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Improving Fairness, Efficiency, and Stability in HTTP-Based Adaptive Video Streaming With Festive

Abstract:

Modern video players today rely on bit-rate adaptation in order to respond to changing networkconditions. Past measurement studies have identified issues with today's commercial players when multiple bit-rate-adaptive players share a bottleneck link with respect to three metrics: fairness, efficiency, and stability. Unfortunately, our current understanding of why these effects occur and how they can be mitigated is quite limited. In this paper, we present a principled understanding of bit-rate adaptation and analyze several commercial players through the lens of an abstract player model consisting of three main components: bandwidth estimation, bit-rate selection, and chunk scheduling. Using framework, we identify the root causes of several undesirable interactions that arise as a consequence of overlaying the video bit-rate adaptation over HTTP. Building on these insights, we develop a suite of techniques that can systematically guide the tradeoffs between stability, fairness, and efficiency and thus lead to a general framework for robust video adaptation. We pick one concrete instance from this design space and show that it significantly outperforms today's commercial players on all three key metrics across a range of experimental scenarios.