



# Rust in Lille



4 april 2017

# Rust historical, notable inspirations



- C++
- Cyclone
- Ocaml
- Haskell
- Erlang

[Influences](#)

[Papers](#)

# Rust cool features

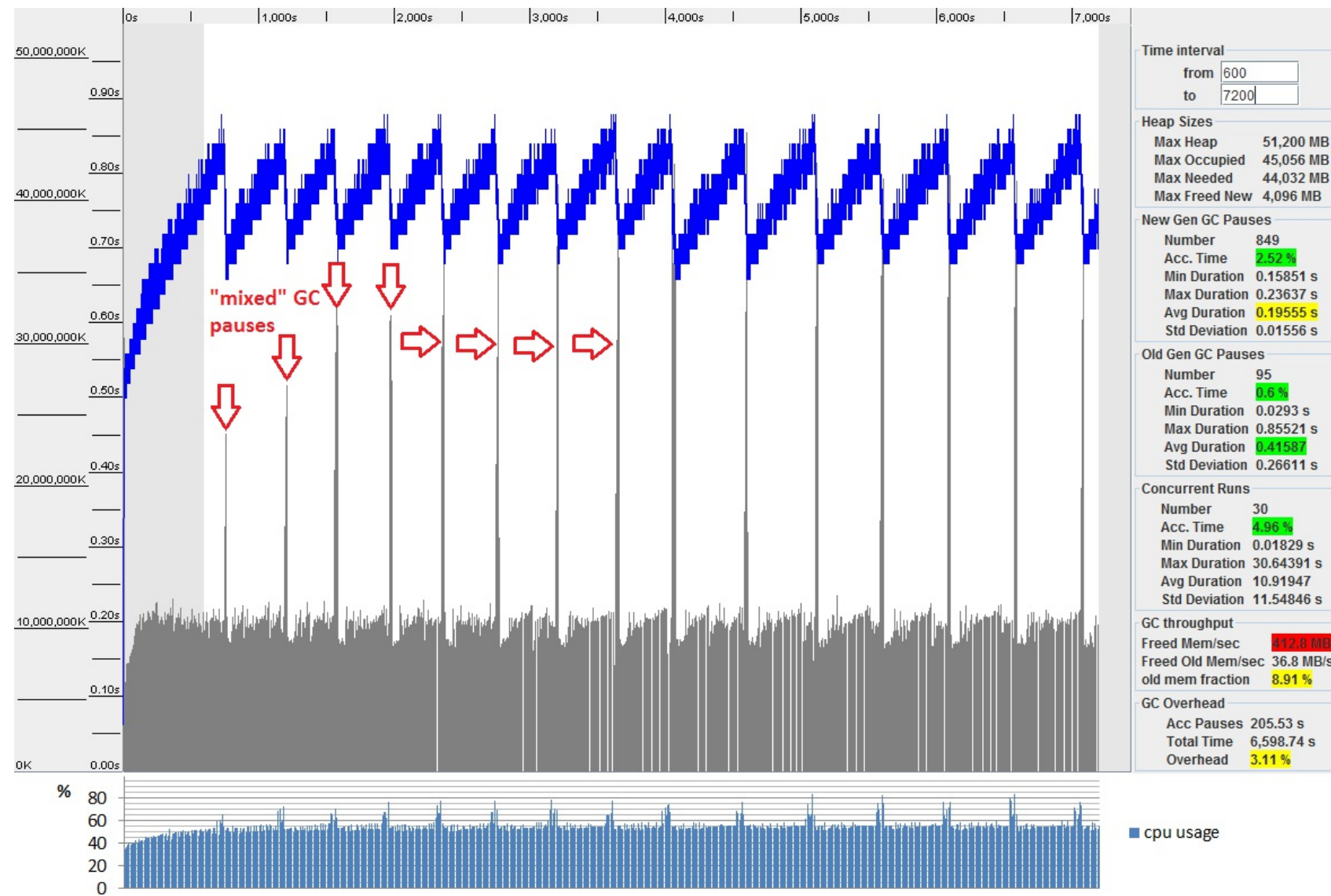
Because he has several advantages.

- Security of inputs (via types, no NULL)
- Modern programming syntax (traits, generics, Meta-programming, pattern matching)
- Multi-plateform, close to OS
- Cargo
- Smooth integration with other languages via [FFI](#) (C, Perl ...)
- Low memory footprints (Borrow Checker) and Zero cost abstraction

# Garbage collectors are nice tools.

1. You delegate your memory handling to another sub program.
2. but this sub-program, has to scale as fast as your program.
3. And sometimes it is not, and this program then become a bottleneck,

# See



I don't say, it doesn't work, but if you don't take the problem from roots.

For some use case, it is just a terrible nightmare idea.

# Rust introduce, a way to do it by yourself.

the garbage collection work without significant productivity overhead through a system called Borrow checker

# Going deeper

## Understanding Ownership and Borrowing

- No GC needed.
- Compiler helps you to not do stupid unsafe things.
- Saving your time

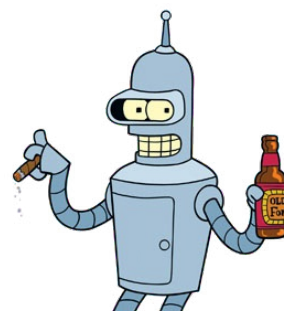
# Ownership system

Let me introduce you some peoples

- Rhondup, is a IA spaceship, protector
- Valerien, is a space and time agent
- LaureLine, is a juggler



- Blender, is an aholic robot





# Ownership : case 1

```
Cocktail::new();
```

Rhonda make a new Cocktail

# Ownership : case 1

```
let valerian = Cocktail::new();
```

Rhonda give ownership of this cocktail to Valerian

Valerian now owns his cocktail

# Ownership : case 1

move semantics

```
let valerian_cocktail = Cocktail::new();  
let laureline_cocktail = valerian_cocktail;  
let bender_cocktail = valerian_cocktail;
```

- Valerian give ownership of a cocktail to Laureline
- Valerian give ownership of a cocktail to Bender
- but Valerian already gave cocktail

# Ownership : case 1

move semantics

```
let valerian_cocktail = Cocktail::new();  
let laureline_cocktail = valerian_cocktail;  
let bender_cocktail = valerian_cocktail;
```

- Valerian give ownership of a cocktail to Laureline
- Valerian give ownership of a cocktail to Bender
- but Valerian already gave cocktail

WRONG

# Ownership : case 1

```
let valerian_cocktail = Cocktail::new();  
let laureline_cocktail = valerian_cocktail;  
let bender_cocktail = laureline_cocktail;
```

- Valerian give ownership of a cocktail to Laureline
- Laureline give ownership of a cocktail to Bender

# Ownership : case 1

```
let valerian_cocktail = Cocktail::new();  
let laureline_cocktail = valerian_cocktail;  
let bender_cocktail = laureline_cocktail;
```

- Valerian give ownership of a cocktail to Laureline
- Laureline give ownership of a cocktail to Bender

GOOD

# Ownership : case 1

```
let valerian_cocktail = Cocktail::new();  
let laureline_cocktail = valerian_cocktail;  
let bender_cocktail = valerian_cocktail.clone();
```

- Valerian give ownership of his cocktail to Laureline
- Valerian try to clone his cocktail to give it to Bender

# Ownership : case 1

```
let valerian_cocktail = Cocktail::new();  
let laureline_cocktail = valerian_cocktail;  
let bender_cocktail = valerian_cocktail.clone();
```

- Valerian give ownership of his cocktail to Laureline
- Valerian ask to Rhonda to clone his cocktail

but already give it to someone else :( **WRONG**



# Ownership : case 1

```
let valerian_cocktail = Cocktail::new();  
let laureline_cocktail = valerian_cocktail.clone();  
let blender_cocktail = valerian_cocktail;
```

- Valerian give ownership of a cocktail clone to Laureline
- Valerian give ownership of his cocktail to Blender

GOOD

# Ownership : case 1

same as clone later

```
let valerian_cocktail = Cocktail::new();  
let laureline_cocktail = valerian_cocktail;  
drink!("{}", valerian_cocktail);
```

# Ownership : case 1

same as clone later

```
let valerian_cocktail = Cocktail::new();  
let laureline_cocktail = valerian_cocktail;  
drink!("{}", valerian_cocktail);
```

Error, Valerian doesn't own a cocktail anymore !

**WRONG**

# Ownership : case 2

nearly same

```
let valerian_cocktail = Cocktail::new();  
fruit_shaker(valerian_cocktail);  
drink!("{}", valerian_cocktail);
```

- valerian put the cocktail into shaker
- Give ownership of cocktail to the shaker

# Ownership : case 2

nearly same

```
let valerian_cocktail = Cocktail::new();  
fruit_shaker(valerian_cocktail);  
drink!("{}", valerian_cocktail);
```

- valerian put the cocktail into shaker
- Give ownership of cocktail to the shaker

**WRONG** fruit\_shaker take ownership of cocktail

# Borrowing : case 1

```
let mut valerian_cocktail = vec_of_string!["tonic","gin"];  
let laureline_cocktail = &valerian_cocktail;  
println!("{}", valerian_cocktail[0], laureline_cocktail[0]);  
laureline_cocktail.push("lemon");
```

**WRONG** try to modify immutable borrow

# Borrowing : case 2

```
let mut valerian_cocktail = vec_of_string!["lemon", "tonic", "gin"];  
drink(&mut valerian_cocktail);  
drink(&mut valerian_cocktail);  
println!("{:}", valerian_cocktail);
```

GOOD

# Lifetimes

- static
- 'a notation
- lifetime of a child var, could not exceed existing one



# Lifetimes ' : case 1

```
{  
  let a;    // -+ `a comes into scope  
            // |  
  let b;    // -+--+ `b comes into scope  
            // | |  
            // | |  
            // * * release  
}
```

# End of lifetime ..

```
impl Drop for Cocktail {  
    fn drop(&mut self) {  
        println!("Give glass back!");  
    }  
}
```

# Design by lifetime

Why lifetimes only for memory allocation ?

# Design by lifetime

Why lifetimes only for memory allocation ?

- sockets

# Design by lifetime

Why lifetimes only for memory allocation ?

- sockets
- locks



# Deeper

Restrictions system [borrow checker](#)

Loan = (Leftvalue, Lifetime, Mutability, Restriction\*)

Restriction = (Leftvalue, [Action])

Action = MUTATE | CLAIM | FREEZE

[] (moves)

- MUTATE (cannot be assign)
- CLAIM (cannot be borrowed mutably)
- FREEZE (cannot be borrowed immutably)

&mut LeftValue => Restrictions(Leftvalue, Lifetime, MUTATE|CLAIM|FREEZE)

&LeftValue => Restrictions(Leftvalue, Lifetime, MUTATE|CLAIM)

# Yay

Now you do not need GC !

Dandling socket, and do not care about socket close.

No use after free problem.

See ownership and borrowing is as simple as a free beer.



# Other use cases

- server & system programming
- video games
- trading engine

# What next ?

- starting tools

# What next ?

- starting tools
- microservices in Rust

# What next ?

- starting tools
- microservices in Rust
- tokio

# What next ?

- starting with tools
- microservices in Rust
- tokio
- more about language feature



Thank you

Questions ?

# Communities

[Lille Elixir](#)

[Lille FP](#)

[Lille Rust](#)