

## Master thesis project: Implementing a BPF NAT gateway

BPF is a technology that allows injecting bits of code into the Linux kernel for various purposes. One of them is for processing network packets, enabling the building of fully programmable data planes. (See <https://ebpf.io/what-is-ebpf> for an introduction to BPF)

This project involves implementing a Network Address Translation (NAT) gateway in BPF. The Linux kernel already supports various modes of NAT, but BPF offers the potential for better performance and the ability to customise the NAT features.

The scope of this project can be adjust according to the student abilities and interests. The example NAT64 implementation in the bpf-examples repository<sup>1</sup> can be used as a starting point. Possibilities for extension include:

- Complete the stateless NAT64 implementation in the example and validate it
- Implement stateless 1-to-1 NAT for IPv4
- Implement stateful IPv4 NAT and/or NAT64, either by doing state tracking in BPF, or by hooking into the kernel connection tracker
- Support XDP as well as TC

A significant part of the project will involve testing and validation of the implementation, as well as performance testing and comparison with the NAT feature of netfilter in the Linux kernel.

The thesis project is offered in collaboration with Red Hat Research.

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<sup>1</sup><https://github.com/xdp-project/bpf-examples/tree/master/nat64-bpf>