



Ferrocene

Qualifying rustc using only open source
software

\$whoami

- ❑ Florian Gilcher
- ❑ Managing Director Ferrous Systems (<https://ferrous-systems.com>)
- ❑ Previously Rust Foundation, Rust Project core & community team
- ❑ Rust Trainer since 2015

Ferrous Systems

- ❑ Formed 2018 by Rust project members to help companies adopt Rust
- ❑ Mainly a training and maintenance company
- ❑ (co-)maintained projects: rust-analyzer, knurling, bindgen, crates.io
- ❑ Ferrocene: bringing Rust into safety-critical

- ❑ Partner in the adoption of Rust at major projects like Google Android:
<https://opensource.googleblog.com/2023/06/rust-fact-vs-fiction-5-insights-from-googles-rust-journey-2022.html>

- ❑ <https://ferrous-systems.com>

AGENDA SLIDE

What is Ferrocene?

Tools Used

Not Rocket Science

Execution

Experiences

What is Ferrocene?



A qualification of the Rust compiler, rustc

Ferrocene is a complete downstream toolchain of <https://github.com/rust-lang/rust>

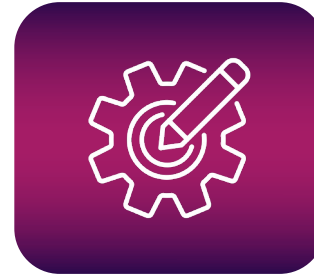
ISO 26262 and IEC 61508



A language specification effort

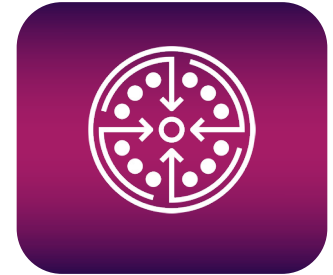
Ferrocene has the only complete specification of Rust 1.68

<https://spec.ferrocene.dev>



Long Term Supported Rust

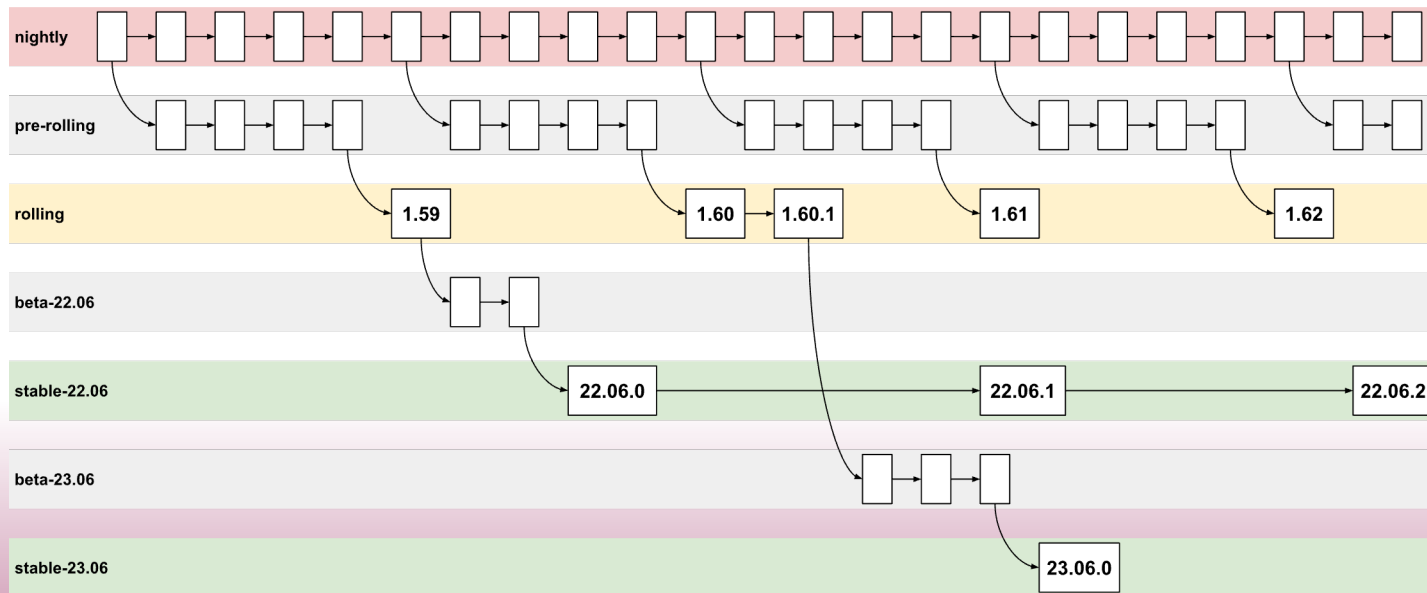
The Rust project supports for 6 weeks, Ferrocene longer



Fully Open Source based

Ferrocene uses open source tools and methodologies derived from the Rust project

Rust Basics: Trains





Rust Basics: Target Tiers

- ❑ Target tiers describe the level of support a target gets
- ❑ Tier 1: Fully supported, breakage blocks release, needs full automated testing
- ❑ Tier 2: Supported, shipped with the compiler, but may not be automatically tested
- ❑ Tier 3: Code is in the repository, but no further guarantees, target is not always shipped
- ❑ Example: aarch64-unknown-none is a Tier 2 target upstream, but Tier 1 in Ferrocene



Not Rocket Science Rule of Software Engineering

Automatically maintain a repository of code that always passes all the tests.



Not Rocket Science Rule of Software Engineering

Plain CI is not enough for this!



Ethos (Mozilla Research)

What can't be released, isn't software.



Every build is a release

The testing of rustc includes building all release artifacts as if a full release is made.



Tools Used



- ❑ Sphinx for documentation <https://www.sphinx-doc.org>
- ❑ Bors-NG for automation <https://bors.tech> (*)
- ❑ Sigstore for document signing <https://www.sigstore.dev/>
- ❑ Reuse for Licensing/SBOM concerns <https://reuse.software/>

- ❑ GitHub as a Platform <https://github.com>
- ❑ CircleCI as a Build Platform <https://circleci.com>

BORS-ng


- ❑ Maintains a queue of PRs that are ready to be merged (reviewed)
- ❑ Serializes them for testing, so only one PR runs at a time
- ❑ Automates *all* operations on the repository
- ❑ Does all important bookkeeping, e.g. tracking who reviewed and who authored a change
- ❑ Signals back on failures


BORS-ng


  **pietroalbini** approved these changes last week [View reviewed changes](#)


pietroalbini left a comment ...


bors merge



 **bors-ferrocene** (bot) commented last week ...


 Waiting for PR status (Github check) to be set, probably by CI. Bors will automatically try to run when all required PR statuses are set.





 **bors-ferrocene** (bot) commented last week ...



Build succeeded:

- full



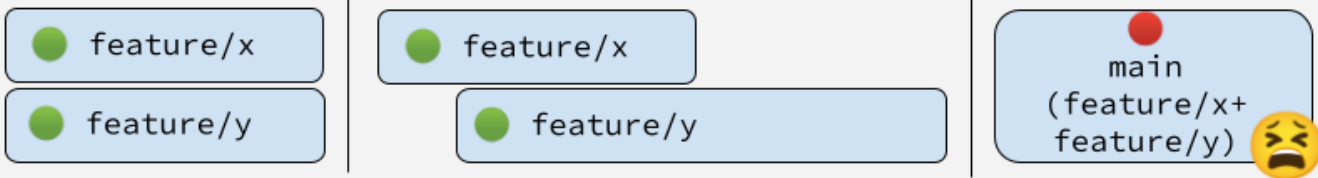
  **bors-ferrocene** (bot) merged commit **6e19a28** into **release/1.68** last week [View details](#) [Revert](#)

3 checks passed

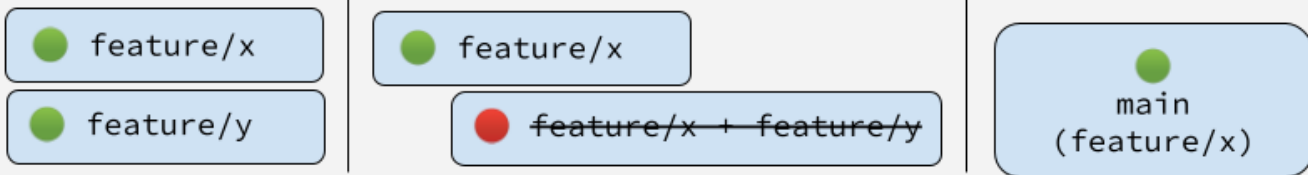
  **bors-ferrocene** (bot) deleted the **automation/backport/w28o1bbu** branch last week [Restore branch](#)

BORS-ng: Merge queue

Feature branch merge tests



Feature branches with merge queue



BORS-ng

Merge #1306 #1307

1306: Allow omitting new-branch argument in generate_pr_body.py r=pietroalbini a=Veykril

Makes manual pulls slightly more convenient

1307: Use default implementation for completest's config r=Veykril a=pietroalbini

This should avoid merge conflicts when new completest options are added. The `Default` impl was added in rust-lang/rust#111348.

Co-authored-by: Lukas Wirth <lukas.wirth@ferrous-systems.com>

Co-authored-by: Pietro Albini <pietro.albini@ferrous-systems.com>



Straight-Forward Path to Improvement

More Testing!

Ferrocene considers the qualification material and tracing part of the software test. It is never allowed to break.

Ferrocene Spec



Language Specification

Search...



Contents:

1. General
2. Lexical Elements
3. Items
4. Types and Traits
5. Patterns
6. Expressions
7. Values
8. Statements
9. Functions

7.1. Constants

Syntax

```
ConstantDeclaration ::=  
    const (Name | _) TypeAscription ConstantInitializer? ;  
  
ConstantInitializer ::=  
    = Expression
```

Legality Rules

- 7.1.1 A **constant** is an **immutable value** whose uses are substituted by the **value**.
- 7.1.2 An **unnamed constant** is a **constant** declared with character 0x5F (low line).
- 7.1.3 The **type specification** of a **constant** shall have `'static` **lifetime**.

Traceability Matrix

● [FLS: Values](#)

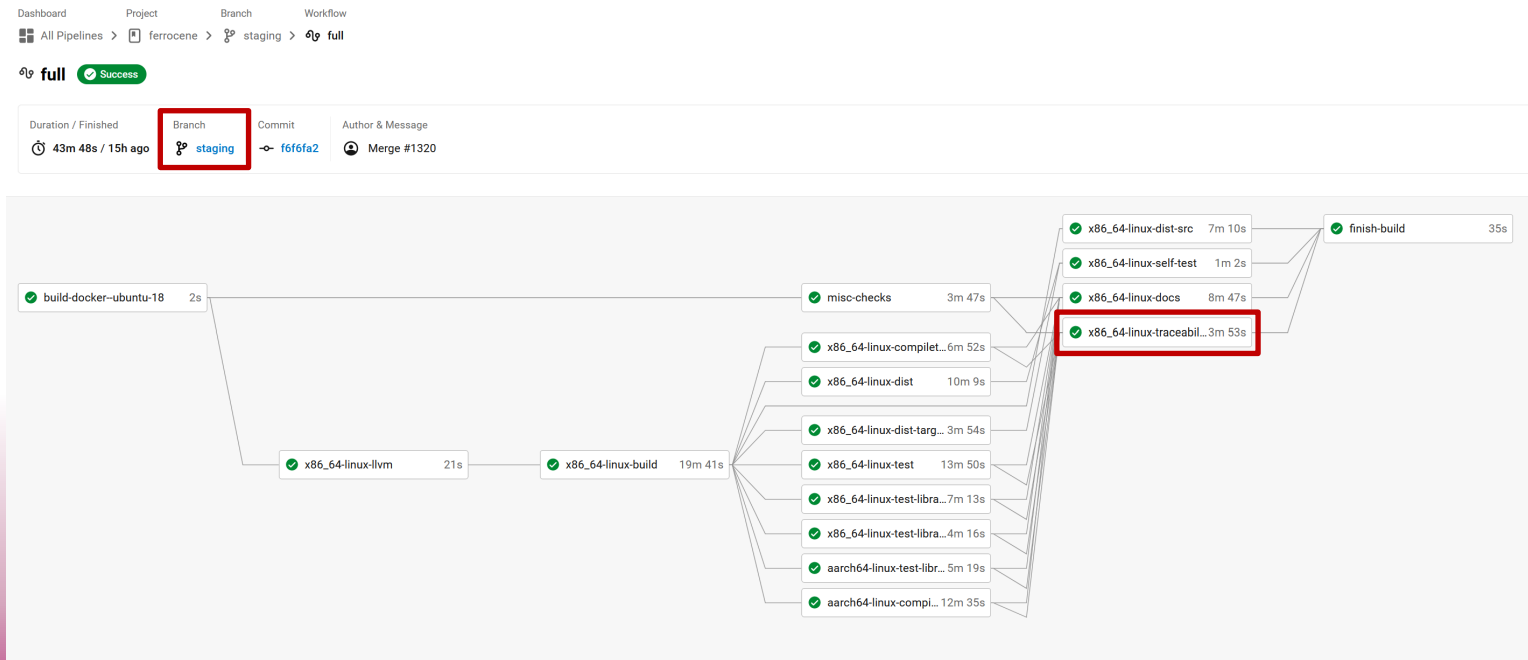
[7.1 Constants](#)

f1s_ixjc5jaamx84




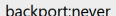













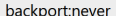




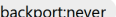

▼ show 690 linked tests

[tests/ui/const-generics/generic_arg_infer/in-signature.rs](#)
[tests/ui/consts/array-literal-index-oob.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/array-literal-len-mismatch.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/array-to-slice-cast.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/assert-type-intrinsics.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/assoc-const.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/assoc_const_generic_impl.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/associated_const_generic.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/async-block.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/bswap-const.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/cast-discriminant-zst-enum.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/chained-constants-stackoverflow.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/check_const-feature-gated.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/closure-in-foreign-crate.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/closure-structural-match-issue-90013.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/const-address-of-interior-mut.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/const-address-of-mut.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/const-address-of.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/const-adt-align-mismatch.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/const-array-oob-arith.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/const-array-oob.rs](#) (annotated in its [parent directory](#))
[tests/ui/consts/const-as-fn.rs](#) (annotated in its [parent directory](#))

No Such Thing As A Partial Build



Platform Automation

<input type="checkbox"/>	 10 Open	<input checked="" type="checkbox"/>	1,187 Closed	Author ▾	Label ▾	Projects ▾	Milestones ▾	Reviews ▾	Assignee ▾	Sort ▾
<input type="checkbox"/>	 Backport to release/1.71									
	#1321 opened 1 hour ago by github-actions (bot)									
<input type="checkbox"/>	 Manual backports into 1.68									
	#1318 opened yesterday by pietroalbini									
<input type="checkbox"/>	 Pull upstream 2023 07 04									 3
	#1317 opened yesterday by Veykriil • Approved									
<input type="checkbox"/>	 Backport to release/1.70									
	#1316 opened yesterday by github-actions (bot)									
<input type="checkbox"/>	 Backport to release/1.68									 5
	#1315 opened yesterday by github-actions (bot) • Approved									
<input type="checkbox"/>	 Automated pull from ferrocene/specification									 8
	#1312 opened yesterday by github-actions (bot) • Approved									

Experiences

- ❑ Major FOSS projects already *informally* do what safety-critical projects do *formally*
- ❑ When downstreaming a project, it is very useful to play along with their rules, as much as one wants to redo them
- ❑ There's many useful FOSS projects that are very useful, mature and accepted in an enterprise setting
- ❑ The ability to tune software to our needs is core to our velocity
- ❑ Simple rules without branches and conditions are *possible* and *easy to automate*
- ❑ Automating and using our platforms API is worth all the time spent
- ❑ *There is no such thing as setting up automation too early*



THANK YOU!