Future Feature Fun

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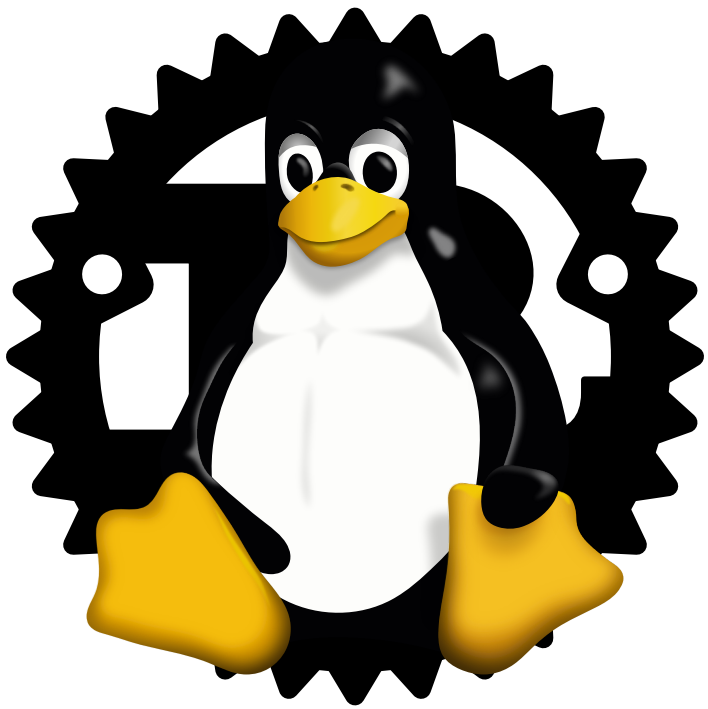
RfL has a long list of necessary features

https://github.com/Rust-for-Linux/linux/issues/2

This is about all the *other* features

We are Kangrejos!



¡Somos Kangrejos!

Example of what I left out:
Trait evolution and other “evolution” features

Not needed in the kernel: “stable API nonsense”

Useful in the standard library and other crates

All of these features are works in progress!

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Some more than others!

Intentionally glossing over fine details

If you're excited about these,
please speak up!

If you want to work on them,
get in touch!

View types: borrowing **part** of a struct

```
let a = &mut my_struct.a;
let b = &mut my_struct.b;
b.method_b();
a.method_a();
```

```
impl MyStruct {
   fn operate_on_b(&mut self) {
      self.b.method_b();
   }
}
```

```
impl MyStruct {
  fn operate_on_b(&mut self) {
    self.b.method_b();
  }
}


let a = &mut my_struct.a;
my_struct.operate_on_b(); // ERROR
a.method_a();
```

This discourages modular code
and helper methods

Example: FUSE and Git

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Built a test app to mount a git tree

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Then tried to wrap it in an object with methods

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Built a test app to mount a git tree

Then tried to wrap it in an object with methods

Almost made me bounce off of Rust!

```
impl MyStruct {
   fn operate_on_b(&mut{b} self) {
      self.b.method_b();
   }
}
```

```
impl MyStruct {
  fn operate_on_b(&mut{b} self) {
    self.b.method_b();
  }
}

let a = &mut my_struct.a;
my_struct.operate_on_b(); // OK
a.method_a();
```

View types status: in progress, tracking issue

Pattern types

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Encode your invariants in the type system

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Generalization of `NonZero`/`NonNull`

```
type Errno = i32 is 0..4096;

type Nanoseconds = u32 is 0..1_000_000_000;

fn fail(...) -> Result is Err(_)
```

(Eventually) literals can have pattern types

What type is `42u64`?

`u64 is 42`

Safely construct a `NonZero` without `unwrap`,
because the compiler knows it isn't `0`

Pattern types are on nightly.

Pattern types do need help!

Turbofishing `Into`

```
x.into::<u64>();
```

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```

Library team hoping to add this in the next edition
(Approach requires no language change)

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“Hot potato”, can’t let it implicitly drop

Database transaction: must either commit or roll back

Linear types: In progress

Was blocked on type system work.
Less blocked now that we have the new trait solver.
Types team can always use help!

`is` operator

let chaining:

```
while let Some(x) = func().await && x.cond() {
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Convenient!

...kinda inside-out, isn't it?

```
while func().await is Some(x) && x.cond() {
```

```rust
while func().await is Some(x) && x.cond() {
```

```rust
opt.is_none()
opt.is_some()
opt.is_some_and(|v| v.cond())
```

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opt.is_none()
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opt is None
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opt.is_none()
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```
opt is None
opt is Some(_)
opt is Some(v) && v.cond()
```

```
my_enum is MyVariant
```

`is` operator: lang experiment in progress

Polonius - next generation borrow checker

```rust
let a = &mut my_struct.a;
let b = &mut my_struct.b;
b.method_b();
a.method_a();

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

Did not work on Rust 1.0.

```rust
let a = &mut my_struct.a;
let b = &mut my_struct.b;
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println!("{:?}", my_struct);
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Did not work on Rust 1.0.

Works today because of Non-Lexical Lifetimes (NLL)

```rust
fn find_one<'m>(
  m: &'m mut HashMap<u32, u32>,
  keys: &[u32]
) -> Option<&'m mut u32> {
  for k in keys {
    if let Some(v) = m.get_mut(k) {
      return Some(v);
    }
  }
  None
}
```

Stable Rust:

```
for k in keys {
    if let Some(v) = m.get_mut(k) {
                     ^ `*m` was mutably borrowed here in
                       the previous iteration of the loop
        return Some(v)
               ------- returning this value requires
                       that `*m` is borrowed for `'m`
```

Knowing this is safe depends on control flow

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  m: &'m mut HashMap<u32, u32>,
  keys: &[u32]
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  for k in keys {
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      return Some(v);
    }
  }
  None
}
```

NLL handled borrows not defined by lexical scope

Polonius handles control flow

Polonius Alpha - enabled on nightly Rust

This code compiles on nightly Rust!

Needs performance optimization before stabilizing.

comptime and macro fn

`const fn` can run at compile time or runtime

`comptime fn` can **only** run at compile time

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This means we can talk to the compiler

`macro_rules!` is its own declarative language.

No loops, no structures, no conditions
only AST matching and recursion

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What if you could write them in normal Rust
with Rust control flow and data structures?

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Without proc macros?

`macro fn`

Compile-Time Function Evaluation (CTFE)
while we're still expanding macros

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while we're still expanding macros

Credit to Oli for suggesting this was possible

Currently a project goal

`comptime fn` in progress

Plan to work on `macro fn` once comptime ships

Guaranteed tail calls

Requires changing drop order to drop **before** tail call

Still need to nail down the syntax

A few more:

- `#[loop_match]` and `#[const_continue]`

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- `#[loop_match]` and `#[const_continue]`
- no panic/sleep/etc, via function “coloring”
- “full” const generics (numeric operations, enums)

https://joshtriplett.org/

Message me on the Rust Zulip:
https://rust-lang.zulipchat.com/

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