Automatic Video Synchronization of Remote TV Sets

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ABSTRACT

Current production infrastructures on top of chroma technologies deal with one TV set to build virtual studios. Revolution in streaming equipment achieving low latency features opens new unexplored possibilities such us real time fusion of geographically distributed sets to create new experiences in consistent and homogeneous scenes. However, it brings synchronization issues to be addressed in order to accomplish a smooth interaction feeling between the remote speakers. To this end, this paper describes a standard-based solution for automatic accurate synchronization, removing the human tuning need.

Keywords

live streaming, synchronization, NTP, virtual set

1. INTRODUCTION

The media production must track new paradigms in terms of mobile connectivity, pushed by people ubiquity, and digital convergence, aimed to foster interoperability and seamless technology deployment over common telecommunication infrastructures. New trends of market solutions exploit the mentioned concepts enabling live broadcasting of high definition contents streaming the mobile device camera. The ubiquitous context and the need of leverage low cost and universal infrastructures turn streaming into the best technological option.

Most of current chroma set infrastructures produce standalone contents putting aside the live production of distant studios mixed to create enhanced and richer performances. However, one of the main technical hurdle to address is the synchronization of the different video sources in order to get a smooth result mitigating network dynamic behaviour jitter. Our work is aimed to achieve automatic synchronization of streamed media to produce live contents.

2. SYSTEM ARCHITECTURE

The proposed solution includes at least one TV studio and a remote chroma key set as depicted in figure 1.

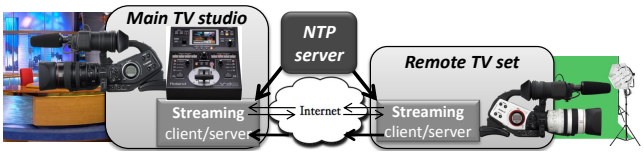

Figure 1: General system architecture.

In terms of network communication one full-duplex streaming connection foster natural speakers interaction prioritizing low latency and giving up image quality. Moreover a half-duplex high quality video stream is send the remote chroma video to the production studio. In order to deal with the jitter both streaming devices are synchronized by an Network Time Protocol (NTP) server. The streaming client of the main studio has a queue for all the video signals encapsulated in RTP using the NTP timestamps. This way, it can absorb the latency of the remote stream by buffering the local one to generate a real time final production mixing both scenes.

All the software has been developed over Gstreamer[1] open source multimedia framework deploying RTSP streams with H.264/AVC. Thanks to the new options for clock definition of the *RtpBin* element, the NTP timestamps are embedded in the RTP packet headers. While the *gstrtpjitterbuffer* element provides buffering for delay compensation.

3. VALIDATION

In order to probe the performance obtained, a complete set of tests have been carried out. To control the network jitter in the network, the traffic control *(tc)* command from Linux package *iproute* set a variable delay in our testbed, where both sets are in the same LAN. The quality of the final production is 1080p 30fps and the synchronization accuracy achieved is frame to frame.

4. CONCLUSIONS

Current production tools features include UGC input and social network feed but future ones must include people mobility and streaming infrastructures. Aimed to real time fusion live streams our approach exploit NTP in order to synchronize distant video sources achieving lip sync overcoming jitter conditions.

[1]Gstreamer site: http://gstreamer.freedesktop.org.