Universität Paderborn — Fakultät EIM
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http://www.upb.de/cs/cn/

BACHELOR/MASTER THESIS

Adding Network Service Header-based Chaining Support to an Multi-Datacenter Emulation Platform

Background

In the next generation of networks, also called fifth generation or 5G, most network services will be comprised of a set of network functions that are executed on cloud or cloud-like infrastructure. Each of these virtualized network functions (VNF) implements only a small portion of the overall service functionality and the final service behavior is defined by stitching multiple of these functions together. This is called *service function chaining (SFC)* [1] and defines which flows should be processed by which functions in which order.

One, currently developed, approach to implement SFC in the data plane of software defined networks (SDN) is called *network services header (NSH)* and proposes an frame or packet encapsulation approach to specify dynamic forwarding graphs. This approach is in particular designed to support very agile environments in which functions and workloads are moved between different locations in the physical infrastructure. However, the amount of practical implementations of this approach are still limited, but it will be implemented by one of the most important cloud platforms, called OpenStack [2].

In addition to this, our group implements an emulation platform [3] which allows a user to emulate multiple cloud data centers on a single machine and execute container-based VNFs in this emulated environment. This platform already implements a rudimentary SFC approach based on VLAN tags but a more realistic, state-of-the-art SFC approach is still missing.

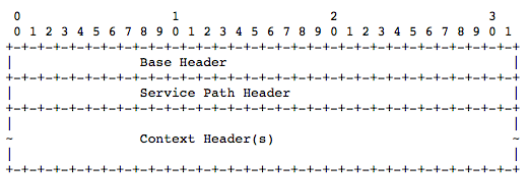

Figure 1: Network Service Header

Thesis Goals

The goal of this thesis is to design and implement an NSH-based service function chaining approach on top of our multi-datacenter emulation platform. The created prototype should be as close as possible to the IETF specification of NSH and has to offer an easy-to-use interface to setup arbitrary complex forwarding paths. In addition, the approach has to be interconnected with the already existing OpenStack-like Neutron-SFC APIs of the emulation platform so that the platform shows the same (or at least very similar) SFC behavior as OpenStack does. The implementation has to be well documented, tested and its performance has to be evaluated so that it can be finally integrated into our open source emulation platform. For a Master thesis, the candidate should also look into more advanced topics, e.g., inter-PoP chaining setups. Please talk to me to define the details.

Milestones

- Detailed investigation of the NSH approach [4] and RFC7665 [1] and comparison to other chaining approaches
- Search for existing NSH controller implementations
- Design and implement SDN controller system to enable NSH chaining in our emulation platform [3]
- Evaluate your prototype with a set of complex chaining use cases

Required knowledge (or willing to learn)

- Networking protocols, Linux
- Good programming skills (e.g. Python, Java)
- Basic knowledge about SDN is a plus

References

[1] J. Halpern and C. Pignataro. RFC 7665: Service Function Chaining (SFC) Architecture, Oct. 2015. Online at: `https://tools.ietf.org/html/rfc7665`.

[2] OpenStack Project. Service Function Chaining Extension for OpenStack Networking, 2017. Online at: `https://docs.openstack.org/networking-sfc/latest/`.

[3] M. Peuster, H. Karl, and S. Van Rossem. MeDICINE: Rapid prototyping of production-ready network services in multi-PoP environments. In *Network Function Virtualization and Software Defined Networks (NFV-SDN), IEEE Conference on*, pages 148–153. IEEE, 2016.

[4] P. Quinn, U. Elzur, and C. Pignataro. IETF draft: Network Service Header (NSH), July 2017. Online at: `https://tools.ietf.org/html/draft-ietf-sfc-nsh-14`.

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