

Rust 101

E. Dunham  
@qedunham

Intro

Run Rust

Write Rust

Improve Rust

# Rust 101

Deploy, Write, and Improve Rust

E. Dunham  
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<http://talks.edunham.net/lca2017/rust101.pdf>

- 1 Intro
  - About Me
  - About You
  - About Rust

- 2 Run Rust
  - Channels
  - Installation Options

- 3 Write Rust
  - Errors
  - Syntax
  - Types & Traits
  - Safety
  - Using Libraries

- 4 Improve Rust
  - Level up
  - Find a project
  - Get involved

## Welcome!

- 100 minutes
- “101” is an intro class
  - Learn what Rust is & isn't
  - Run Rust code
  - Meet Rust's special features
  - Improve Rust
- Not:
  - Hack time for you
  - Unsafe or advanced Rust
  - Exhaustive Q&A <sup>1</sup>

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<sup>1</sup>Come to the BoF at lunch!

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You'll learn the key concepts necessary for successful Rust programming, as well as how to continue exploring the language after LCA.

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*The Abstract*

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## About Me:

- DevOps for Mozilla Research <sup>2</sup>
- Rust Community Team member
- FOSS & robotics background
- NOT a compiler wizard

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<sup>2</sup>Infra is mostly Python

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## Have you...

- Heard of Rust?
- Used Rust?
- Contributed to Rust?

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## Have you...

- Written C, C++, Assembly, etc?
- Written Java, Python, Ruby, JS, etc?
- Written Haskell, Erlang, Ocaml, etc?

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## Have you...

- Used version control?
- Used GitHub?
- Contributed to a FOSS project?



## What's Rust?

- Systems language<sup>3</sup>
- Safety + Performance
- Community... (Thriving but controversial)

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<sup>3</sup>Contrast to Go, a language for sysadmins

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## Rust's Buzzwords

- Safety, Speed, Concurrency
- Memory safety without garbage collection
- Zero-cost abstractions
- Hack Without Fear

## Aside: Safety & GC

- Memory must be reused
- C: “Just follow these rules perfectly, you’re smart”
- Java, JS, etc: “Wait a minute, I’ll take care of it”
- Rust: “I’ll prove correctness at compile time”

## History

- Since ~2010
- 1.0 Stable in May 2015
- Currently <sup>4</sup> version 1.14.0
- Mozilla sponsorship & support

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<sup>4</sup>until January 26th

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## Notable Projects

- `servo.org` Browser Engine
- `habitat.sh` Infrastructure Tooling
- Dropbox (internal use)
- <https://www.rust-lang.org/en-US/friends.html>

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## Where is Rust a good tool?

- Speed + Safety essential
- LLVM-supported architecture
- Team ♥ new technology

## Where might Rust be a bad tool?

- Timeframe prohibits new learning
- Need code reuse <sup>5</sup>
- Can't handle CoC

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<sup>5</sup>Corrode can translate C to unsafe Rust

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Questions about Rust's place in the world?



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## Rust's channels:

- Nightly: Trying neat ideas
- Beta: Release candidates
- Stable: Always backwards-compatible <sup>6</sup>

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<sup>6</sup><https://blog.rust-lang.org/2015/05/15/Rust-1.0.html>

## Which channel to use?

- Stable code should run anywhere
- Switch to nightly for dependencies
- New project? Pick stable <sup>7</sup>

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<sup>7</sup>Unless you need an unstable feature

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## Aside: Crater

- Compile all published libraries
- Diff results from stable and candidate
- <https://github.com/brson/taskcluster-crater>

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Questions about channels & installation?

## Installation:

- Online: `play.integer32.com` or `play.rust-lang.org`
- Many rusts: `rustup.rs`
- System package manager <sup>8</sup>
- Tinfoil hat: Compile from source

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<sup>8</sup>Or add Rust to your favorite!

## Playpens:

- Source at <https://github.com/rust-lang/rust-playpen>
- Choose output, LLVM IR, or ASM
- Gist your progress
- Config alters editor settings

## Rustup:

- Docs at `https://github.com/rust-lang-nursery/rustup.rs`
- `~/.cargo/bin`
- *rustup install nightly*
- *rustup run nightly cargo new*



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## Security:

- All releases GPG signed
- Key only held by Rust Core Team members
- [keybase.io/rust](https://keybase.io/rust) (proved by local signing)
- Rustup checks signatures for you
- [github.com/rust-lang/rust](https://github.com/rust-lang/rust)

## Deployment

- Check README for system dependencies
- *git clone projecturl*
- *cd project*
- *cargo run*
  - Downloads any dependencies
  - Compiles deps & code
  - Executes src/main.rs

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IDE support:

- <https://areweideyet.com/>
- <http://www.jonathanturner.org/2017/01/rls-alpha-release.html>

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## REPL equivalents:

- Use the playpen
- playbot on IRC
- <https://github.com/murarth/rusti> worked briefly on nightly

Rust wants you to succeed.

- Rules catch things that look unsafe
- “Unsafe” directive is an override
- Errors deserve helpful docs
- Click error number in playpen!

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## Erroneous Errors?

- Search the web!
- Gist your code
- Ask on IRC #rust-beginners
- File a bug



## Aside: Other helpful tools

- <https://github.com/nrc/rustfmt>
- Rustfmt standardizes style for you
- <https://github.com/manishearth/rust-clippy>
- Clippy gives helpful suggestions

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Questions about errors?

## Scope Syntax:

- Everything between matched `{ }`
- Scopes can nest
- `{Outer Scope {Inner Scope}}`
- Pay attention to a value's scope!

## Function Syntax:

- `fn myfunction { ... }`
- `fn myfunction (arg: type, arg: type) - } resulttype { ... }`
- Type signatures are like Mad Libs
- Function has at least name and scope

## Macro Syntax:

- Shorthand for functions with variable number of arguments
- *macroname!(foo, bar, baz)*
- `doc.rust-lang.org/beta/book/macros.html`
- You'll see "println!"

## A Function:

```
fn halve(x: i32) -> i32 {  
    return x / 2;  
}  
  
fn main(){  
    println!("{}", halve(4));  
}
```

## Punctuation Matters:

- Expressions end with a semicolon
- Exception: bare expression on last line of function returns result
- Spaces separate tokens: `i32` is not `i 32`
- Whitespace is mostly irrelevant

## Abusing Whitespace:

```
fn halve
(x
    :
i32)->i32
{
return
x
    /
        2
; } fn main
()
{ println!("{}", halve
(
4
));}
```

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## Control Flow Syntax:

- Conditionals and loops are familiar
  - `if x { ... }`
  - `loop { ... }`
  - `while x { ... }`
  - `for x in 1..100 { ... }`
- Match statements combine conditionals
- <https://doc.rust-lang.org/book/if.html>
- <https://doc.rust-lang.org/book/loops.html>
- <https://doc.rust-lang.org/book/match.html>

## Matching on a variable:

```
fn main() {  
    let day = 19;  
    println!("January {} 2017 is:", day);  
    match day {  
        15 => println!("Travel to Hobart"),  
        16 | 17 => println!("Miniconf Time"),  
        18..20 => println!("The Conference"),  
        _ => println!("not LCA at all"),  
    }  
}
```

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Questions about basic syntax?

## Why Types & Traits?

- Describe characteristics of inputs and outputs
- Avoid allocating unneeded memory
- Remind humans how code works <sup>9</sup>

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<sup>9</sup>Even type signatures that the compiler could infer must be spelled out. 

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## Built-in types

- <https://doc.rust-lang.org/book/primitive-types.html>
- Primitives, arrays, strings, tuples

## Custom types

- [http://rustbyexample.com/custom\\_types.html](http://rustbyexample.com/custom_types.html)
- Structs & Enums
- Use types from your dependencies (example in a few slides)

## Traits

- <https://doc.rust-lang.org/book/traits.html>
- Traits describe a type's abilities
- You can tell Rust how type has trait with "impl"
- Generalize function's input and output

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Questions about types & traits?



## Ownership:

- `let myint = 42;`
- “myint” is a variable binding
- “myint” **owns** the value 42
- Every value has exactly one owner
- See <https://doc.rust-lang.org/book/ownership.html>

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## Mutability:

- Owner can only change value if it's **mutable**
- *let mut myint = 42;*

## Changing the owner:

```
fn main() {  
    let first = 42;  
    println!("{}", first);  
  
    let second = first;  
    println!("{}", second);  
  
    // this would be an error:  
    // println!("{}", first);  
}
```

## Borrowing

- Grant temporary access to a value
- 1 mutable borrow XOR unlimited immutable borrows
- Syntax: `&myvar`
- <https://doc.rust-lang.org/book/references-and-borrowing.html>

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## Lifetimes

- Remember {scopes}?
- Variables disappear when their scope ends!
- No borrow may outlive its value's owner.

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Questions about safety?

## Package Management

- Package manager: Cargo
- Libraries: Crates
- Package index: crates.io
- See “Package Managers All The Way Down”, Tasman B, 3:40pm today
- See <http://doc.crates.io/guide.html>

## Create a binary or library

- *cargo new -bin*
  - Binary
  - You run main.rs
  - cargo.lock stores state of last good build
- *cargo new*
  - Library
  - src/lib.rs, no main function



'cargo new' creates:

- Cargo.toml
- src/main.rs or src/lib.rs
- .git if absent

## Depending on a crate

- Search crates.io
- Search the web, check recent blogs
- Check docs, license, & project policies
- Add it to 'dependencies' section of cargo.toml
  - *name = "0.1"*
  - *name = { git = "https://github.com/org/repo.git" rev = "123abcd" }*
- *extern crate rand; use rand::Rng;*

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Always...

- Respect others' licenses
- License your own code
- Document & share what you learn!

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## Read a Book

- <https://doc.rust-lang.org/stable/book/>
- <https://doc.rust-lang.org/nomicon/>
- O'Reilly Book coming soon

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## Follow the News

- <http://www.newrustacean.com/> podcast
- <https://soundcloud.com/posix4e/sets/rustyradio> interviews
- <https://this-week-in-rust.org/> Weekly newsletter
- <https://blog.rust-lang.org/> Official Blog

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## Practice

- <https://github.com/carols10cents/rustlings>
- <http://rustbyexample.com/>



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Questions about learning more Rust?

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## Join a project

- <https://crates.io/>, find popular crates
- Search GitHub “is:issue label:easy language:rust”

## Port something

- <https://github.com/jameysharp/corrode>
- [linux.conf.au/schedule/presentation/51/](http://linux.conf.au/schedule/presentation/51/) Friday 1:20pm
- <https://blog.rust-lang.org/2015/04/24/Rust-Once-Run-Everywhere.html>

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## File or Fix issues

- `github.com/rust-lang/rust`
- We triage regularly
- If in doubt, ask on IRC first

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## Chat Online

- IRC: #rust, #rust-beginners on irc.mozilla.org
- users.rust-lang.org Users Forum
- Reddit, StackOverflow, etc.

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## Find or join a meetup

- Search for your area + Rust meetup
- Community Team Calendar, [goo.gl/EJ2iRb](https://goo.gl/EJ2iRb)
- #rust-community on Mozilla IRC

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## Attend a conference

- [rustconf.com](http://rustconf.com) Oregon, September
- [www.rust-belt-rust.com](http://www.rust-belt-rust.com), Pennsylvania, October
- [www.rustfest.eu](http://www.rustfest.eu), Europe, September



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## Attend the LCA Rustlang BoF!

- Right here, lunch today
- Start Hacking

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Thank you!