.	4 years ago
deny.toml	Setup license checks.	4 years ago
rust-toolchain	Update to stable toolchain and futures 0.3	5 years ago

About

This is an implementation of the W3C Vehicle Information Service standard.

car

Readme · MIT license · Activity · Custom properties · 38 stars · 9 watching · 8 forks

Releases: No releases published

Packages: No packages published

Contributors 2: buesima, santhosh-rgb Santhosh Ramapuram ...

Languages: Rust 100.0%

Vehicle Information Service

CI

This is an implementation of the Vehicle Information Service standard.

NOTICE

Before you use the program in productive use, please take all necessary precautions, e.g. testing and verifying the

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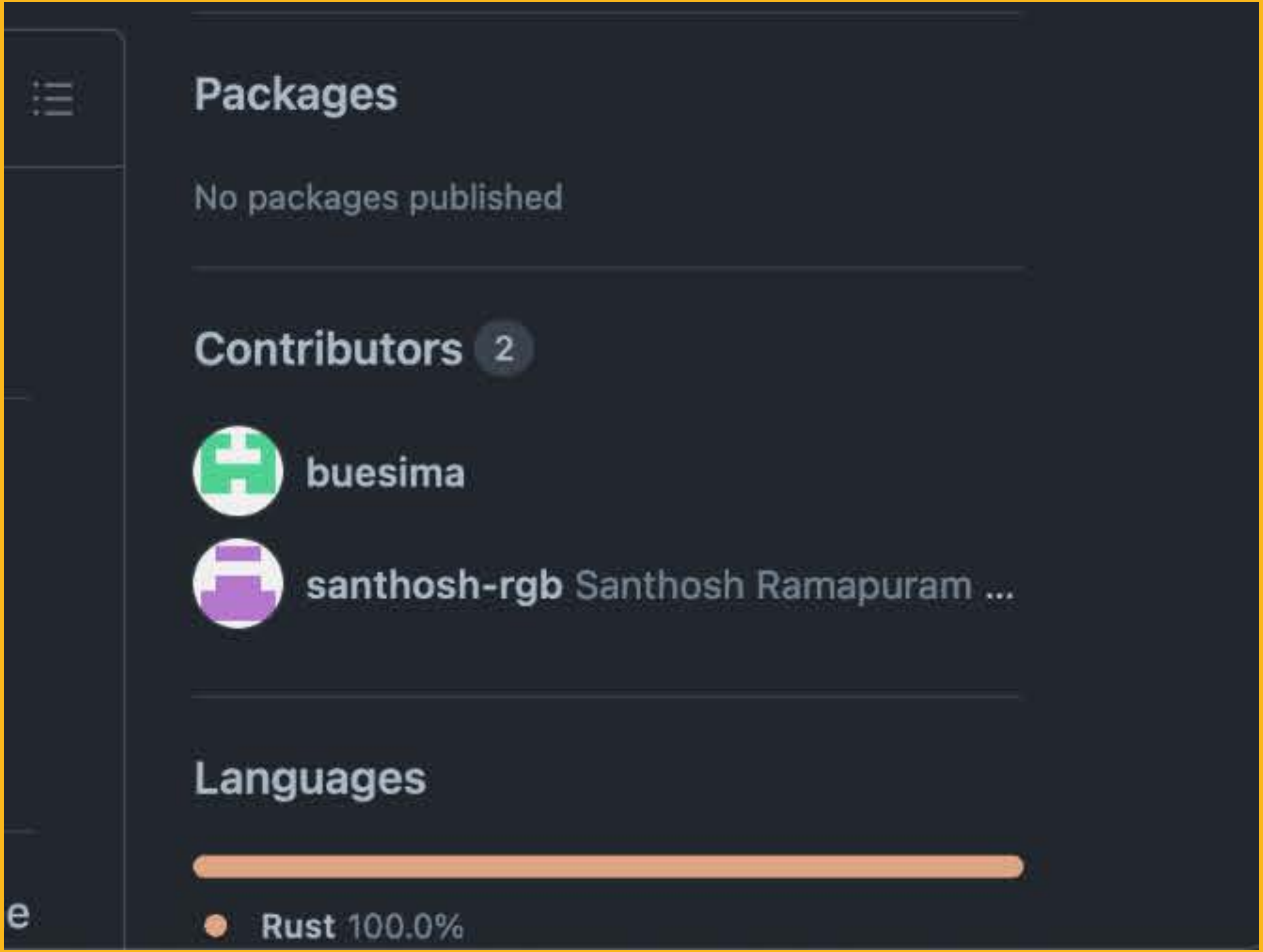
Packages

No packages published

Contributors 2

buesima

santhosh-rgb Santhosh Ramapuram ...

Languages

● Rust 100.0%

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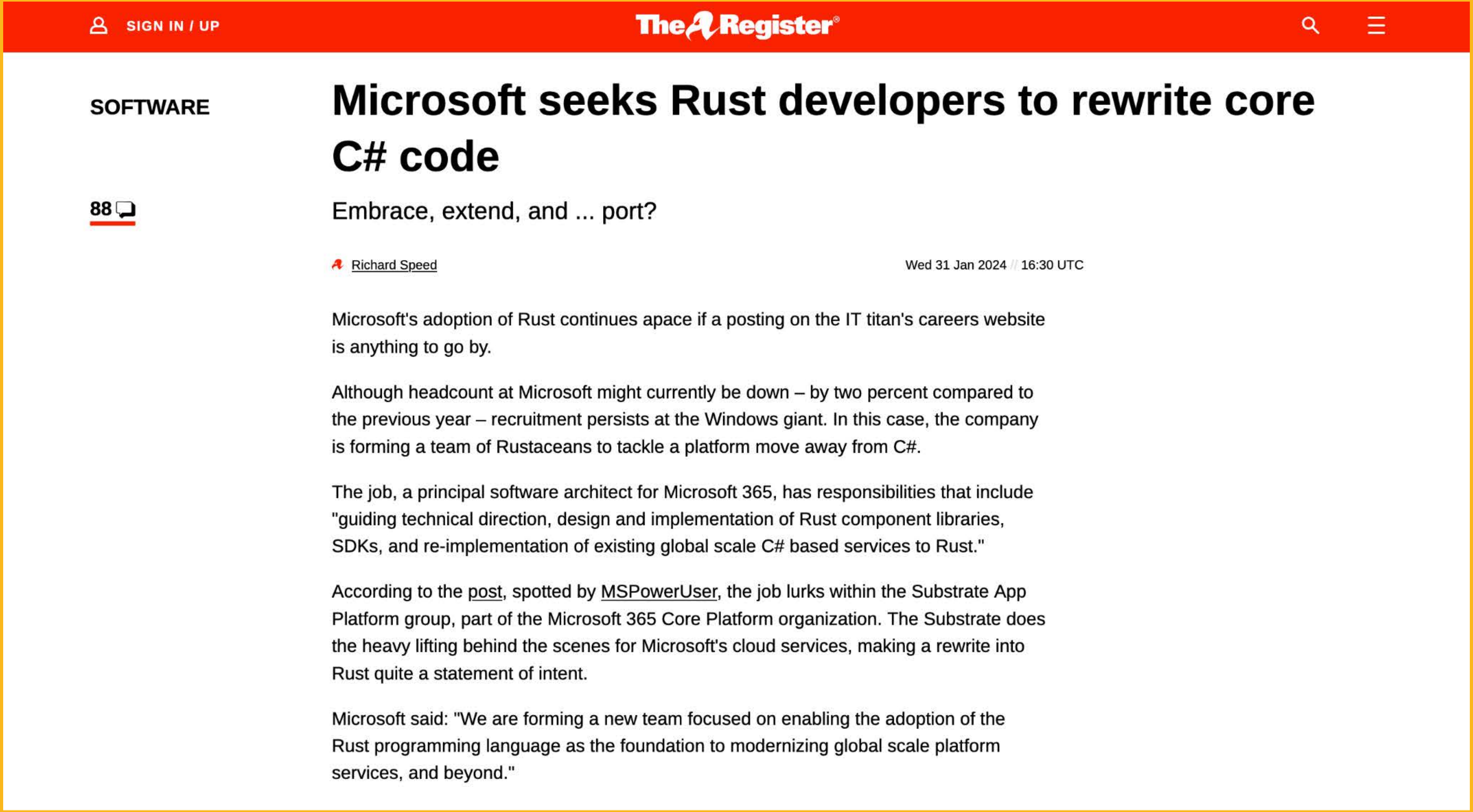


SOFTWARE

88

Microsoft seeks Rust developers to rewrite core C# code

Embrace, extend, and ... port?

Richard Speed Wed 31 Jan 2024 // 16:30 UTC

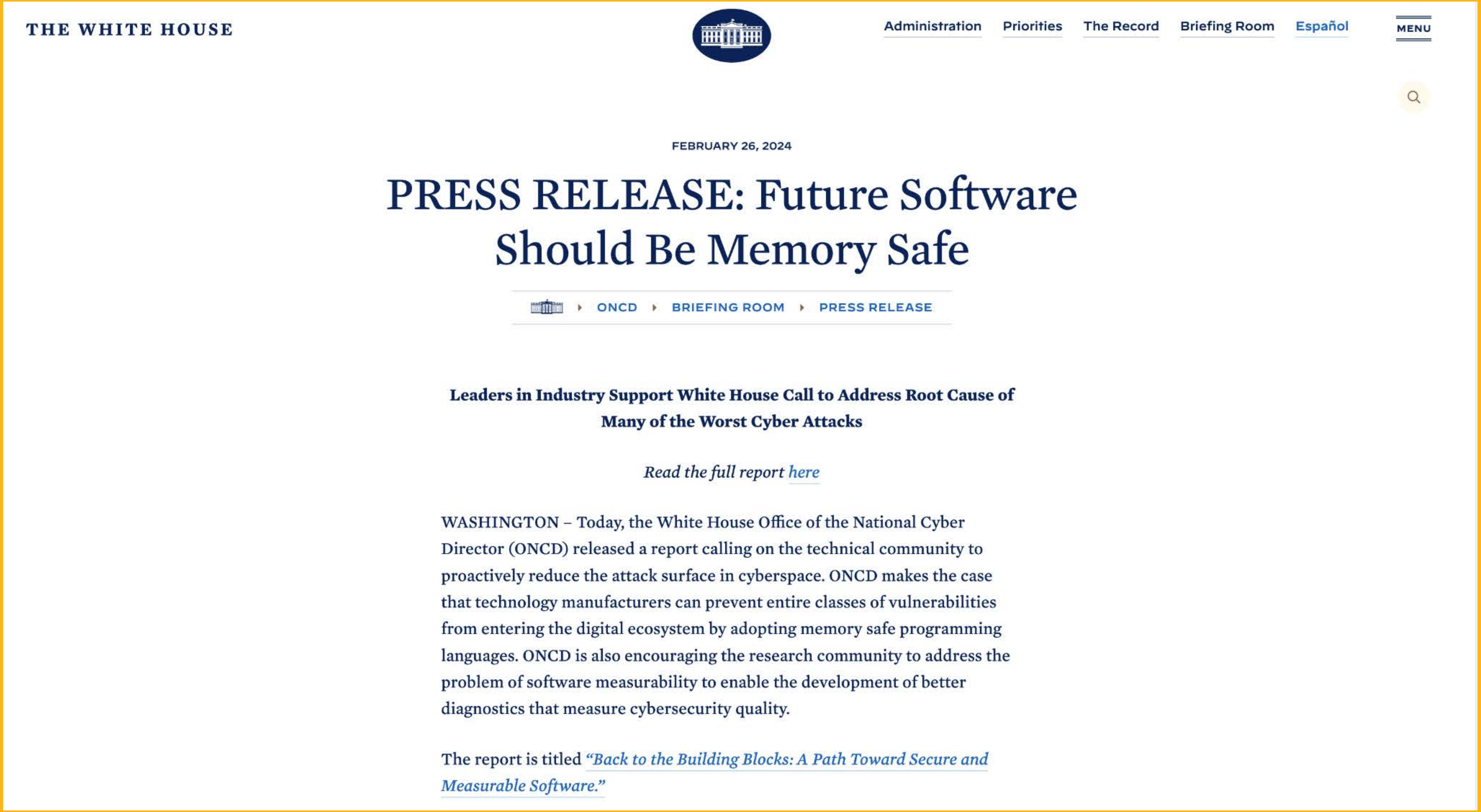
Microsoft's adoption of Rust continues apace if a posting on the IT titan's careers website is anything to go by.

Although headcount at Microsoft might currently be down – by two percent compared to the previous year – recruitment persists at the Windows giant. In this case, the company is forming a team of Rustaceans to tackle a platform move away from C#.

The job, a principal software architect for Microsoft 365, has responsibilities that include "guiding technical direction, design and implementation of Rust component libraries, SDKs, and re-implementation of existing global scale C# based services to Rust."

According to the post, spotted by MSPowerUser, the job lurks within the Substrate App Platform group, part of the Microsoft 365 Core Platform organization. The Substrate does the heavy lifting behind the scenes for Microsoft's cloud services, making a rewrite into Rust quite a statement of intent.

Microsoft said: "We are forming a new team focused on enabling the adoption of the Rust programming language as the foundation to modernizing global scale platform services, and beyond."



FEBRUARY 26, 2024

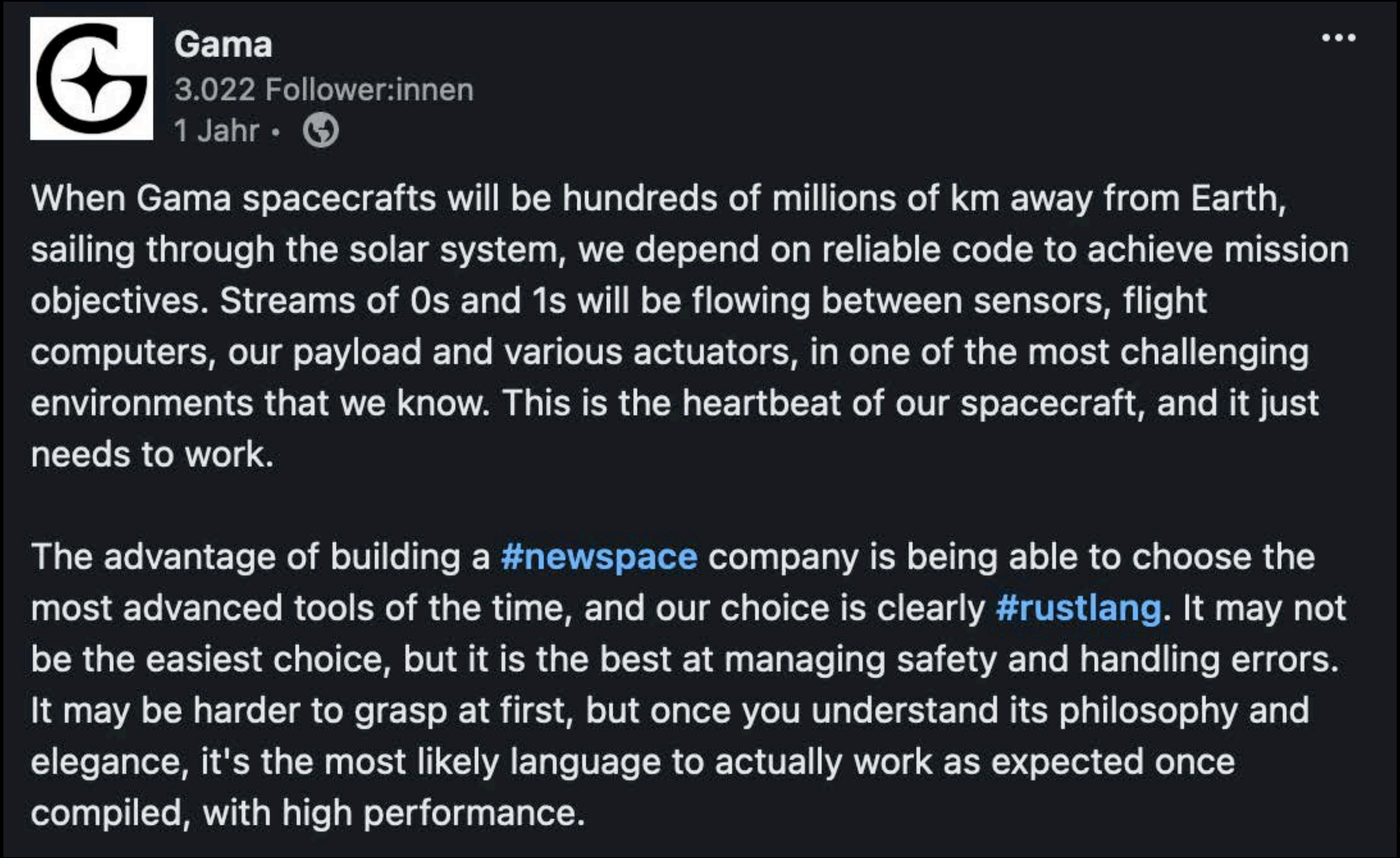
PRESS RELEASE: Future Software Should Be Memory Safe

Leaders in Industry Support White House Call to Address Root Cause of Many of the Worst Cyber Attacks

Read the full report here

WASHINGTON – Today, the White House Office of the National Cyber Director (ONCD) released a report calling on the technical community to proactively reduce the attack surface in cyberspace. ONCD makes the case that technology manufacturers can prevent entire classes of vulnerabilities from entering the digital ecosystem by adopting memory safe programming languages. ONCD is also encouraging the research community to address the problem of software measurability to enable the development of better diagnostics that measure cybersecurity quality.

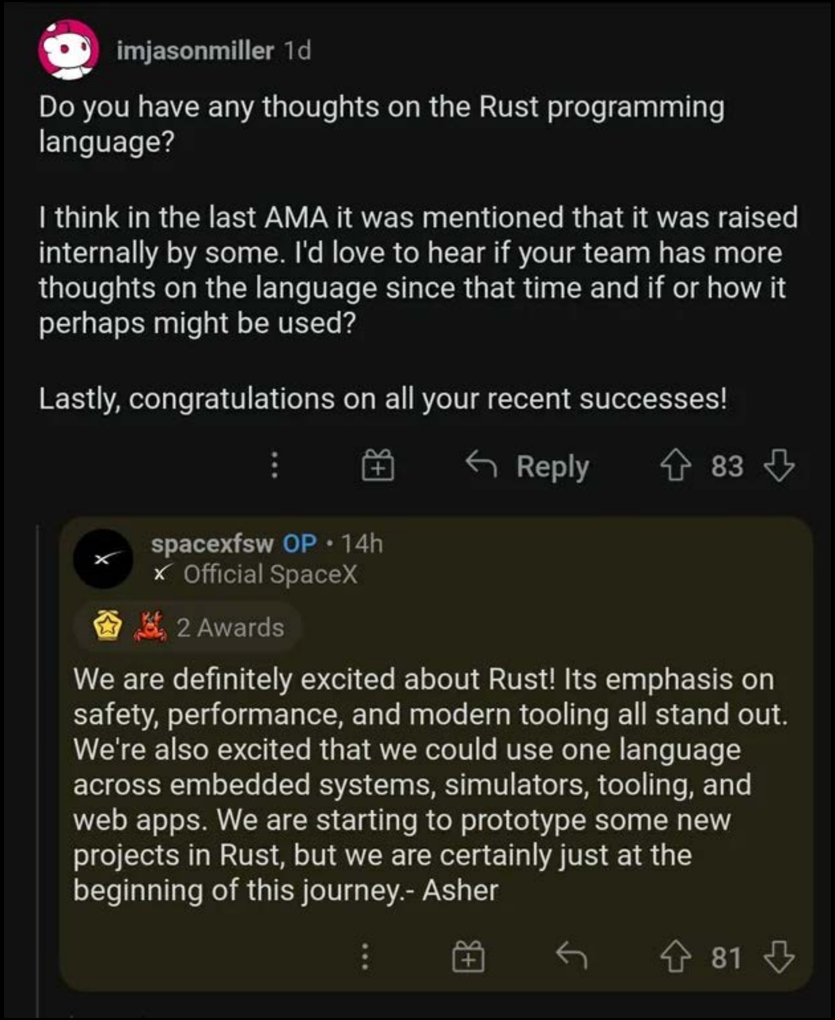
The report is titled *"Back to the Building Blocks: A Path Toward Secure and Measurable Software."*


Gama
3.022 Follower:innen
1 Jahr •

When Gama spacecrafts will be hundreds of millions of km away from Earth, sailing through the solar system, we depend on reliable code to achieve mission objectives. Streams of 0s and 1s will be flowing between sensors, flight computers, our payload and various actuators, in one of the most challenging environments that we know. This is the heartbeat of our spacecraft, and it just needs to work.

The advantage of building a #newspace company is being able to choose the most advanced tools of the time, and our choice is clearly #rustlang. It may not be the easiest choice, but it is the best at managing safety and handling errors. It may be harder to grasp at first, but once you understand its philosophy and elegance, it's the most likely language to actually work as expected once compiled, with high performance.

https://twitter.com/gamaspace



imjasonmiller 1d

Do you have any thoughts on the Rust programming language?

I think in the last AMA it was mentioned that it was raised internally by some. I'd love to hear if your team has more thoughts on the language since that time and if or how it perhaps might be used?

Lastly, congratulations on all your recent successes!

spacexfsw OP • 14h
Official SpaceX

2 Awards

We are definitely excited about Rust! Its emphasis on safety, performance, and modern tooling all stand out. We're also excited that we could use one language across embedded systems, simulators, tooling, and web apps. We are starting to prototype some new projects in Rust, but we are certainly just at the beginning of this journey.- Asher

You RN

A CASE FOR YOUR COMPANY?

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STRATEGIES FOR RUST ADOPTION

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POPULAR WAYS OF RUST INTEGRATION

- Network APIs
  - Microservices
  - GraphQL
- Foreign-Function Interface (FFI)
  - Java
  - Python
  - C++
- WebAssembly
  - Frontend
  - Plugin-systems

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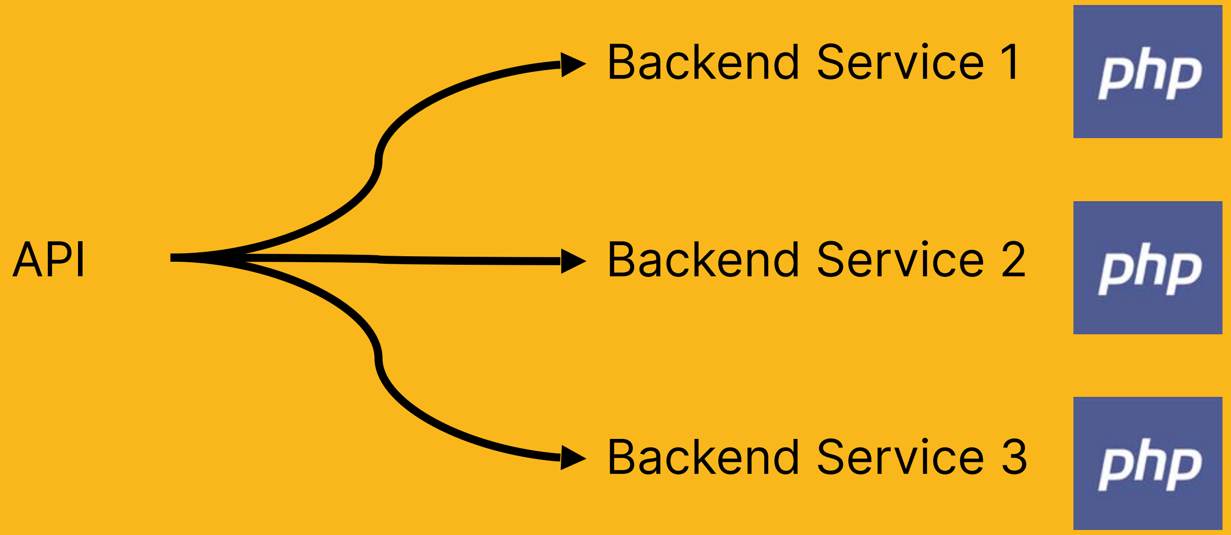
RUST ADOPTION IN NETWORK APIS



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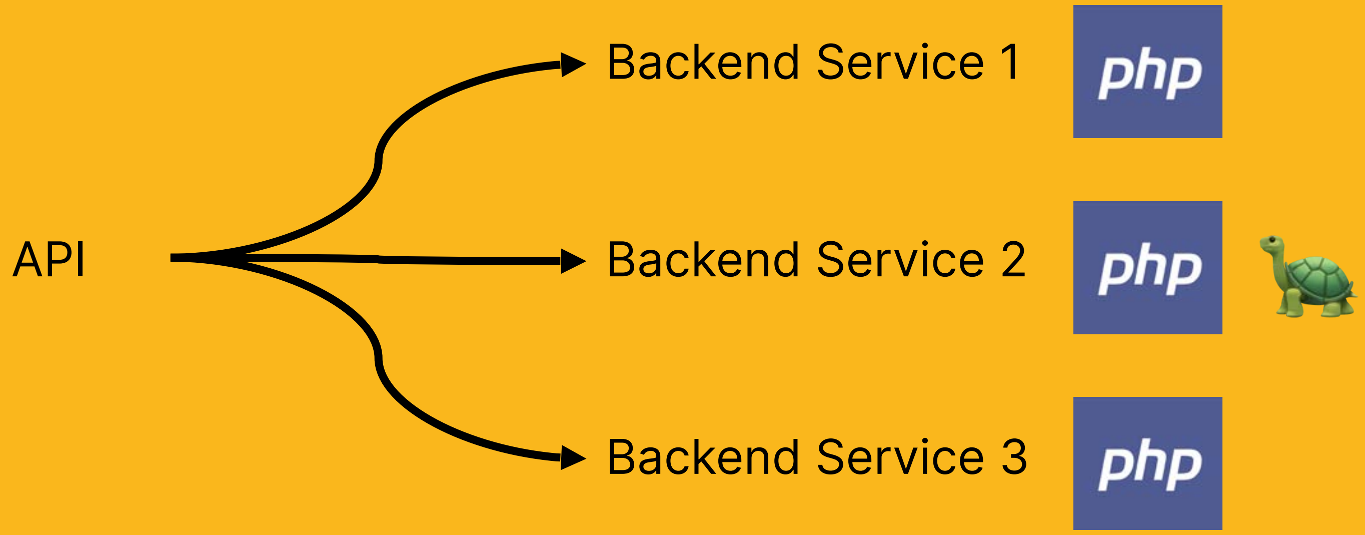
RUST ADOPTION IN NETWORK APIS



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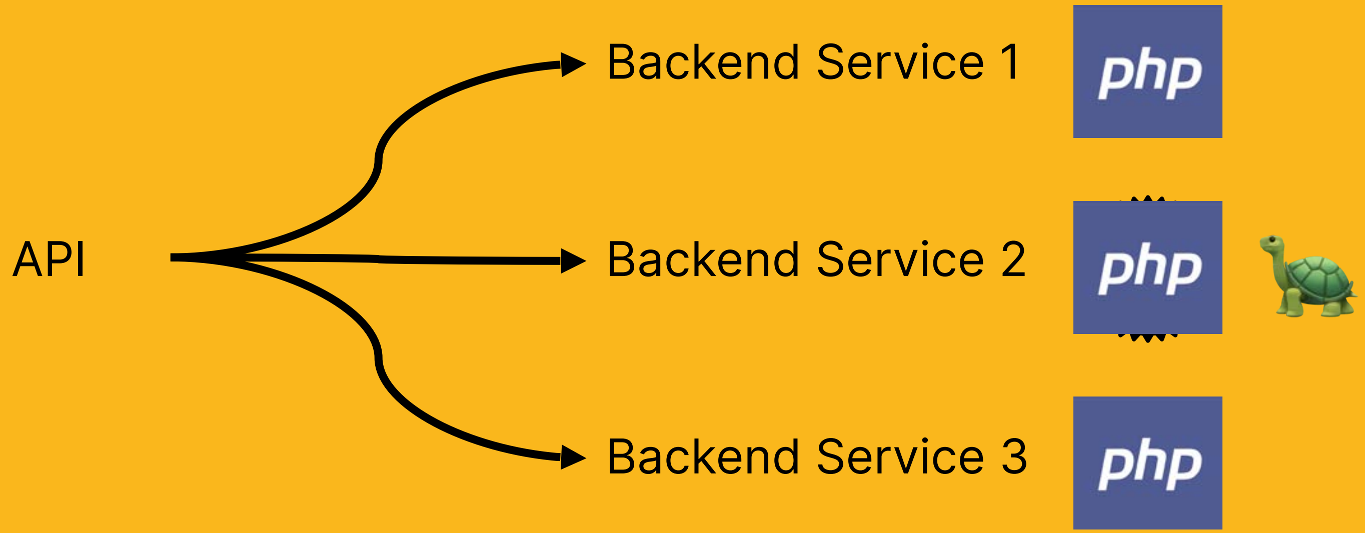
RUST ADOPTION IN NETWORK APIS



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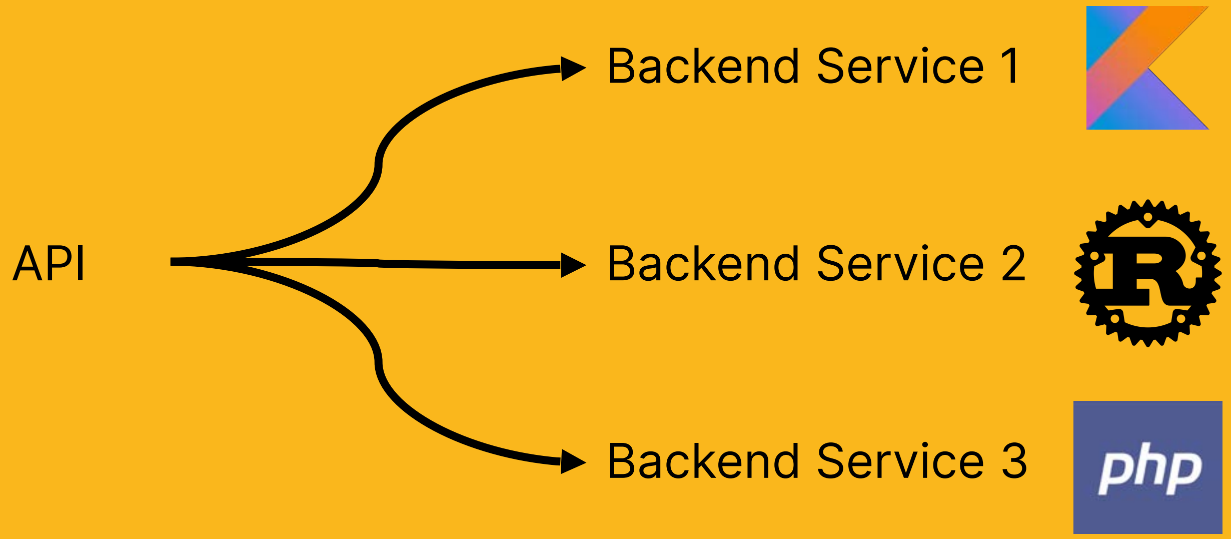
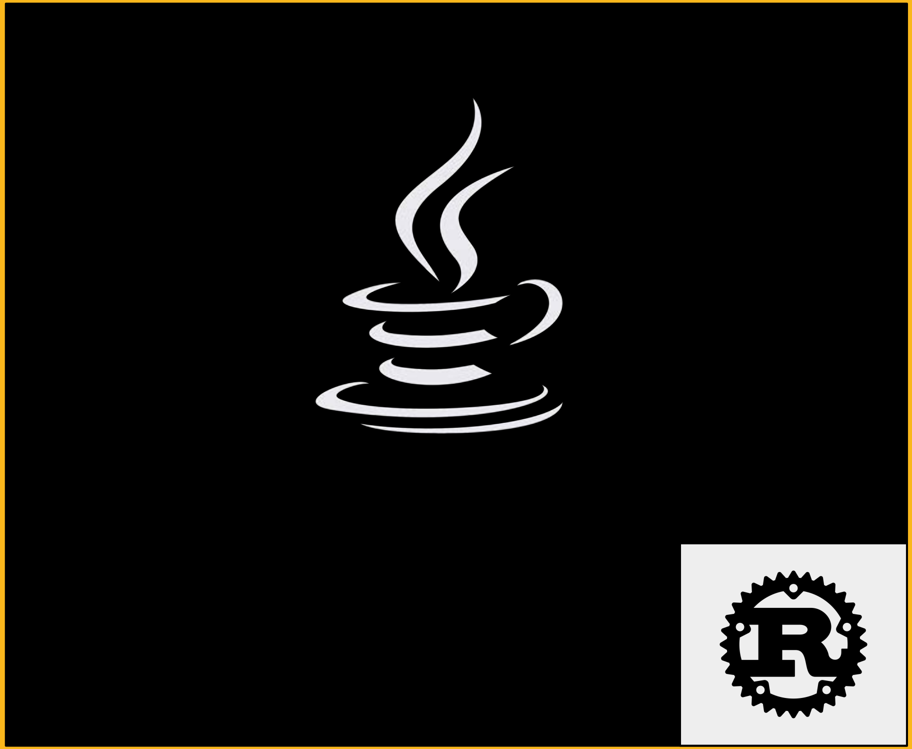
RUST ADOPTION IN NETWORK APIS



RUST ADOPTION IN MONOLITHS

RUST ADOPTION IN MONOLITHS



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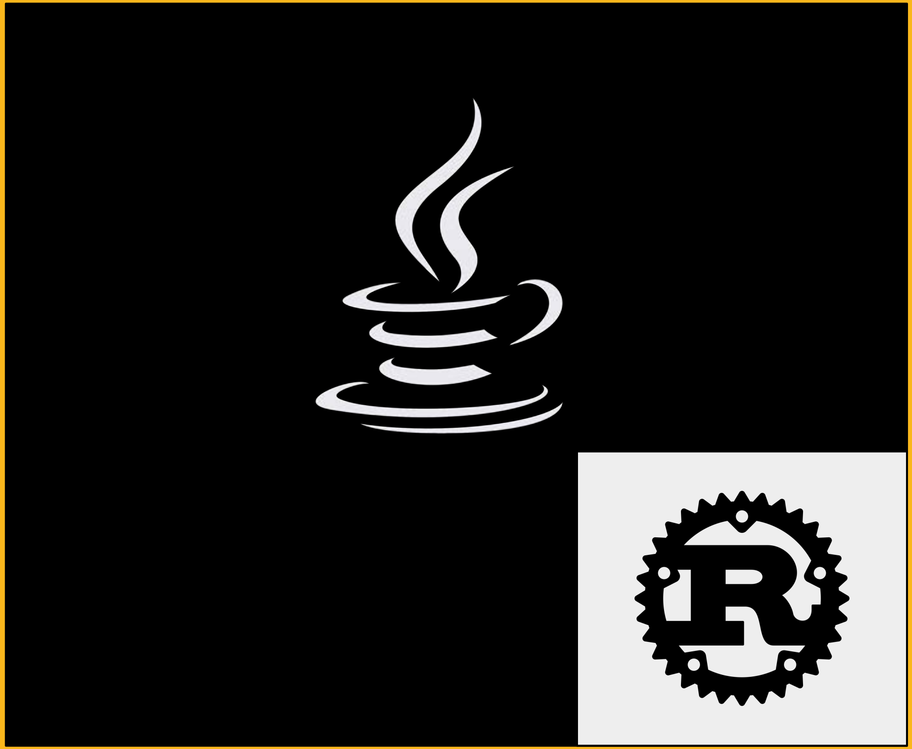

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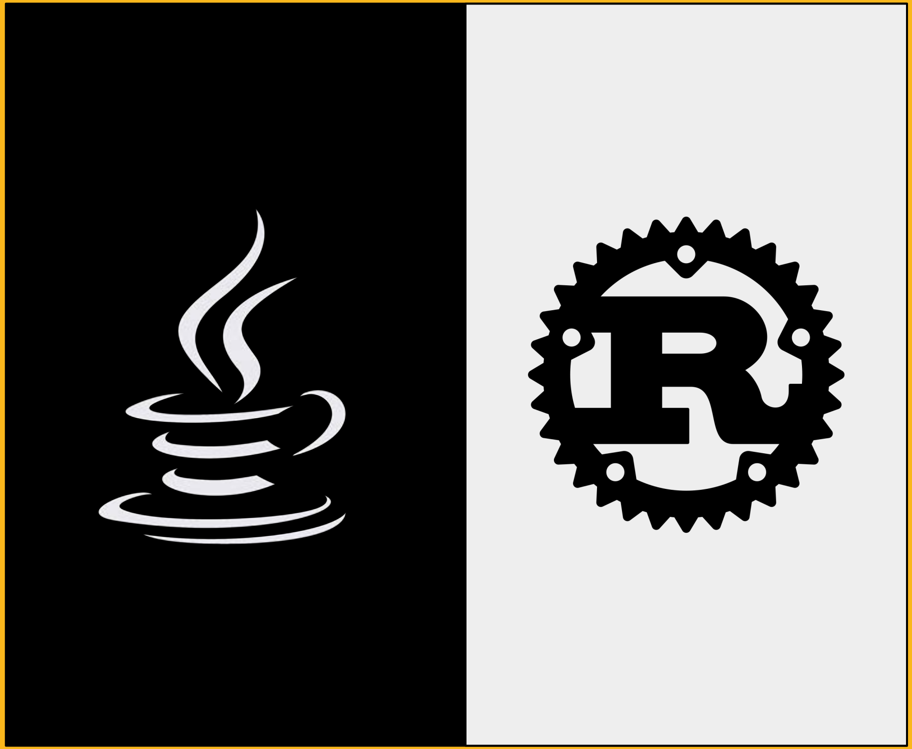

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Vortexa & Rust, our Journey

JAVA VS RUST

Source corrode

JAVA

⏱️ 7 days

🤑 $1100/run

VS

RUST

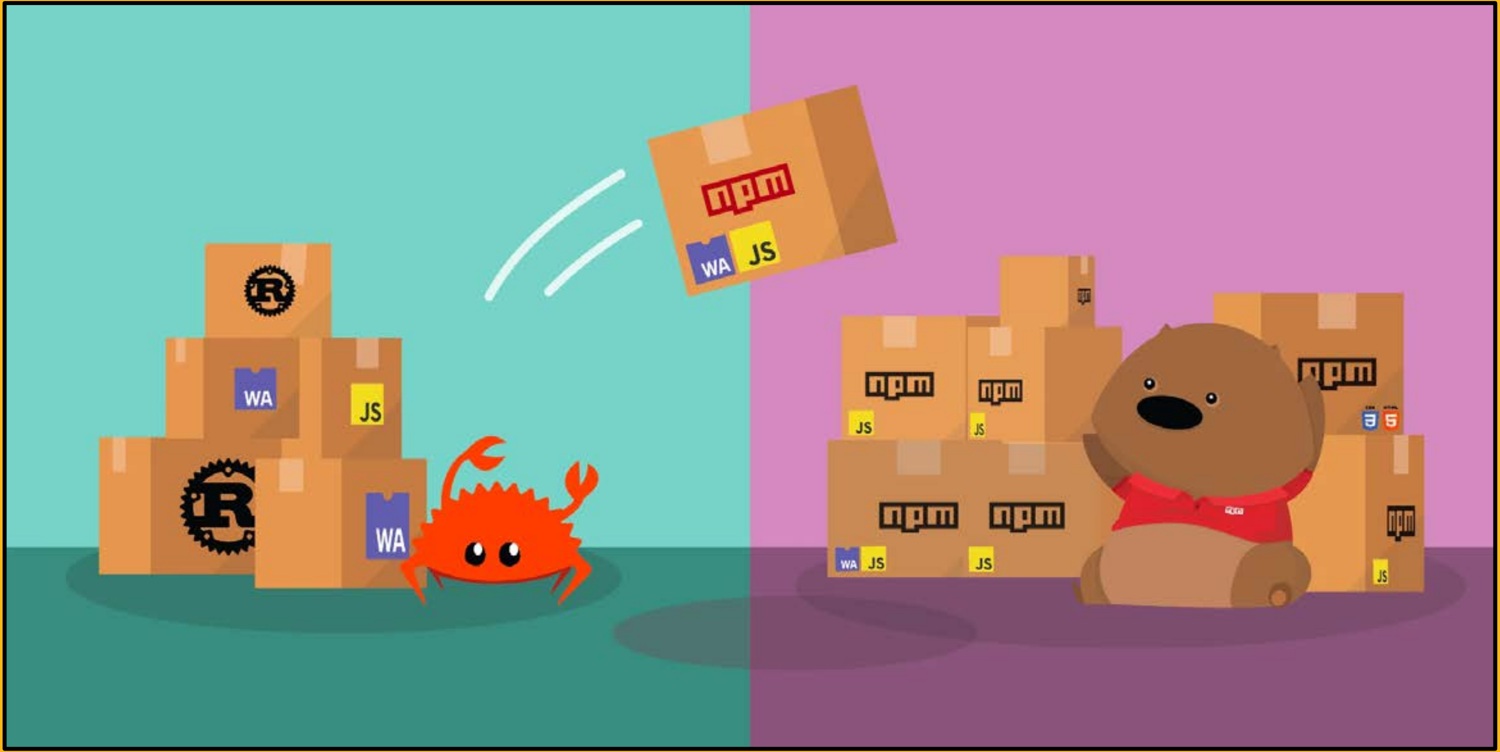
⏱️ 1 day

🤑 $80/run

Source corrode

RUST ADOPTION IN HS-WEB-APP

RUST INTEGRATION IN FRONTENDS / JAVASCRIPT



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REQUIREMENTS FOR ADOPTION

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RUST ADOPTION NEEDS A CATALYST FOR SUCCESS

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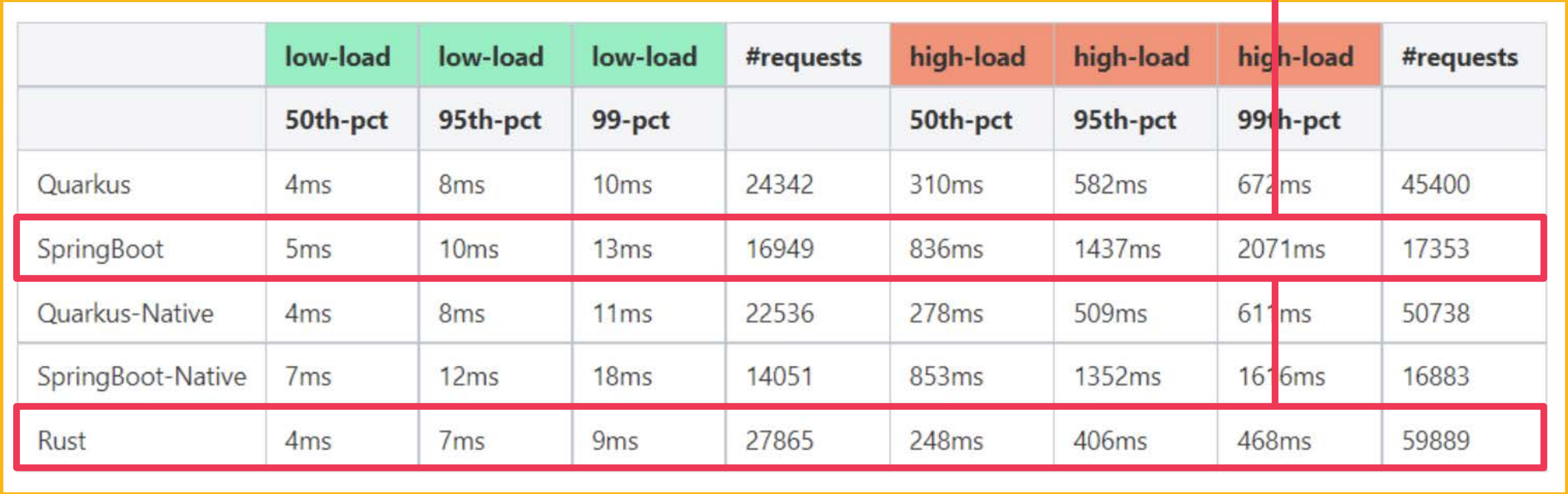
PERFORMANCE IS A WEAK CATALYST

4X PERFORMANCE BOOST



	low-load	low-load	low-load	#requests	high-load	high-load	high-load	#requests
	50th-pct	95th-pct	99-pct		50th-pct	95th-pct	99th-pct	
Quarkus	4ms	8ms	10ms	24342	310ms	582ms	672ms	45400
SpringBoot	5ms	10ms	13ms	16949	836ms	1437ms	2071ms	17353
Quarkus-Native	4ms	8ms	11ms	22536	278ms	509ms	611ms	50738
SpringBoot-Native	7ms	12ms	18ms	14051	853ms	1352ms	1616ms	16883
Rust	4ms	7ms	9ms	27865	248ms	406ms	468ms	59889

https://blog.consol.de/software-engineering/web-application-development/rust-vs-quarkus-native-vs-spring-native/

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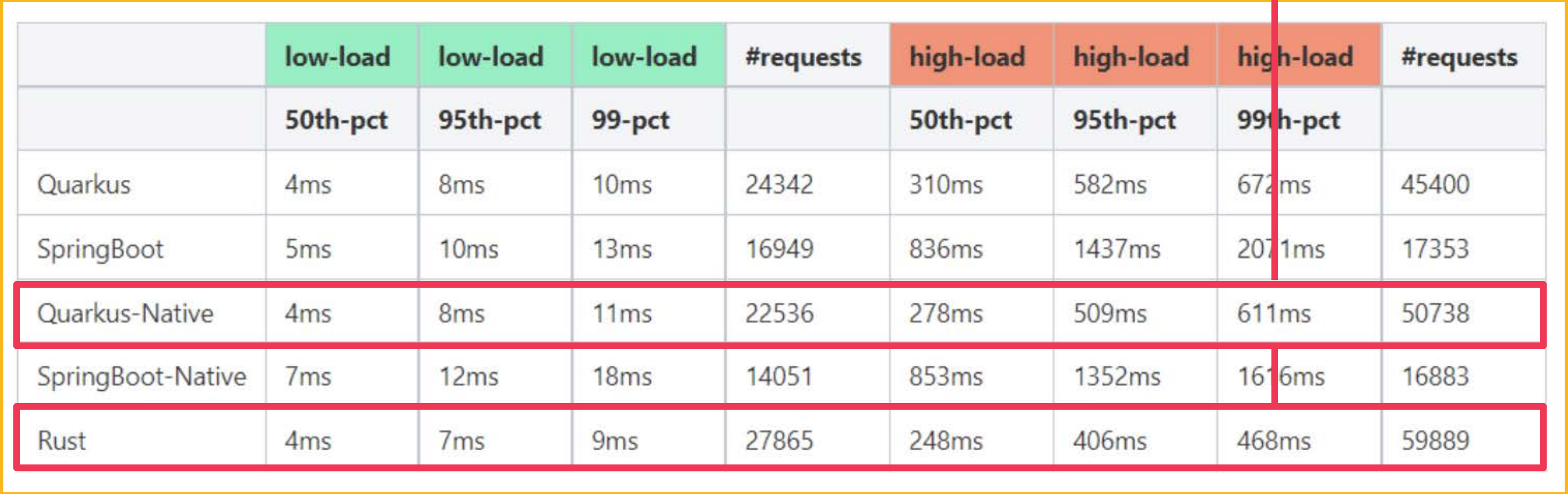
PERFORMANCE IS A WEAK CATALYST

1.5X PERFORMANCE BOOST



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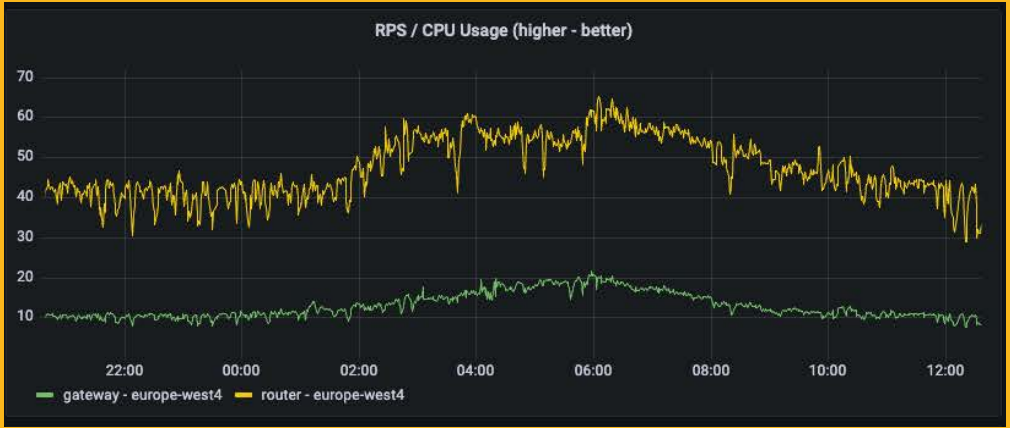
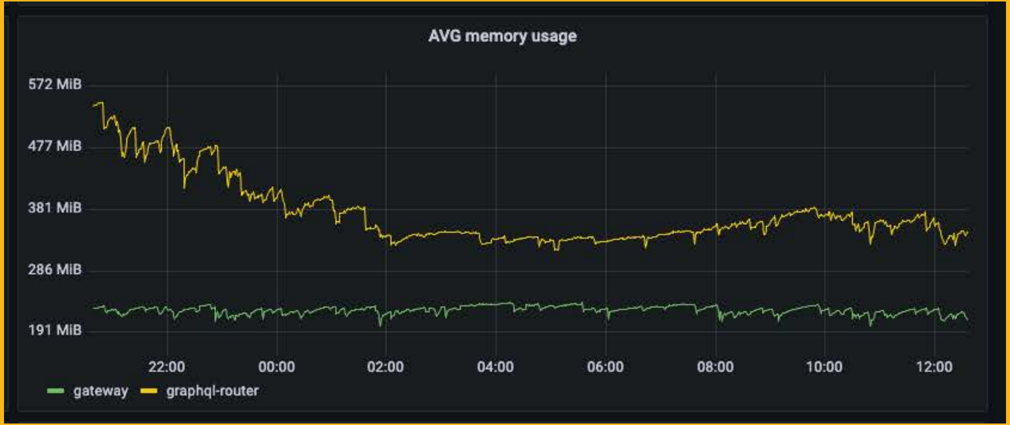
GRAPHQL CASE-STUDY





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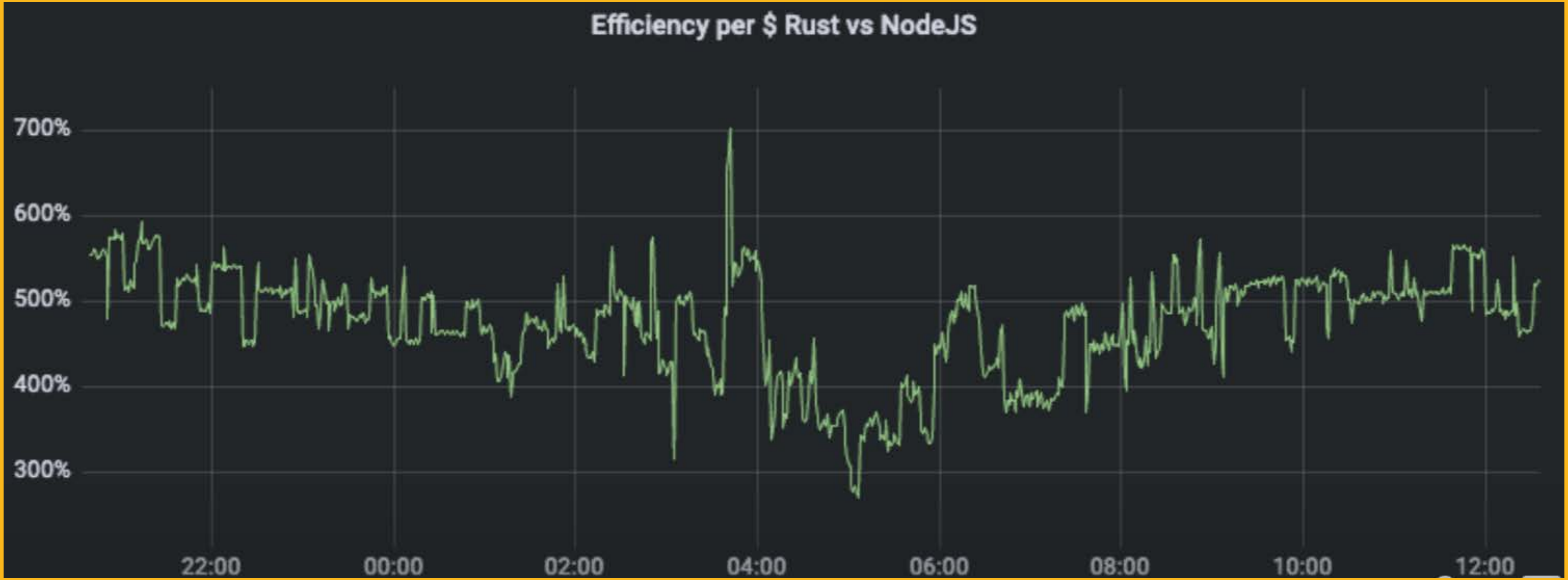
GRAPHQL CASE-STUDY



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1. THE CHOSEN PROJECT DETERMINES THE ODDS OF SUCCESSFUL RUST ADOPTION.

(Choose wisely)

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FINDING YOUR FIRST PROJECT FOR RUST

1. **Fix Pain Points**
   Ideal for performance or concurrency issues.

2. **Limit Scope**
   Choose an impactful yet medium-sized projects.

3. **Play Rust's Strengths**
   Find projects benefiting the most from lower operational costs and stability.

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RECRUITING IS HARD AND EXPENSIVE.

TRAIN YOUR OWN PEOPLE.

(Or hire me to do it)

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ADOPTING RUST

1. **Identify Project**
   Select a meaningful project for Rust implementation.

2. **Team Assessment**
   - Do not hire new staff specifically for Rust.
   - Evaluate the current team's readiness:
     - Check for hidden Rust experts.
     - Consider experience in languages similar to Rust. (Java, Kotlin, C++)
     - Gauge the team's willingness to learn Rust.

3. **Upskilling the Team**
   - Self-guided learning using books and hands-on exercises.
   - Organize training workshops.
   - Team augmentation for asking harder questions.
   - Code reviews to improve the codebase.

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YOU NEED A LONG-TERM MINDSET

(Think: years)

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RISKS

- No quick wins
- Steep learning curve
- Long build times (locally and in CI)
- Custom libraries required
- Need to write integrations with existing code

BENEFITS

- Reduce operational costs
- Predictable performance
- Enable faster development cycles
- Less friction between dev and ops
- Developer happiness (most loved language for 7 years in a row)
- Gradual adoption possible

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Rust
in
Production
Podcast

corrode.dev/podcast

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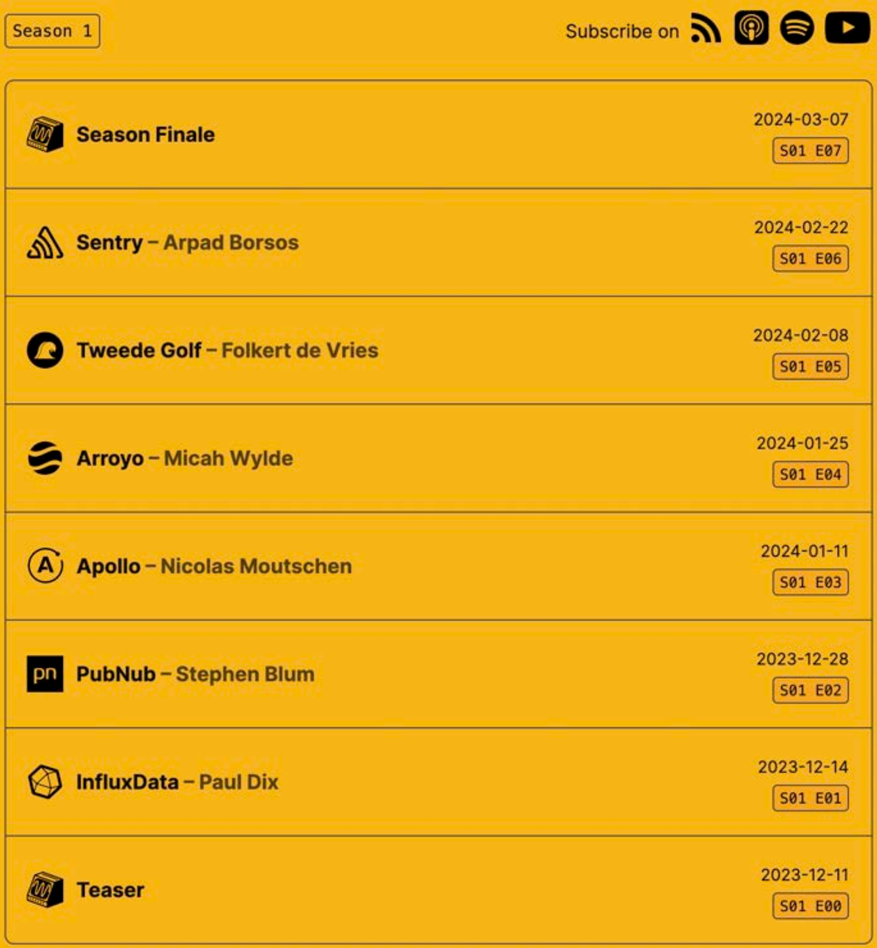

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