

## Abstract

The amount of video viewed over the Internet is increasing thanks to the wide diffusion of Smart TVs, tablets, and smartphones. Nowadays, most video content is streamed using Adaptive bit-rate streaming (ABR) over HTTP-based adaptive streaming (HAS), the de facto technology for video streaming over the Internet. Despite many efforts, achieving a good quality of video streaming over WiFi networks remains a tremendous challenge. This challenges the rate adaptation of HAS clients when multiple streaming clients share the same network bottleneck link and compete for available bandwidth. These competitions can affect directly the client performance which leads to player instability, unfairness between players, and bandwidth underutilization.

Server and Network Assisted DASH (SAND) can solve the performance problems by allowing executing better collaborations between the network elements, and providing advance policies for sharing and allocating network resources. Aiming at improving the performance for HAS, this study focuses on performance limitations and proposes a novel bit-rate assistance algorithm on the WiFi AP that assists HAS clients and improves their performance. In particular, we adopt SAND mechanisms in order to build network assisted algorithms that improve the performance of HAS clients that share a common bottleneck link. We propose to use DASH Assisting Network Elements (DANEs) and implement network assistance algorithms over a WiFi AP.

As visual video quality and buffer stalls are shown to have a significant impact on user's Quality of Experience, we consider average video bit-rate and buffer occupancy in modelling our objective function. As a first step, we use the Hungarian algorithm to find a bit-rate providing the highest utility for each HAS client. While the Hungarian algorithm finds a solution to our problem, it might be infeasible as it might be violating the bottleneck capacity constraint. If the solution is infeasible we propose several heuristics to decrease the assigned bit-rates of selected users based on following three categories: i) utility, using Utility-based Feasible Assignment (UFA) and Utility-Cost Feasible Assignment (UCFA), ii) buffer level, using Buffer-based Feasible Assignment (BUFF) and Buffer-based Highest First Feasible Assignment (BAHIA), and iii) assigned bitrate, using Rate-based Feasible Assignment (RAF) and Highest-Increasing Bitrate Based Assignment (HIBA).

To evaluate the proposed algorithms, we design and implement the algorithms in a network simulator. We evaluate the impact of the proposed algorithm on the client-based algorithms by comparing them with three client-based algorithms which are PANDA, FESTIVE, and TOBASCO. Performance is assessed through several metrics such as average video quality, fairness, stability, efficiency, and buffering ratio. The results show promising performance gains of HAS when using our proposed network assisted approaches.