Anticipatory Quality Adaptation for Mobile Streaming: Fluent Video by Channel Prediction

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Demonstrated System

Motivation

Video streaming stalls is a major problem faced by users while moving in a cellular network

- Video streaming on mobile devices becomes more and more popular [1].
- Video players implement HTTP adaptive streaming (HAS) [2] policies.
- HAS policies attempt to adapt video quality instantaneously.
  ⇒ Not enough time to react and fill up the buffer with sufficient content.

Proposed Solution: *Anticipatory* HAS (AHAS)

- Policy that adapts video quality to channel state and its prediction

⇒ The adaptation of video quality comes at no visual impairment
⇒ The spectral efficiency is improved while stalling time is highly reduced [3].

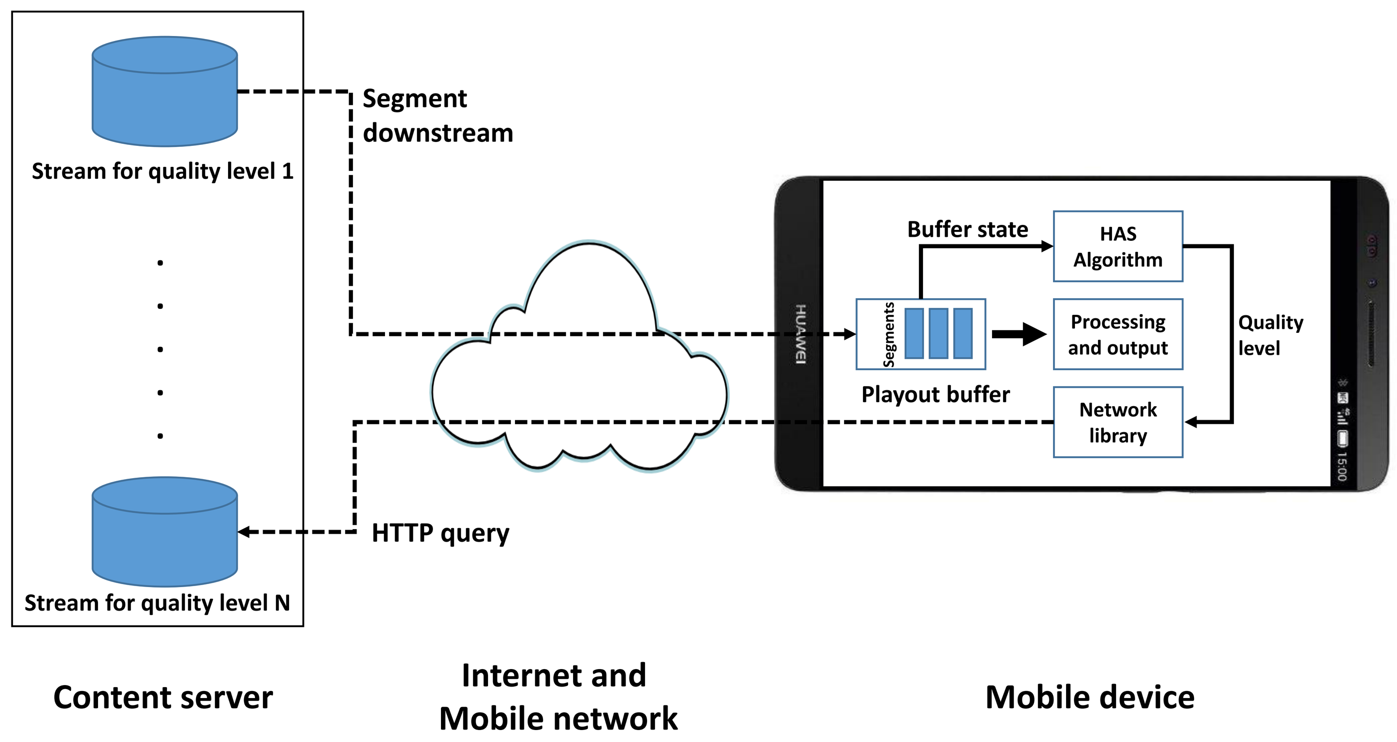

Figure 1: Components of the demonstrated system for mobile video streaming

Functional Overview

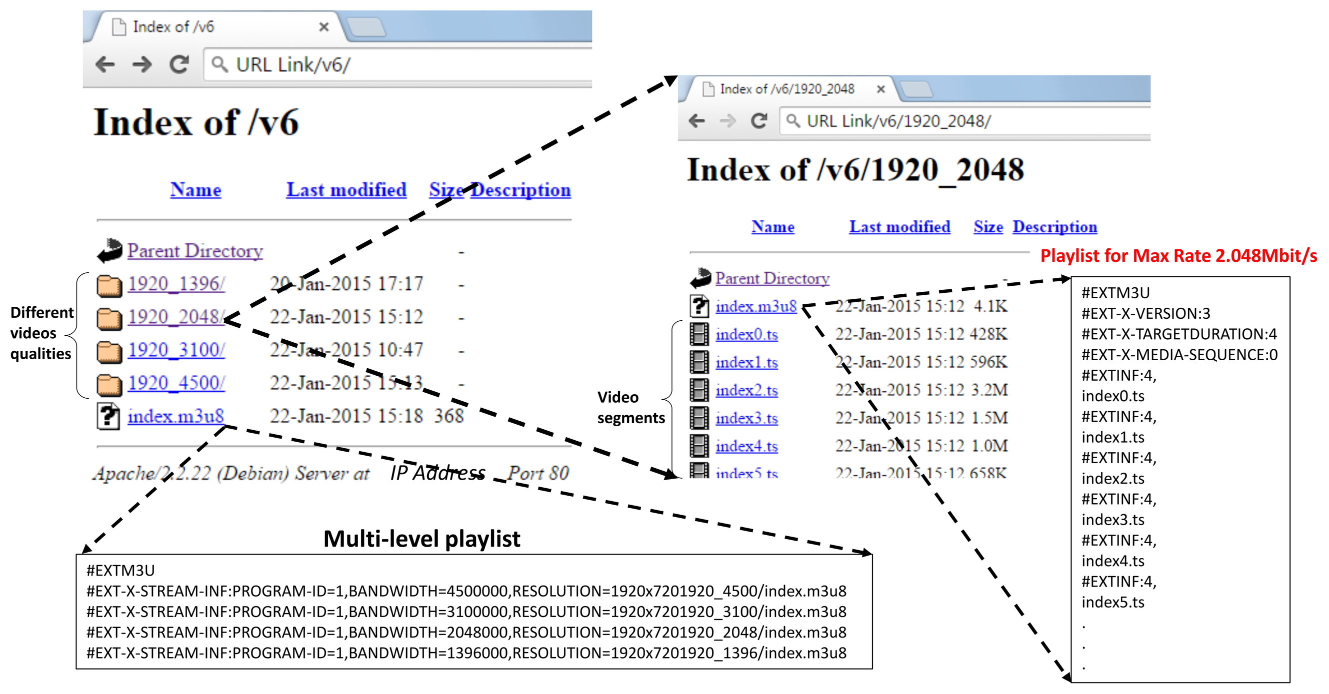

Figure 2: Organization of the video files and playlists on the content server

- The HTTP server offers a segmented video stream. N quality levels are available.
- Each quality level corresponds to the maximum bitrate of the encoded video stream.
- The video client applies an HTTP adaptive streaming (HAS) policy to choose the adequate quality level for each of the video segments that best adapts to the link quality.
- For the selected quality level, the video client requests the segments from the URL given in the playlist.

Anticipatory HTTP Adaptive Streaming (AHAS)

- The *anticipatory* HAS policy observes the Received Signal Strength (RSS) at the application layer and provides a direct and fast adaptation to the wireless channel state.
- Once the user walks into the building, RSS decreases until coverage is lost.
- AHAS maximizes the number of seconds in the playout buffer by reducing video quality *before* the user loses coverage to maximize the number of seconds in playout buffer.
- Video quality adaptation is performed based on predicted channel state [4].
- Channel state is predicted with the help of location information, derived from GPS, WiFi or other location sources.

⇒ The AHAS policy is designed to predict the coverage gaps and fill the buffer with the maximum number of seconds in advance.

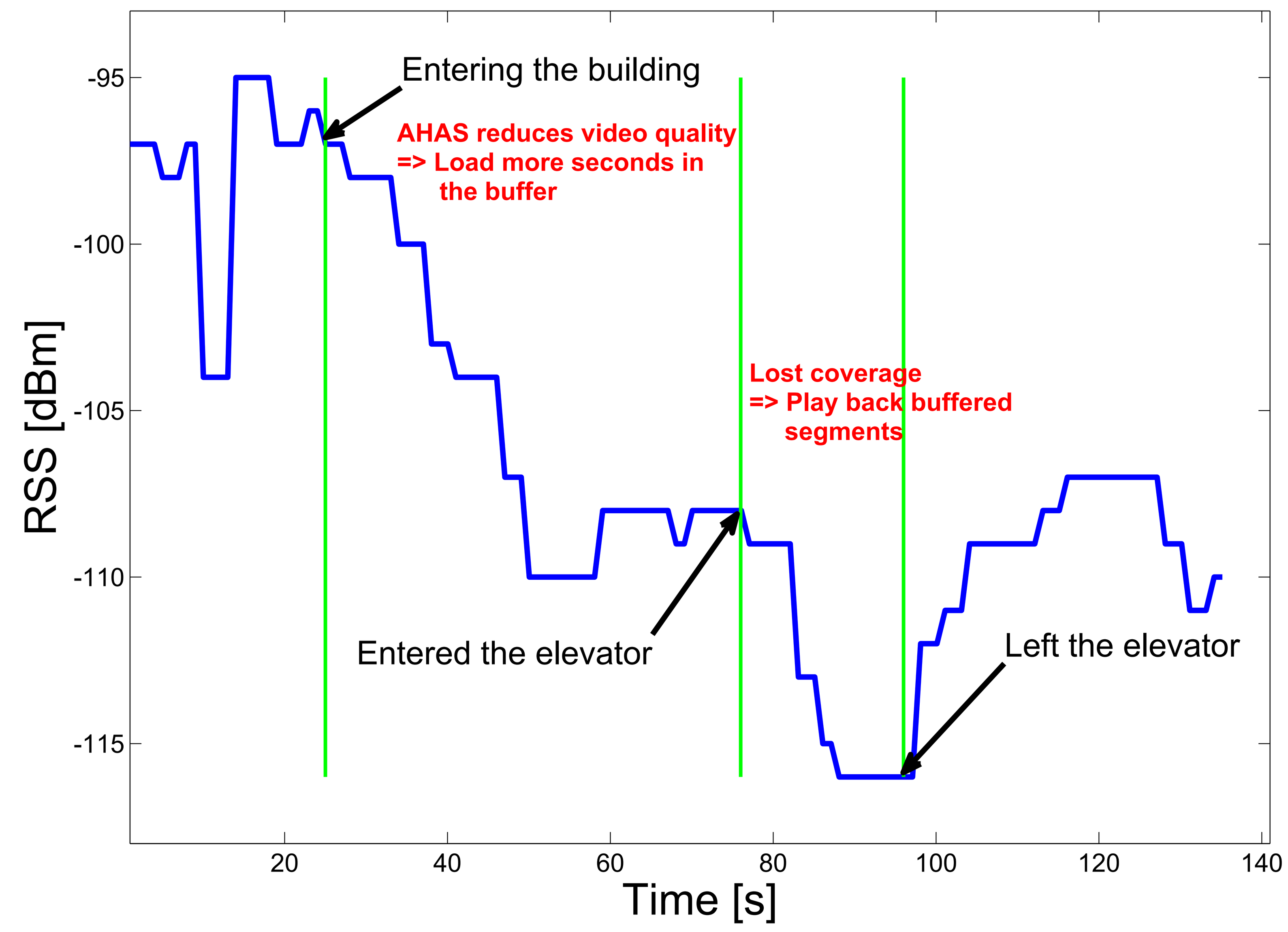

Figure 3: RSS in dBm measured with an off-the-shelf Smartphone in a typical office building in Paris, France

Demo results

Figure 4: Two conventional Smartphones running a conventional video player (left) and the AHAS policy (right) over a 4G network.

- The proposed AHAS policy shows outstanding fluency even in very bad coverage situations.
- The adaptation of the video quality is based on RSS measurements and location-aided prediction of the wireless channel state.
- The video quality adaptation results in no visual impairment.

References

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[2] "Dynamic adaptive streaming over HTTP (DASH)," ISO/IEC, International Standard DIS 23009-1.2, 2012.

[3] W. Bao and S. Valentin, "Bitrate Adaptation for Mobile Video Streaming Based on Buffer and Channel State," in Proc. IEEE International Conference on Communication (ICC), 2015, to appear.

[4] Q. Liao, S. Valentin, and S. Stanczak, "Channel gain prediction in wireless networks based on spatial-temporal correlation," in Proc. IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC), 2015, to appear.