Thesis M.Sc.

IDP

Running P4 on a Netronome SmartNIC - A Performance Analysis

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.

P4 programming language

This is possible because P4 allows programming P4-enabled forwarding devices. Currently forwarding devices such as switches or routers can only be configured or programmed in a rather restrictive way. For instance, only certain protocols with pre-defined functions can be used. 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.

The Netronome SmartNIC is one of the first network cards with native support for P4, using its own SDK. Netronome offers an SDK which allows the P4 programs to be compiled directly for this SmartNIC.

The goal of this thesis is to write simple P4 programs running on the Netronome SmartNIC performing black box measurements with our own packet generator MoonGen. These results are to be compared to P4 software implementations, we already investigated in previous work.

This thesis is offered in cooperation with the Chair for Integrated Systems of the electrical engineering department. In parallel, they will offer another thesis, compiling P4 code onto a NetFPGA and focusing on the interaction of the hardware modules. A collaboration between both theses is encouraged and could involve a direct comparison of the hardware backends or an investigation of bottlenecks in the processing chain. Therefore, the LIS' NetFPGA load generator can be used to obtain an even more detailed latency analysis of the Netronome SmartNIC.

Tasks

This thesis is being offered in cooperation with the electrical engineering department. Prior experience with P4 is not necessary.

- Implementing P4 programs for Netronome SmartNIC
- Detailed performance analysis using black box measurements
- Fine-grained analysis of latency behavior
- Comparison with other software and hardware approaches

This thesis allows to study recent research trends and work with brand new hardware.

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