Presenting

Developing Device Drivers in Rust

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BSc (Honours) Computing Science

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Image: David Carson

device drivers

- Control peripheral devices – interact with underlying hardware.
- Provide extensions to the Operating System.
- A necessity that suffers from a range of issues with dangerous consequences.

problems

- Continue to be written in C.
  - Originally developed 1969-1973.
  - Suffers from issues with memory safety.

- Memory safety can lead to critical vulnerabilities and is mostly present in C, C++ and Assembly

Image: David Carson

project aim

Overcome previously described issues by developing a Linux device driver in r u s t

Image: David Carson

rust for Linux

2019, Miguel Ojeda

introduce a new system programming language into Linux kernel

memory safe language

- strong compiler
- borrow system
- variable lifetimes

Stroustrups criticism

“every safe language, including rust, has loopholes allowing unsafe code”

memory safety

Accessing memory typically outside the bounds of a data structure which then provides a vector to attack from to conduct further exploitation/attack.

Android	>65% of High & Critical security bugs
Android (bluetooth & media components)	90% of vulnerabilities
IOS 12	66.3% of all vulnerabilities
MacOS Mojave	71.5% of all vulnerabilities
Chrome	~70% of serious security bugs
Microsoft	~70% of CVE vulnerabilities
Firefox (CSS subsystem)	73.9% of bugs
Ubuntu kernel	65% of CVEs (In security updates between November and May 2020)

(Alex Gaynor, 2020)

Each statistic is that of a large code base containing millions of lines of code.

All are written in C or C++.

Includes;

- Use-after-free
- Double-free
- Heap Buffer overflow
- Integer overflow
- Out-of-bounds read
- Out-of-bounds write

Image: David Carson

the great below

(progress)

Industry input has informed development and other aspects of project.

- Alex Gaynor
- Miguel Ojeda
- Jonathan Blow

(development)

- Have enabled Rust support on Linux 6.1 Machine.
- USB support is under development within RFL.
- Not all kernel subsystems are implemented.
- Conclusion seems to be the that the project is still quite young but has a bright future.
- Demo: compilation & execution of ‘Hello, World’ in a Rust driver.

(findings)

Google & Android 13

Significant drop in memory safety vulns & severity.

Now 35% of total Android vulns (previously 76%).

Exo-kernel

Remove as many hardware abstractions as possible.

Allow the application to control its own memory resources.

Paging, Scheduling, Context, Faults.

Improve performance, efficiency, development, testing.

Image: David Carson

underneath it all

these slides inspired by ‘The Fragile’ by Nine Inch Nails

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