A Novel Algorithm for Flow-Rule Placement in SDN Switches

The forwarding rules, used by the legacy and SDN network devices to perform routing/forwarding decisions, are generally stored in Ternary Content Addressable Memory (TCAM) modules, which offer constant look-up times, but have limited capacity, due to their high capital and operational costs, high power consumption and high silicon footprint. To counter this limitation, some commercial switches offer both, hardware and software flow table implementations, termed hybrid flow table architecture in this paper. The software-based tables are stored in non-TCAM memory modules, which offer higher capacity, but with slower lookup times. In addition, these memory modules are limited in terms of how many requests they can serve per time unit. Thus, exceeding this threshold will lead to packet loss in the network. This paper proposes a novel placement algorithm, which dynamically decides whether a new flow rule should be placed in a hardware (expensive) or a software (cheap) table. The placement decisions are based on a number of criteria with the goal to increase the utilization of the software-based table, without introducing performance degradation in the network in terms of significant delay and packet loss. The performance of the placement algorithm was evaluated through experimental measurements in a testbed, which comprises a hybrid SDN switch, a server performing traffic generation and a server hosting the SDN controller. The results indicate that, by limiting the maximum allowed processing capacity of the software table, the number of accommodated flows is significantly increased, while bounding any excessive delays and avoiding packet loss.