Lazy Ctrl: A Scalable Hybrid Network Control Plane Design for Cloud Data Centers

The advent of software defined networking enables flexible, reliable and feature-rich control planes for data center networks. However, the tight coupling of centralized control and complete visibility leads to a wide range of issues among which scalability has risen to prominence due to the excessive workload on the central controller. By analyzing the traffic patterns from a couple of production data centers, we observe that data center traffic is usually highly skewed and thus edge switches can be clustered into a set of communication intensive groups according to traffic locality. Motivated by this observation, we present Lazy Ctrl, a novel hybrid control plane design for data center networks where network control is carried out by distributed control mechanisms inside independent groups of switches while complemented with a global controller. Lazy Ctrl aims at bringing laziness to the global controller by dynamically devolving most of the control tasks to independent switch groups to process frequent intra-group events near the data path while handling rare inter-group or other specified events by the controller. We implement Lazy Ctrl and build a prototype based on Open vSwitch and Floodlight. Trace driven experiments on our prototype show that an effective switch grouping is easy to maintain in multi-tenant clouds and the central controller can be significantly shielded by staying “lazy”, with its workload reduced by up to 82%.