Rust's cargo

Special Topic

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Intro to Rust

Hello Rust World

```rust
fn main() {
    println!("{}", convert_hex("Supply Chain Security"));
}

fn convert_hex(input: &str) -> String {
    return const_hex::encode_upper(input.as_bytes());
}
```

Crates

A crate is a compilation unit. A crate can be compiled into a binary or into a library. By default, rustc will produce a binary from a crate.

Cargo.toml

Tom's Obvious Minimal Language
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```
[package]
name = "hex_converter"
version = "0.1.0"
edition = "2021"


[dependencies]
const-hex = "1.10.0"
```

Dependency Trees

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- A lot of functionality is in external crates.
- Popular crates depend only on micro-crates and sub-crates, thus the illusion of a huge dependency tree.
  - In Tokio for example a lot of dependencies are optional and barred behind additive compilation features.
- Smaller ones with less community support forget to turn off features.

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  - In Tokio for example a lot of dependencies are optional and barred behind additive compilation features.
- Smaller ones with less community support forget to turn off features.
- Use lightweight sub-crate

cargo tree output

```
hex_converter v0.1.0 (/home/.../cargo/example/hex_converter)
   const-hex v1.10.0
       cfg-if v1.0.0
       cpufeatures v0.2.11
```

Application Binary Interface

Application Binary Interface (ABI) I

- A stable ABI enables dynamic linking between Rust crates, which would allow for Rust programs to support
  - Support for dynamically loaded plugins (a feature common in C/C++).
  - Because of dynamic linking, short compile times.
  - Lower disk-space use for projects, as multiple projects could link to the same dynamic library.
- abi-stable-crate allows linking.

- It would allow Rust libraries to be loaded by other languages, such as Swift, which has an ABI.
- Interop with libraries defined in other programming languages.
- Non-Rust crates could be integrated with Rust toolchains.
- Cross-language compatibility would increase the diversity of Rust's package ecosystem.

- It enables swapping out binaries, without recompilation.
  - Security updates without recompiling.

.lock Files

Example

```
# This file is automatically @generated by Cargo.
# It is not intended for manual editing.
version = 3

[[package]]
name = "autocfg"
version = "1.1.0"
source = "registry+https://github.com/rust-lang/crates.io-index"
checksum = "d468802bab17cbc0cc575e9b053f41e72aa36bfa6b7f55e...."

....
```

Changing It

With the command cargo update the .lock file gets regenerated.

build.rs

build.rs

- Build script written in Rust lang.
- Used to build a native library before the Rust crate itself.
- Manifest in cargo.toml

Example of a build.rs

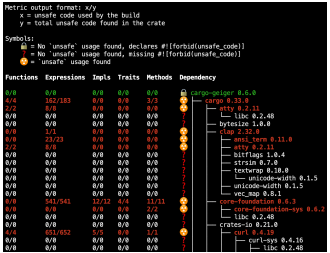
```rust
fn main() {
    // if the given file changes rerun this build script.
    println!("cargo:rerun-if-changed=src/hello.c");

    // cc crate to build a C file and statically link it.
    cc::Build::new()
        .file("src/hello.c")
        .compile("hello");
}
```

Auditing and Inspection

Some Usefull Commands

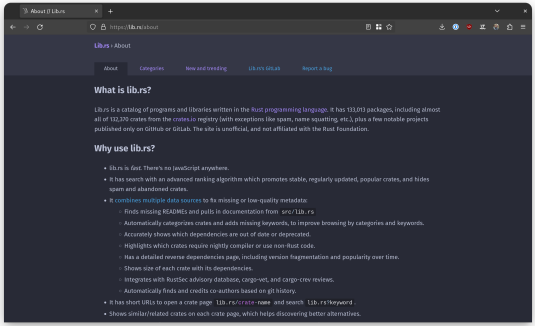
- cargo-audit for checking against rustsec advisories.
- cargo-geiger lists statistics related to the usage of unsafe Rust code in a crate and all its dependencies.



Example output of cargo-geiger. Source: github.com.

lib.rs

libr.rs replaces crates.io. But not crates.io.



Key Takeaways

- Use smaller sub-crates.
- ABI is nice to have.
- Be very cautious with build.rs files.
- Use provided tools and integrate them.
- Check out lib.rs.

Appendix

More Commands to try out yourself

- cargo-outdated; compare .lock file to what is available
- cargo deny; fetching crates only from trusted sources and blacklisting crates.

Supply Chain Security Features from GitHub

- GitHub Advisory Database
- Dependabot
- GitHub blog entry