The process of planning a virtual topology for a Wavelength Devision Multiplexing (WDM) network is called Virtual Topology Design (VTD). The goal of VTD is to find a virtual topology that supports a routing of the expected traffic without congestion. When looking at networks with fluctuating, high traffic demands, it can happen that no topology fits all traffic patterns occurring in a large period of time. Thus, during operation, the virtual topology has to be reconfigured. Since modern networks tend to be large, VTD algorithms have to scale well with increasing network size. To this end, algorithms need to be distributed. Existing distributed VTD algorithms, however, either require gathering a global network state or use time consuming distributed election processes. This makes them too slow to react quickly on congestion.

We propose Selfish Virtual Topology Reconfiguration (SVTR) as a new paradigm for distributed VTD. It combines reconfiguring the virtual topology and routing through a Software Defined Network. SVTR is used for online, on-the-fly network reconfiguration without knowledge of future traffic patterns. Its integrated routing and WDM reconfiguration keeps connection disruption due to network reconfiguration to a minimum and is able to react very quickly to traffic pattern changes. SVTR works by iteratively adding/deleting single lightpaths to adapt the virtual topology to the observed traffic patterns without global traffic information and without future traffic estimations. Using traffic demands collected from a real nation-wide network, we show by simulation that SVTR achieves higher throughput and lower latency than a popular centralized topology design algorithm.