



Thesis
B.Sc.

Thesis
M.Sc.

IDP

Implementation of IEEE 802.1CB in eBPF, XDP, and Open vSwitch

Motivation

The Time-sensitive networking (TSN) family of standards aims to bring deterministic and high-availability guarantees to Ethernet networks. Such guarantees are required in industrial and mobility networks, whereas now, they have mostly used solutions that cannot cope with the increase in throughput demand. Ethernet is chosen as a technology of the future due to its cost, flexibility, and wide adoption in other domains. However, Ethernet provides only a best-effort service, which is a problem for real-time applications, such as control data in a vehicle.

IEEE 802.1CB Frame Replication and Elimination for Reliability offers high-availability of data, by duplicating and de-duplicating packets at strategic points in the network. These operations happen at a source, sink, and bridges in the network. Duplication on a bridge can be achieved by using Open vSwitch (OvS). A more challenging aspect is packet duplication at the source or de-duplication on the bridge or sink. For these operations a more low-level technology is recommended such as eBPF.

The main motivation is to create SW 802.1CB implementation, which is currently unavailable, and the only limited solutions require specific HW to support it or are proprietary.

Your Tasks

- Familiarize yourself with the topic (TSN family of standards - 802.1Qxx, 802.1CB, 802.1AS, eBPF, XDP, OVS, etc.)
- Research on available implementations of 802.1CB
- Work out a concept of how 802.1CB could be integrated into the above-explained testbed setup and implement it
- Evaluate which guarantees this concept brings and its impact on the system

References

- [1] <https://1.ieee802.org/tsn/802-1cb/>
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- [3] blogs.igalia.com/dpino/2019/01/07/a-brief-introduction-to-xdp-and-ebpf/
- [4] <https://dl.acm.org/doi/10.1145/3281411.3281443>
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Contact

Filip Rezabek	rezabek@net.in.tum.de
Kilian Holzinger	holzinger@net.in.tum.de
Thomas Paul	paulth@in.tum.de
Sebastian Gallenmüller	gallenmu@net.in.tum.de

