Rust

Memory Thinking

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Prerequisites

- Rust development experience

and (optional)

- Basic memory dump analysis (Windows or Linux)

Training Goals

- Review fundamentals of Rust
- Review Rust specifics from a memory analysis perspective
- Use WinDbg and GDB for learning Rust internals

Warning

This is not a Rust course for C or C++ developers. But knowledge of C and C++ helps.

Training Principles

- Talk only about what I can show
- Lots of pictures
- Lots of examples
- Original content and examples

Schedule

- `let sessions: Vec<Session> = vec![Session::default(); 8];`
- `assert_eq!(sessions.len(), 8);`
- `assert!(sessions.capacity() >= 8);`

Training Idea

- Similar C and C++ courses for Windows and Linux
- System programming language role
- Memory dump analysis training courses
- Debugging training courses

General Rust Aspects

- Philosophy of unsafe pointers
- Philosophy of values
- Rust: a Copernican revolution
- Rust philosophy of values
- Ownership
- Lifetime
- Rust philosophy of pointers
- References
- Static, stack, and heap memory
- Memory and pointers
- Basic types
- Size and alignment
- Conversion
- Tuples and tuple-like structs
- Structs
- Source code and symbols
- Free functions
- Function pointers and references
- Associated functions
- Type-associated functions
- Trait functions and objects
- Trait object memory layout
- Constructors and destructors
- Clone and Copy
- Parameters by value
- Parameters by reference/pointer
- Closures
- Pinning

What We Do Not Cover

We promise to include these topics in the second edition

Linux Rust Aspects

- Necessary x64 and A64 disassembly
- Parameter passing
- Implicit parameter
- Useful GDB commands

Windows Rust Aspects

- Necessary x64 disassembly
- Parameter passing
- Implicit parameter
- Useful WinDbg commands

Why Rust?

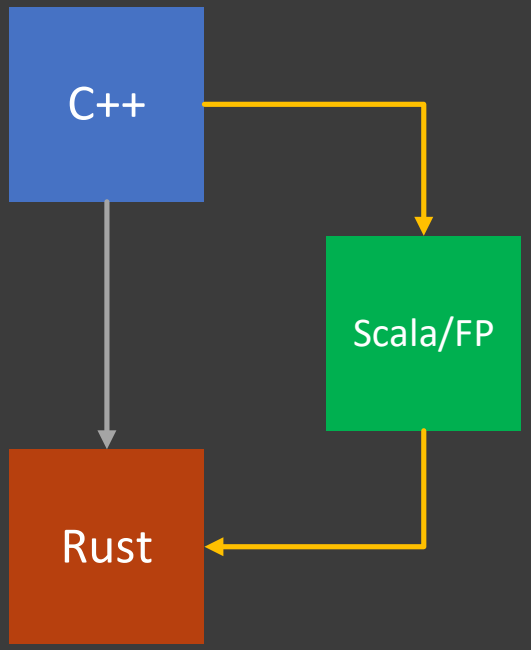
- Better Rust developer and maintainer

Unsafe now / Rust Runner, 2049

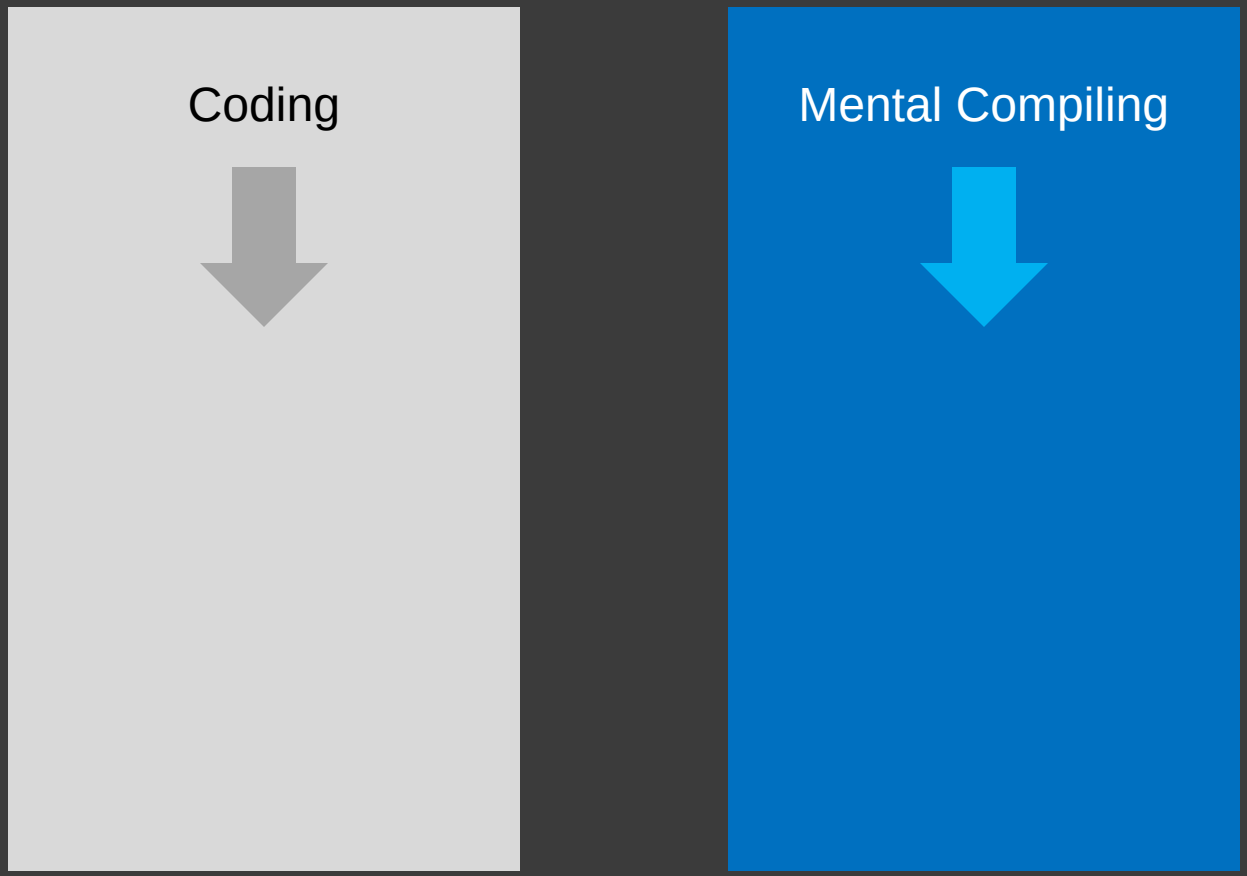
- Interfacing
- Malware analysis
- Vulnerability analysis and exploitation
- Reversing
- Diagnostics
- Low-level debugging
- OS Monitoring
- Memory forensics
- Crash and hang analysis
- Secure coding
- Static code analysis
- Trace and log analysis

My Genealogy of Rust

- C from 1987 and C++ from 1989 (Old CV)
- C++98/03/STL from 2001
- C++/STL semantics (2001-2003)
- First heard about Rust in 2015
- C++11/14 from 2016
- C++17 from 2017
- C++20 from 2023
- Scala/FP from 2020
- Functional programming from 2020
- Rust from 2022 (Windows API book)
- Rust included in Linux API book (2023)
- Rust included in Windows memory dump analysis book (2023)
- Rust included in Windows Debugging book (2024)
- Rust included in Linux Debugging book (2024)
- Rust Windows memory dump analysis book (2024)



Rust Mastery Process



Thought Process

- Rust, C, C++ — Memory
- Rust, Scala/FP — Functions
- Rust, Python — Data