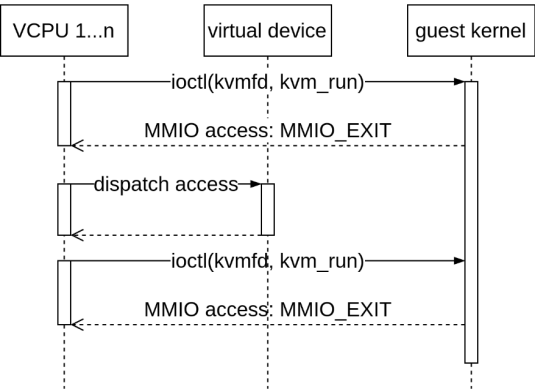
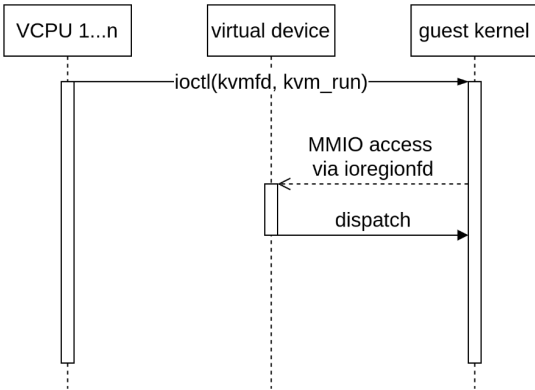


# Rethinking IO emulation architectures for VMs

Status Quo



IoRegionFd (Goal)



**General information**

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**Date** 18.01.2022

**Type**

Bachelor / Master / Guided Research

**Description**

Nowadays VMs use hardware acceleration to speed up CPU and memory virtualization. On Linux the necessary hardware features are exposed via KVM (kernel virtual machine) [1]. Virtualization of IO devices on the other hand most importantly relies on emulating direct register accesses

(MMIO accesses) which, historically, had bigger overheads. Recent development efforts in the kernel have brought up a new yet-to-be-upstreamed feature called `IoRegionFd` [2, 3, 4] to improve such register accesses both from a performance as well as an architecture standpoint.

The goal of this thesis is to leverage this new kernel feature in QEMU. You explore, implement and evaluate ways how QEMU's virtual devices could benefit from `IoRegionFd`.

If the implementation is promising, it could be brought upstream into QEMU.

#### Keywords

C lang, Linux, VMs, KVM, `IoRegionFd`, `VirtIO`

#### Goals

##### Concrete outcomes

1. Adapt QEMU to support `IoRegionFd`.
2. Optimize emulated devices (`VirtIO` etc.) for new `IoRegionFd` features.
3. Extensive performance measurements.

##### Bonus points

4. Take care of a fallback when `IoRegionFd` is not available.
5. Bring Qemu patches upstream.

#### Prerequisites

##### Compulsory

- Experience in systems programming
- Good knowledge of and experience with C. You will need to work in a big C project.

##### Preferred

- Familiarity with KVM/qemu.

#### References

1. <https://www.kernel.org/doc/html/latest/virt/kvm/api.html>
2. <https://www.spinics.net/lists/kvm/msg208139.html>
3. <https://github.com/Mic92/linux/tree/peter/5.12.14-vo>
4. <https://sbrksb.github.io/2020/12/10/intro.html>

### Application process

Please send an email to the advisor including the following:

- Email subject: “Thesis application (DSE)”
- CV
- A copy of your transcript(s)
- A short motivation statement, please include samples of your work that you are proud of (e.g., major projects, open-source contributions, **Github page or similar**, etc.) and/or writing samples (e.g., your technical blog, project reports, etc.)