



Task for the preparation of a Diploma Thesis

Name:

Matriculation number:

Title:

Early HMAC Verification in the Linux Networking Stack Using
XDP and AF_XDP

Objectives of work

Network coding holds great promise for resilient communication, but it also raises security concerns. HMAC has been recognized as a suitable technique for ensuring integrity in such systems, though its computational overhead can hinder low-latency applications.

The main focus of this work is the implementation of HMAC verification at the earliest possible stage in the Linux networking stack. This includes exploring eBPF/XDP for in-kernel verification and AF_XDP for user-space packet processing. The objective is to investigate whether performing HMAC verification closer to the data path reduces the delay compared to conventional implementations (e.g., AF_PACKET or AF_INET).

The task includes measuring performance improvements (latency, throughput, CPU load), identifying challenges that arise from limitations of XDP/AF_XDP (such as program size constraints and lack of cryptographic primitives), and analyzing trade-offs between overhead reduction and security. While a short literature review will provide background on HMAC in network coding, the emphasis is on practical implementation and evaluation of early verification strategies.

As a requirement, the student must document the outcome of the project work in a scientific report. Additionally, the diploma thesis should be written in English.

Focus of work

- Conducting a concise literature review on HMAC in network coding and related verification methods implementations.
- Implementing HMAC verification using XDP and AF_XDP.
- Comparing delay, throughput, and CPU usage against conventional AF_PACKET/AF_INET-based implementations.
- Identifying challenges and limitations of XDP/AF_XDP for cryptographic use cases.
- Discussing the benefits, trade-offs, and security implications of early HMAC verification.
- Preparing an intermediate presentation and a final report for the thesis.

Referee:

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Issued on:

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Due date for submission:

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