

Rust Intro

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Disclaimer

I am not a pro in rust and I suck explaining stuff and I don't know much about compilers and etc. It is my general impression.

History

- Created in 2006 by a Mozilla employee in his spare time.
- In 2009 Mozilla started sponsoring it.
- Original compiler was written in OCaml and it got rewritten in rust and was able to compile itself in 2011 and uses llvm as backend.
- First stable version was released in 2015.
- Mozilla uses it to develop servo, a browser engine.

Hello world

```
fn main() {  
    println!("Hello world!");  
}
```

```
Hello world!
```

Features

- Fast as C and flexible as C++.
- Memory safe, no leaks and it does not use a GC.
- Abstraction without cost.
- Easy to understand after you fight with the error system and the borrowing.
- It uses pattern matching to deal with results and optionals instead of throwing exceptions or returning a parameter with error and the other with the value.

Things I like

Matches

```
#[derive(Debug)]  
enum Foo {  
    A = 1,  
    B = 2,  
    C = 3  
}  
  
struct Bar {  
    baz: Foo  
}
```

```
fn main() {  
    let a = Bar { baz: Foo::A };  
    let b = Bar { baz: Foo::B };  
    let c = Bar { baz: Foo::C };  
    match a.baz {  
        Foo::A => println!("Match a {:?}", Foo::A),  
        _ => {}  
    }  
    match b.baz {  
        Foo::B => println!("Match b {:?}", Foo::B),  
        _ => {}  
    }  
    match c.baz {  
        unknown => println!("Unknown match {:?}", unknown)  
    }  
}
```

```
Match a A  
Match b B  
Unknown match C
```

Borrow system

What will happen here?

```
#[derive(Debug)]  
struct Foo;  
  
fn test(a: Foo) {  
    println!("Data {:?}", a);  
}  
  
fn main() {  
    let a = Foo {};  
    test(a);  
    println!("{:?}", a);  
}
```

it will move the ownership of a to the called function.


```

error: use of moved value: `a` [--explain E0382]
  --> <anon>:11:22
    |>
10  |>     test(a);
    |>           - value moved here
11  |>     println!("{:?}", a);
    |>                               ^ value used here after move
<std macros>:2:27: 2:58: note: in this expansion of
    format_args!
<std macros>:3:1: 3:54: note: in this expansion of print!
    (defined in <std macros>)
<anon>:11:5: 11:25: note: in this expansion of println!
    (defined in <std macros>)
note: move occurs because `a` has type `Foo`, which does
    not implement the `Copy` trait

error: aborting due to previous error

```

Fixing it

```
#[derive(Debug)]
struct Foo;

fn test(a: &Foo) {
    println!("Data {:?}", a);
}

fn main() {
    let a = Foo {};
    test(&a);
    println!("{:?}", a);
}
```

```
Data Foo
Foo
```

Another fix

```
#[derive(Debug)]  
struct Foo;  
  
fn test(a: Foo) -> Foo {  
    println!("Data {:?}", a);  
    a  
}  
  
fn main() {  
    let mut a = Foo {};  
    a = test(a);  
    println!("{:?}", a);  
}
```

Mutability

```
fn main() {  
    let a = 1;  
    a += 1;  
    println!("{}", a);  
}
```

```
error[E0384]: re-assignment of immutable variable `a`  
--> <anon>:3:5
```

```
|  
2 |     let a = 1;  
|       - first assignment to `a`  
3 |     a += 1;  
|       ^^^^^ re-assignment of immutable variable
```

```
error: aborting due to previous error
```

```
fn main() {  
    let mut a = 1;  
    a += 1;  
    println!("{}", a);  
}
```

2

Thread safety

```
use std::thread;
use std::time::Duration;

fn main() {
    let mut data = vec![1, 2, 3];

    for i in 0..3 {
        thread::spawn(move || {
            data[0] += i;
        });
    }
    thread::sleep(Duration::from_millis(50));
}
```

```

error[E0382]: capture of moved value: `data`
--> <anon>:9:13
|
8 |         thread::spawn(move || {
|                        ----- value moved
|                               (into closure) here
9 |             data[0] += i;
|             ^^^^ value captured here after move
|
= note: move occurs because `data` has type
       `std::vec::Vec<i32>`, which does not implement
       the `Copy` trait

error: aborting due to previous error

```

Fixing it

```
use std::sync::{Arc, Mutex};
use std::thread;
use std::time::Duration;

fn main() {
    let data = Arc::new(Mutex::new(vec![1, 2, 3]));

    for i in 0..3 {
        let lock = data.clone();
        thread::spawn(move || {
            let mut data = lock.lock().unwrap();
            data[0] += i;
        });
    }

    thread::sleep(Duration::from_millis(50));
    println!("Output value: {:?}", data);
}
```


Output

```
Output value: Mutex { data: [4, 2, 3] }
```

- You cannot share global writable data between threads without locks.
- You can share readable data between threads without locks.

Modularity

A lot of "stdlib" modules are crates [1] like rand [2] which for me is amazing because packages can react better to changes i.e. security fixes are easier to deploy as an external modules than the whole language.

[1] <https://crates.io>

[2] <https://crates.io/crates/rand>

Exceptions

There are none!

You use macros like `let value = try!(function())` which would translate for something like:

```
let value = match function() {  
    Ok(value) => value,  
    Err(err) => return Err(err)  
}  
println!("Value is: {:?}", value);
```

on nightly you can activate `?` to make it shorter like `function()?`

Other stuff

- A function that can fail, returns a `Result` which can contain `Ok(value)` or `Err(err)` and instead of returning tuples (like in go) and checking if error is not null, you just use the `try!` macro, `unwrap` or the other functions like `map`, `expect_or` and etc...
- There is no concept of `null`, you have `Option` that can have `Some(value)` or `None` and these values must be unpacked some way before doing some stuff like `function().non_existent_field`, you would have to do at least `function()?.field` and it would break the current function if `None` was returned.
- Generics and traits, but too big to talk here.

Demo time!

Initialize the project:

- `curl https://sh.rustup.rs -sSf | sh -s` this will install rust up, something like pyenv.
- `rustup update nightly`
- `cargo new --bin example`
- `cd example`
- `rustup override add nightly`
- `cargo run`

Setting up the database

```
cargo install diesel_cli  
echo DATABASE_URL=postgres://username:password@localhost/d  
diesel setup  
diesel migration generate create_users
```

Thank you