The UvA carried out two activities in the context of the RoN 2020 program:

**Topic 1 – Segment Routing performance**

**Topic 2 - P4 telemetry : processing and adapting**

**Topic 1**

The paradigm of Network Function Virtualization (NFV) requires the underlying networks to be able to route traffic through dynamically deployed nodes. We demonstrated the feasibility of using Segment Routing (SR) and suitable SDN controllers to accomplish the traffic steering goal. Specifically, we focused on IPv4 SR and built a proof of concept SR-MPLS network using Juniper vQFX routers with custom built VNFs. In our implementation the VNFs can be deployed in different nodes in the network. The Juniper NorthStar SDN controller was used to build SR-MPLS LSPs via the Path Computation Element Communication Protocol (PCEP). BGP-LS (link state extension to BGP) was used to gather the network topology information at the NorthStar controller. We validated the operation of our proof of concept in two scenarios: VNF re-instantiation and service chain creation and support. In both cases traffic can be successfully steered through the functions (VNFs) by pushing the SR-LSPs to the routers in the network, hence demonstrating for the first time the feasibility of adoption of the proposed technologies.

The result of this work will be presented at the upcoming ICIN 2021 conference [1] as well as in the Experience Session of IM 2021 conference [2].

**Topic 2**

In collaboration with ESnet work was done to establish a telemetry pipeline where telemetry data was extracted for existing network traffic, combined with network device state, and stored in a collection system for later analysis. A P4 capable device processed packets mirrored by a standard router and sent the processed packets to a device running a DPDK application that acted as a Kafka (https://kafka.apache.org/) producer. This DPDK application batched the telemetry data and sent it to Kafka brokers. Custom Kafka consumers where then used to perform analysis on the collected data examining properties such as data rates, jitter, and fairness on extremely small time scales.

In collaboration with two SNE master’s students we researched the possibility of using P4 in combination with RDMA – Remote Direct Memory Access - to improve the packet per second performance of telemetry data captures. The students implemented a technique where a program setup a RoCE session between a switch and a collector system. The P4 capable switch was used to craft RoCE packets and send them to the collector system where an RDMA capable NIC efficiently stored the data in memory. This work demonstrated the potential of using P4 with RDMA in a telemetry collection pipeline. It also provided promising performance measurements and identified areas for improvement. The results of this work were presented at the INDIS workshop and are part of a publication [3].

There is now ongoing work to improve performance and address some of the challenges identified in the P4 with RDMA technique. We are exploring the possibility of using an
unreliable connection in place of the reliable connection normally used for the RoCE session. This potentially mitigates issues with invalid sequence numbers due to packet loss causing a significant number of valid packets to be dropped. In order to address limitations dealing with trailers and hashing, intermediate checksum values have been implemented allowing the payload size to be increased. These improvements should allow telemetry packets to be received at higher packet per second rates while at the same time allowing each packet to contain more telemetry data.

References
