WRITE YOURSELF A SHELL IN RUST

A **3-hour course** to learn intermediate Rust concepts

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ABOUT THE TEAM

Matthias Endler

- Rust consultant at corrode
- Started with Rust in 2015
- Member of the Rust Cologne Meetup
- Hosted Hello Rust YouTube channel

Marco Ieni

- Infrastructure Engineer at Rust Foundation
- Host of RustShip podcast
- Author of release-plz, automating Rust package publication

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ABOUT THE WORKSHOP

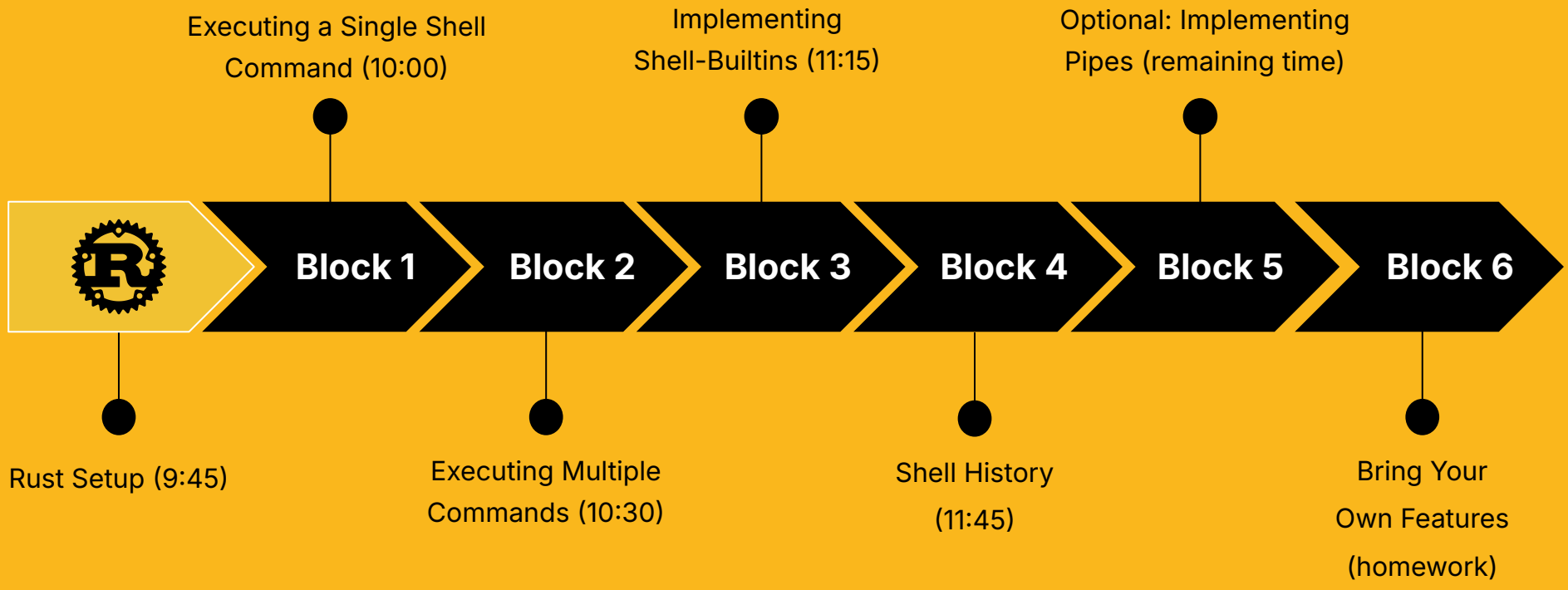
Goals

- Learn intermediate Rust
- Work on a real-world project
- Use plain Rust; no dependencies
- Focus on idiomatic code

Structure

- 3 hours total
- Split up into six blocks
- Roughly one hour per block

SCHEDULE



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BLOCK 0 - RUST SETUP

Main objective

- Install Rust using rustup or any other way.
- Run `rustc -V` to see if everything is okay.

Bonus track

- Set up rust analyzer for code completion (https://rust-analyzer.github.io/)
- Set up your project with additional clippy lints. (Example setup)

BLOCK 1 - EXECUTING A SINGLE SHELL COMMAND

Main objectives

- Write a shell which can run a single command on a separate process.
- *Hint:* Take a look at the Command API in the standard library to do that.
- Print the output to stdout.

Bonus track

- Create a `Cmd` struct holding the binary and the arguments.
- Make the code as idiomatic as possible. (`cargo clippy` should run without errors.)
- Write some unit tests to make sure that command parsing works.

BLOCK 1 - PROJECT STRUCTURE

```
fn main() {
    loop {
        // Read line from standard input
        // “Parse” line into executable command
        // Execute the command in a separate process
        // Show output
    }
}
```

BLOCK 2 - EXECUTING MULTIPLE COMMANDS

Main objectives

- Try to run two or more commands separated by `;` in sequence.
- Print all output in sequence to stdout.

Bonus track

- Implement && and ||
- Write an integration test for chaining multiple commands. (`echo 'hello' && echo 'world'`)

BLOCK 2 - EXECUTING MULTIPLE COMMANDS

Main objectives

```
> echo 1; echo 2
1
2
```

Bonus track

```
> true && echo "output"
output
> false && echo "output"
>
```

```
> true || echo "output"
> false || echo "output"
output
>
```

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BLOCK 3 - IMPLEMENTING SHELL-BUILTINS

Main objectives

- Implement the `cd` shell builtin.
- Implement the `exit` shell builtin.

Bonus track

- Implement `exec` builtin

BLOCK 3 - IMPLEMENTING SHELL-BUILTINS (EXAMPLES)

Main objectives

```
> pwd
/dir1
> cd /dir2
> pwd
/dir2
```

```
> exit
(Shell gets closed)
```

Bonus track

```
> exec fish
Welcome to fish, the friendly
interactive shell
```

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BLOCK 4 - IMPLEMENT SHELL HISTORY

Main objectives

- Store all executed commands in the shell history.
- You can store the history in memory for now.
- Add a `history` builtin, which lists the commands

Bonus track

- Store the history inside a file
- Come up with an extended storage format (e.g. add the time of execution as metadata)

BLOCK 4 - IMPLEMENT SHELL HISTORY

Main objectives

```
> history
echo 1
echo 2
```

Bonus track

```
in sqlite:
> SELECT * from history
```

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BLOCK 5 - IMPLEMENTING PIPES

Main objectives

- Implement pipes, which are a way to feed the output of one command into another one.

  Syntax:

  `command1|command2`

Bonus track

- Support multiple pipes:

  `c1 | c2 | c3`
- Add redirection:

  `c1 > output.txt`
- Think about ways to make command representation more idiomatic.

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BLOCK 5 - IMPLEMENTING PIPES (EXAMPLES)

Main objectives

```
> echo foo | grep -c foo
1
```

Bonus track

```
> ps auxwww | grep fred | more
```

```
> echo 1 > test.txt
```

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BLOCK 6 - BRING YOUR OWN FEATURES!

Main objectives

- It's all free-style from here. What will you do next?
  - Readline support
  - Control signals
  - Command completion
  - use a grammar for parsing
  - Implement more shell-builtins
  - Surprise us! (Optional show-and-tell at the end)

Bonus track

- Get inspired by looking at existing shells:
  - ion (Rust)
  - elvish (Go)
  - "the *other rush*" (Rust)

SHOW AND TELL

WHAT WE LEARNED

- Intermediate Rust concepts
  - Command handling
  - Parsing
  - Piping inputs
- Idiomatic code
  - Command abstractions
  - Unit tests
- Zero dependencies
  - Plain Rust is powerful
  - No magic