Betriebssysteme

Tutorium 01

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0.1 ABI

ABI

What does that acronym even mean?
Application **B**inary **I**nterface

And what does that specify?

- Interface of *binary* programs (i.e. *after* compilation)

- Instruction Set (e.g. x86, ARM)

- Calling convention (e.g. `cdecl` or `System V AMD64 ABI`)

- Basic data types and their size / alignment (`int`, `sizeof(int)`)

- How to perform System Calls

ABI

You might also know the term „ABI of a library"?
This is used when talking about *binary compatibility* of different library versions. ⇒ Do you need to recompile your code against the new version?

ABI

What's the usual calling convention on modern Linux?
`System V AMD64 ABI` https://godbolt.org/z/68xexn

- Integer arguments in `rdi`, `rsi`, `rdx`, `rcx`, `r8`, `r9`, then stack

- FP arguments in `xmm0` to `xmm7`

- Integer return value in `rax`, `rdx`

0.2 Operating System – Tasks and Responsibilities

OS - Tasks and Responsibilities

Abstraction / Standardization

- Devices and how to talk to them differ greatly ⇒ Remember the „Driver-CDs" shipped with motherboards to could properly configure the hardware?

- Strange user demands: Programs should run on *more than one* hardware configuration

⇒ Abstract away hardware details!

Operating System – Tasks and Responsibilities

Resource management

- You want to print? Too bad, another program is already using that printer.

- You want to access the storage drive? Too bad, another program is already doing that.

- You want to get CPU time? Too bad, this `while (true)` loop is more important.

- . . .

Operating System – Tasks and Responsibilities

Security and Protection

- You are a good citizen and use a password manager. What could happen without your helpful OS? ⇒ Other programs may read its memory!

- You copied a password to your clipboard? ⇒ Ooops. You're on your own there. The Clipboard is not provided by the OS and mostly has no special protections.

- You write a cool little program that fills a buffer with a random value. Sadly you made a mistake and missed a bounds check. What happens? You crash, but your text editor doesn't suddenly have its memory overwritten!

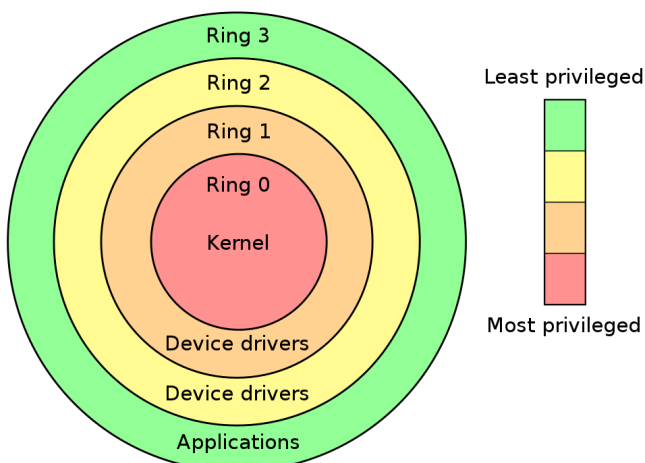- . . .

Operating System – Tasks and Responsibilities

Provide an execution environment for applications

- What does that mean? Basically all of the above combined and more. Make a homely place where applications like to live!

0.3 Kernel and user mode

Kernel and user mode

What are the differences between a processor running in kernel or user mode? Why are both modes needed?

Wikipedia - Hertzsprung (x86 only) Actually used: Ring 0 and 3

Kernel and user mode

What are the differences between a processor running in kernel or user mode? Why are both modes needed?

- In kernel mode you have full access to privileged instructions.

Kernel and user mode

Great, but what is a privileged instruction?

- Change control registers for memory mappings ⇒ Read other process's memory

- Disable / Enable interrupts ⇒ No preemption for you.

- Access platform devices (network card, storage, printer,. . .)

- Some nice registers: `LGDT` (Load Global Descriptor Table) or the `LLDT`, `INVD` (Invalidate cache), `HLT` (Halt processor!)

- Is `MOV` (Move) a priviledged instruction? Yes, if moving to debug/control registers!

„Hello, world!"

But now in C
We follow the arduous journey of Aeneas

- ? Start with ILIAS

- ? Obtain a text editor

- ? Obtain a compiler (we will probably use `gcc`)

- ? Draw the rest of the owl