Software Defined Networking - DTU Orbit (28/07/2019)

**Software Defined Networking: Applicability and Service Possibilities**

Network Service Providers (NSP) often choose to overprovision their networks instead of deploying proper Quality of Services (QoS) mechanisms that allow for traffic differentiation and predictable quality. This tendency of overprovisioning is not sustainable for the simple reason that network resources are limited. Hence, to counteract this trend, current QoS mechanisms must become simpler to deploy and operate, in order to motivate NSPs to employ QoS techniques instead of overprovisioning. Software Defined Networking (SDN) represents a paradigm shift in the way telecommunication and data networks are designed and managed. This thesis argues that SDN can greatly simplify QoS provisioning in communication networks, and even improve QoS in various ways. To this end, the impact of SDN on QoS is assessed from both a network performance perspective (e.g. bandwidth, delay), and also from a more generic perspective (e.g. service provisioning speed, resources availability). As a result, new mechanisms for providing QoS are proposed, solutions for SDN-specific QoS challenges are designed and tested, and new network management concepts are prototyped, all aiming to improve QoS for network services, from this extended point of view. Specifically, the challenge of SDN based QoS provisioning is addressed by considering every layer of the SDN architecture. In chapter 2, a short introduction to SDN is given, following that a complete architecture for QoS aware service provisioning in SDN is introduced in chapter 3. The following three chapters (4, 5 and 6) focus on each logical plane of the SDN architecture and identify the major challenges with respect to QoS, in relation to that specific plane (i.e. data, control and management). Further, each chapter proposes solutions to address the identified challenges, and demonstrates these solutions by testing them in various network scenarios. The last chapter of the thesis concentrates on applying SDN to improve QoS and increase the network utilization in a novel data center environment. This environment comprises a hybrid packet-circuit architecture, on top of which intelligent algorithms are applied in order to selectively offload traffic from the capacity constrained packet based network onto optical circuits. Overall, the research work presented in this thesis identifies and addresses the critical aspects of SDN based QoS provisioning. Moreover, several tests and demonstrations have been performed by using virtualization techniques. These tests aim to support the proposed ideas, and also to create a better picture of practical SDN deployments and the difficulties that arise in such virtualized environments.

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