Personalization of Media Delivery in Seamless Content Delivery Networks

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Abstract. In this paper, we propose an innovative system that aims to adapt to the user needs and preferences the media content transmissions within IP and P2P environments. To personalize the manner the content is displayed to the final user, this proposed network allows the transmission of multiple views and different layers for each media content piece. In addition, we suggest an approach on how to deal with the problem of contents transmission over P2P networks while preserving the author's rights. In this document, the system architecture is presented, especially the structure concerning the different streams sent over it and the security involved. This research path is being investigated within "SEAmless Content delivery" (SEA) project [1].

Keywords: MVC, SVC, layered video coding.

1 Introduction

Our objective is to present an innovative and interoperable solution to share and transfer personalized media content over the different identified networks, and receive the data in the possible different devices where a user may like to view the media content. Additionally, we are aiming to preserve the creator's rights while sharing their contents. Taking into account the benefits of peer-to-peer networks, our proposed solution leans on these network structures.

Figure 1 illustrates the different networks, and end-user devices with which we have developed our system [1]. As the end-user terminal characteristics can be very different and there are several kind of networks, in order to display the media content correctly some adaptations may be required to be done. An important element of the network is the sHMG, the gate to the home environment. Its functionality is to interconnect various access networks (e.g. DVB-T, DVBS/ S2, xDSL, WiMAX) with indoor networks (e.g. WiFi, Ethernet, Powerline, ZigBee), as Figure 1 shows [2].

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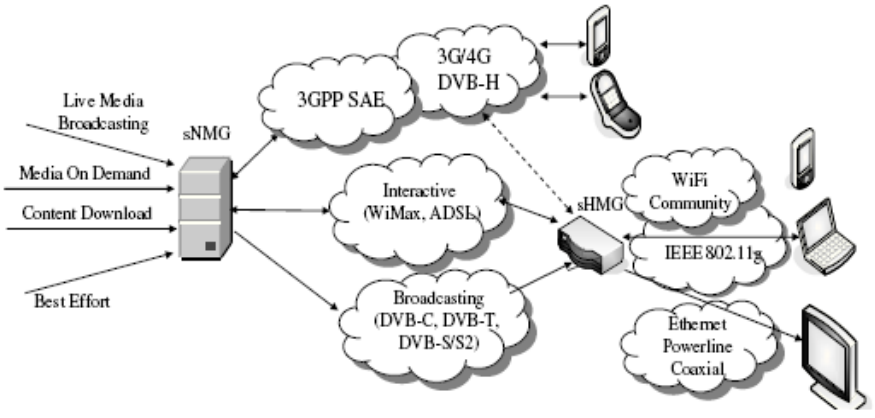

Fig. 1. Network elements and interfaces (figure taken from [2])

This paper is organized in three parts. Following this introduction we analyze the different approaches suggested to achieve the desirable personalization in the media delivery system of the proposed network, and we illustrate the method we use to securely transfer media and to protect the contents author rights. Finally, conclusions are drawn.

2 Content Delivery and User Personalization

As we have explained in the introduction, we are aiming the interoperability of different access networks and devices whilst adapting the contents displayed depending on different imposed or decided causes.

There are mainly two coding solutions that we are investigating and implementing to allow the desired personalization in our network: Scalable Video Coding (SVC) and Multiview Video Coding (MVC). The first one does layered temporal/spatial/ quality scalability, and the later allows the transmission of different views embedded in a single video stream. Considering the need and desire of a high security system, each different layer and view stream is encrypted separately.

We propose to carry out the personalization and adaptation under three points of view: end-user preferences, end-device capabilities and network congestion.

2.1 End-User Preferences

Our first target is to take into account the end-user preferences. The user can choose the layers and views he wants to receive. The content shared in our network will have at least one associated license, and will have more than one if various possibilities on how this content can be viewed are given. We have analyzed different approaches on how the licenses can be obtained. Trying to keep the interaction with the server whilst allowing a simple communication with the user, we have decided to include in a web site a database with the licenses. There, the user can see the different contents

available, and the various possibilities each license offers. As the license states the characteristics of the media content associated with it, the end-user can purchase different licenses depending on his/her choices.

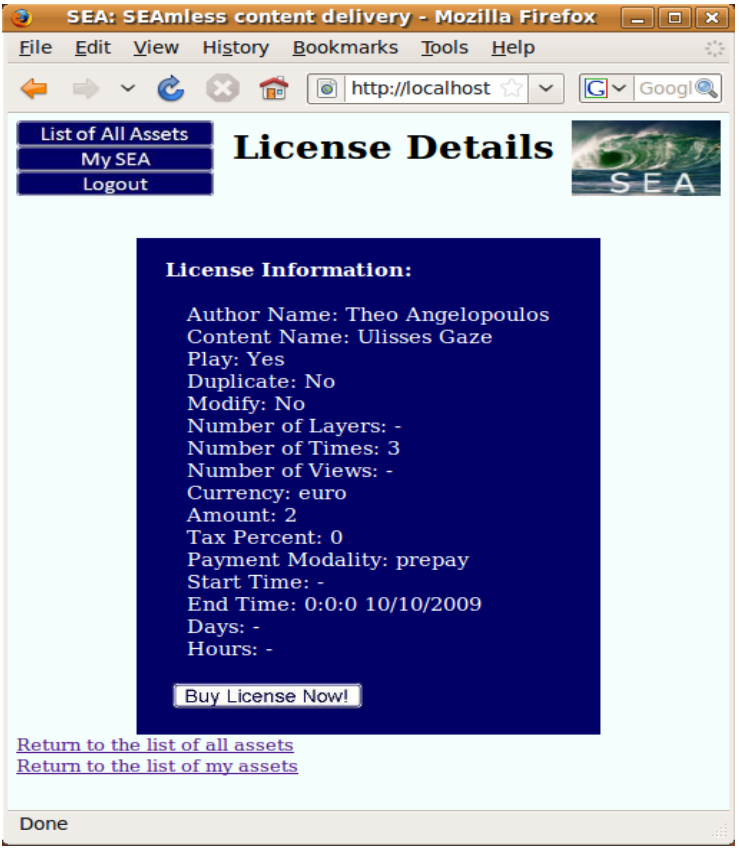

Fig. 2. Capture of the web page. License characteristics are shown in this figure.

The creator of the content will create a license associated with it. We have implemented a simple graphic interface to facilitate this task (see figure 3). On it, the content creator specifies the rights he grants to the users that buy the license. The possible rights he can offer are the number of layers, views and times a user can play the content. Moreover, we include payment and date/time requirements to indicate the license price and to complete the permissions given.

Once the content and license are created, the license should be uploaded to the web page, where the end users can easily navigate though the songs, videos and media contents offered, and the options given in each license. End-users should then purchase the desired license, start receiving the streaming data and enjoy the content they have bought.

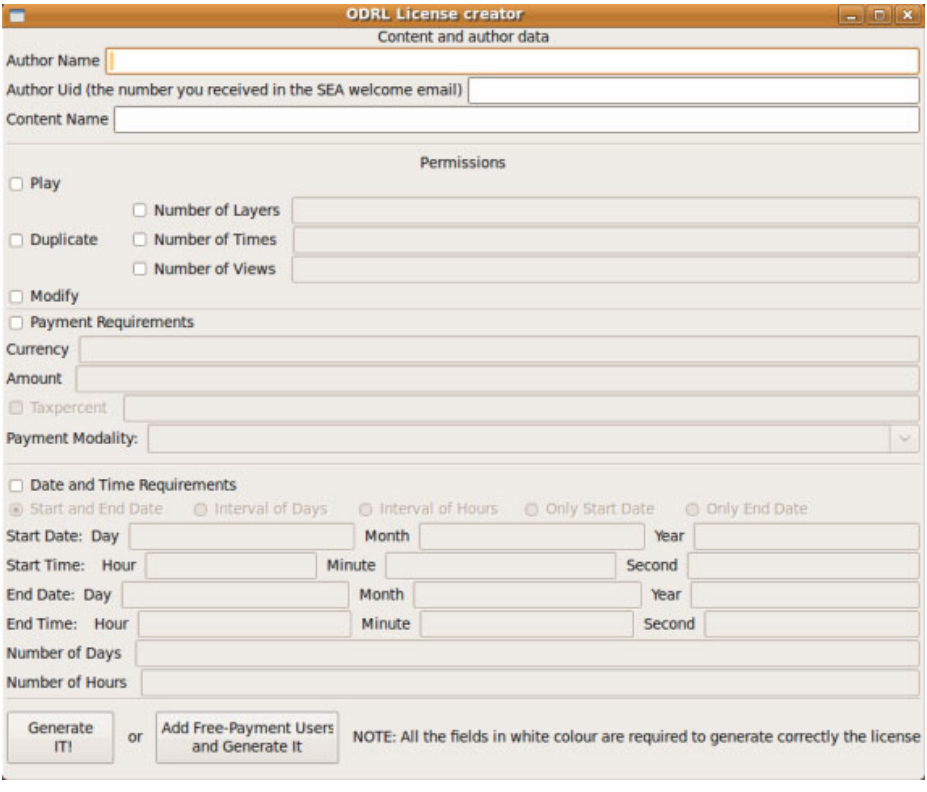

Fig. 3. Capture of the license creator program. The license offers various options to the content creator.

2.2 End-Device Capabilities

Depending on the end-device, some of the offered possibilities may not be really achievable. As a simple example, users feel a difference when watching a film in a 42" TV screen or in a 4" PDA screen. For instance, if high resolution content is delivered, the user will find an improvement in the video resolution when watching it on the TV, but may not notice a clear difference in the PDA. In addition, we have to consider that different machines have different maximum decoding bit rates. Furthermore, if the viewing device is a mobile device we have consider other issues, as would be batteries consumption, mobility (including service continuity while the user position moves and forces a change in the base station that relies it to the main network), etc.

In our network, we consider these constraints. A module aware of the terminal characteristics is incorporated in our network [3]. This module is aware of the terminal properties, its processing constraints, codec capabilities, etc. and is in charge of the management of any possible restriction the end-device may impose. If an end-device does not have the suitable characteristics to receive an enhanced video layer or multiple views, these streams should not be sent. Our objective is to avoid the transfer

over the network of data that would be useless to the end-user and may result in network congestion. This network saturation produce several problems, as the one we will explain in the next section.

2.3 Network Parameters

Once the end-user have purchased the adequate license and the terminal awareness module has assured that the devices involved have the suitable characteristics to send, receive and play the media content chosen, the data streaming are delivered over the P2P network. However, one last problem may occur. If we want the terminal to be capable of displaying the content, the reception of the media content stream needs to fulfill a certain QoS (Quality of Service), especially regarding the maximum tolerable jitter in the packet arrival. If the network is congested, the general QoS may not be sufficient to permit the terminal to reproduce the media content as desired. Nevertheless, the network may have the necessary bandwidth to transmit correctly the base layer of the content. A module aware of the network characteristics is included in our system [3]. If this module realizes that the network is congested, it will inform the sender and the enhanced layers and additional views will not be sent.

3 Conclusion

In this paper we have analyzed further our proposed seamless P2P network to deliver media. We have identified the different causes that may force an adaption in the delivery of the media content to the end-user. Bearing in mind our interoperability aim, this personalization can take place for mainly three reasons: end-user preferences, devices restrictions and network proprieties. We have proposed three solutions that allow to manage the adaptation for each one of the tree cases presented. The end-user preferences can be easily considered as we enhance the network security using licenses where these preferences are described. In addition, our network model includes the necessary device capabilities aware and network aware elements to seamlessly perform the media delivery.

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