Live Demonstration: End-to-End Real-Time ROI-based Encryption in HEVC Videos

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***Abstract*—This paper presents a demonstration setup for live HEVC video coding with Region of Interest (ROI) encryption. The showcased approach splits video frames into independent HEVC tiles and encrypts tiles belonging to the ROI. This end-to-end content protection scheme is put into practice by integrating the algorithms of selective encryption into Kvazaar HEVC encoder and decryption into openHEVC decoder. The shown implementation performs secure encryption of the ROI in real time with small bit rate and complexity overhead.**

Keywords— user identity management; High Efficiency Video Coding (HEVC); tiles; Region of Interest (ROI); selective encryption

I. Introduction

This work demonstrates selective encryption [1] that encrypts the *Region of Interest (ROI)* in video (human faces, personal data) and keeps the rest of the video (background) unencrypted. The ROI is extracted from the background by first splitting the HEVC video into separable rectangular regions called tiles and then encrypting only the tiles belonging to the ROI. The usage of independent tiles introduces some bit rate overhead but it prevents the propagation of encryption outside the ROI. The encryption is based on the chaotic generator that encrypts a set of HEVC syntax elements in conformance with HEVC. Thus, the bit stream can be decoded with a standard HEVC decoder and a secret key is only needed for ROI decryption.

II. Demonstration Setup

Fig. 1 depicts the end-to-end demonstrator setup showcased to the visitors. The raw 1080p30 video is shot by Sony FDR X1000V action camera, captured by Epiphan AV.io HDMI capture card, and converted from RGB to YUV 4:2:0 format by FFmpeg. The YUV stream is encoded and encrypted in real time by Kvazaar open-source HEVC encoder [2] and then encapsulated by FFmpeg to MPEG-2 TS format on the first laptop. The encrypted video is sent in TS format over the Ethernet cable to the second laptop where the video is played by GPAC MP4Client using openHEVC decoder [3] for decoding and decryption.

III. Visitor Experience

Visitors are able to see in real time how our solution can encrypt ROI of the scene while keeping the rest of the video clear. They can interact with the demonstrator by selecting on the fly the encrypted regions in the displayed video. Fig. 2 shows example snapshots of the demonstrator output without and with encryption for a tile configuration of 6×3.

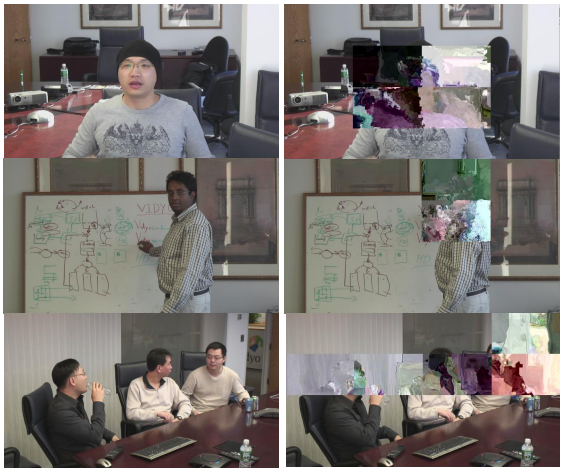

Fig. 2: Clear and ROI encrypted videos.

References

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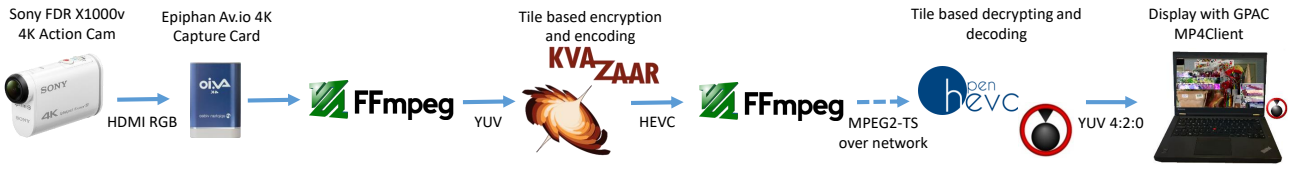

Fig. 1: End-to-end real-time HEVC coding flow with ROI encryption.