

Title:

A Control-Theoretic Approach for Dynamic Adaptive Video Streaming over HTTP

Presenter:

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Abstract:

User-perceived quality-of-experience (QoE) is critical in Internet video applications as it impacts revenues for content providers and delivery systems. However, there is little support in the network for optimizing such measures and bottlenecks could occur anywhere in the delivery system (e.g., content delivery network, user home, ISP). Consequently, a robust bitrate adaptation algorithm in client-side video players is critical to ensure good user experience. This is a key problem for the Internet video ecosystem as new standards for dynamic adaptive streaming over HTTP (DASH) are emerging. Previous studies by leading commercial providers (e.g., YouTube, NetFlix, Conviva) and academic efforts have shown key limitations of state-of-art commercial solutions and proposed a broad spectrum of heuristic fixes. Despite the emergence of several proposals, there is still a distinct lack of consensus on (a) how best to design this client-side bitrate adaptation logic (e.g., use rate estimates vs. buffer occupancy); (b) how well specific classes of approaches will perform under diverse operating regimes (e.g., high variability); or (c) how they actually balance different Quality-of-Experience (QoE) objectives (e.g., startup delay vs. buffering). In this work, we formalize the DASH problem through the "lens" of control theory and develop a principled control-theoretic model to reason about a broad spectrum of adaptation strategies. We propose a novel model predictive control algorithm that can optimally combine bandwidth and buffer-size information to significantly outperform traditional approaches in common conditions. Finally, we describe a practical implementation of this algorithm in the industry reference video player DASH.js to confirm the validity of the approach in real world scenarios.