A federated network is an ensemble of independent but collaborating partners that share resources in order to optimize their usage, improve the quality of services, and reduce provisioning costs. We leverage Software-Defined Networking (SDN) to introduce an end-to-end connectivity service among the networks of federated partners. In particular, we accomplish this by applying SDN to the network edge, where it has been marginally exploited so far.

Our approach consists in applying suitable Network Address and Port Translation (NAPT) strategies both to the source and to the destination IP address and port of data packets exchanged by the partners: in this way, such packets can be routed on a standard IP network, including the Internet. We define various alternative NAPT strategies and evaluate their effectiveness using simulations as well as tests inside emulated network scenarios.

We evaluated the effectiveness of our address translation strategies by estimating the end-to-end connection establishment latency. To build this estimate, we modeled the message exchanges using a queuing network, where the customers are new TCP connections and the servers are C1, C2, CPE3, and CPE4. We exhibited an ad-hoc piece of software to simulate the queuing network. We used a realistic assortment of IP addresses and port numbers as input to the network, which we derived from real TCP connections found in packet traces available.

To demonstrate the practical applicability of our approach, we performed several experiments in a network topology running in the Mininet network emulator. We are working on a prototype controller implementation, based on the Ryu framework. The partial implementation of our controller is already downloadable at http://www.dia.uniroma3.it/~compunet/www/view/topic.php?id=sdn

This paper makes a step towards the introduction of interconnection technologies for federated networks by exploiting SDN on the edge, but several aspects deserve more attention and are part of our future work plan:

- The signaling protocol talked between controllers needs to be defined, and a caching mechanism can be introduced to reduce their communication overhead;
- Moreover, we would like to further refine the port allocation strategies;
- Our controller implementation needs improvement: for example considering the possibility of overlapping subnets among the federated networks and introducing a DNS based mechanism in order to reduce the information exchanged between the controller and make the architecture more dynamic;
- Also we would like to test our approach with more realistic traffic loads by collaborating, for example, with some Internet Service Providers.