

Thesis  
M.Sc.

IDP

## Virtualizing the DPDK-based t4p4s P4 Target

### Motivation

P4 is a programming language intended to describe the behavior of packet processing systems. P4 was introduced in 2014 and can be used to define entirely new networks with new protocols which behave differently from the networks we currently use. Compiler exist for a variety of targets (software, FPGA, SmartNIC, ASIC).



P4 programming language

t4p4s is a compiler for the software-based DPDK. It uses the official P4 compiler to generate a JSON representation of the P4 program. This JSON object is then parsed by t4p4s using python, which in turn creates C code. This C code is platform independent and is linked with platform specific (DPDK) functions.

t4p4s was recently extended to be capable of handling virtual devices (`vdev`) and virtual ethernet (`veth`). In addition to that, DPDK offers other virtual device drivers like a `virtio` wrapper and SR-IOV drivers. `virtio` interfaces can be used to connect different virtualized (e.g. using a KVM-hypervisor) instances to each other and SR-IOV to share networking hardware between instances.

Goal of this thesis is to enable `virtio` and SR-IOV virtual functions in t4p4s and to integrate it into an existing topology virtualization framework developed by our Chair. Then, the cost of virtualization can be analyzed and the performance can be compared to other P4 targets in virtualized environments like BMv2 on Mininet. Additionally, the performance of different virtualized topologies can be evaluated.

### Tasks

The thesis requires diving into DPDK-based t4p4s backend as well as qemu and virtio.

- Get familiar with P4 and the t4p4s toolchain and DPDK
- Connect t4p4s to virtio and SR-IOV VF interfaces
- Test functionality by providing small P4 example programs
- Evaluate the cost of virtualization
- Compare to other virtualized P4 targets / baremetal solutions
- Experience with C programming and Linux is required.

### Sources

- <https://p4.org/>
- <https://github.com/P4ELTE/t4p4s>
- <https://doc.dpdk.org/guides/nics/virtio.html>

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