

Thesis  
M.Sc.

IDP,  
Guided  
Research

# Evaluating TCP SYN Flood Mitigation Mechanisms Using P4

## Motivation

P4 ([www.p4.org](http://www.p4.org)) 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. P4-enabled devices offer higher flexibility; they can be programmed to act as a switch or a router – but it does not stop there – the design of entirely new functions and devices becomes possible and gets as easy as just replacing a piece of software without the need to change any hardware.



P4 programming language

One interesting use case is Denial-of-Service defence, in particular, mitigating TCP SYN flood attacks. Commonly, TCP SYN cookies are used to protect against this attack (e.g. see Linux kernel). In data center environments, a dedicated black-box is used in a proxy setting, i.e., all traffic is routed through it, and only legitimate traffic will be forwarded to servers. As these blackboxes have to handle potentially hundreds of Gigabyte of traffic, they fall back to simpler methods, called SYN authentication. This includes replying to the initial SYN segment with an invalid segment, and whitelisting either the IP or complete subnet for this client's next connection attempt.

We want to use P4 to implement these mechanisms directly in the switch as a case study. The goal is to analyse how difficult it is to implement such a simple (authentication) or complex (cookie) mechanism with P4. Furthermore, the performance will be evaluated and compared to existing kernel-bypass based on DPDK/libmoon implementations developed at our chair.

## Your Task

We will provide introductory tutorial material to learn programming with P4.

- Familiarize yourself with P4 and the TCP SYN flood mitigation mechanisms
- Implement SYN authentication methods for a P4-enabled platform
- Implement SYN cookies
- Discuss encountered challenges and potential improvements required for P4
- Perform a basic performance evaluation

Aside from programming in P4, parts of the switch, which is implemented in python and C, have to be modified.

## Contact

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