

Chapter 32

Media Resource Adaptation for Multimedia Services and Streaming Media for Mobile Telephones

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ABSTRACT

Nowadays an intensive diversification can be experienced among the devices that can display multimedia content to the user. Typically, clients are unable to receive large audio-visual data volumes in original quality because of resource limitations and deficiency of terminal capabilities. The aim of media resource adaptation is to provide multimedia items for users in a format that is most appropriate with respect to the current terminal capabilities, network characteristics, server capacities and user preferences. The execution time of adaptation is crucial in order to shorten startup delay. The chapter is intended to give a survey on media resource adaptation. Our aim is to introduce the related standards and specifications, show an adaptation framework. We put special emphasis on the algorithmic aspects of adaptation decision taking and present some optimization methods to efficiently select adaptation parameters.

INTRODUCTION

Recently the mobile telephones have increase their computing power and displays. But they are still limited in the visualization of media information (Chittaro, 2006; Loizides and Buchanan, 2010).

On the other hand, mobile networks have increased their bandwidth but still they cannot transport efficiently high definition and 3D multimedia information (Wortham, 2009; Väättäjä and Männistö, 2010). Moreover, mobile devices are not able to receive always and everywhere multimedia content in high quality. This makes that, the access to online multimedia content, especially streaming videos,

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from the own mobile device provokes disappoint. Still, in many cases the requested video can be displayed only on a high performance *Personal Computer (PC)* and efficiently communicated through a high bandwidth communication network. Sometimes the multimedia stream is jerky because it overloads the display device and/or the network. Sometimes the service providers are too cautious and the quality of the media stream is poorer compared to the quality accepted by the device and the network.

Nowadays, there is a high diversity (Chukwu, 2009; Higgins et al., 2010) of:

- Devices that can display multimedia content (the capabilities of devices are different in terms of graphical resolution, storage capacity, processor speed, audio quality),
- Supported media formats,
- Networks and
- Content providers.

Indeed, mobile device can be used as a source of multimedia to other devices. This makes very challenging the delivery of multimedia contents to any current mobile device. To solve this media objects or media resources (content) must be adapted. The goal of content adaptation (Chang and Vetro, 2005; Hu, 2010) is to present it in a format that is appropriate for the current mobile devices capabilities, network characteristics, server capacities, user rights and user preferences. The replacement of the content itself is not considered content adaptation. A simplest way to do resource adaptation is to store media objects of different qualities. An advanced way is to store only one instance of the high-quality content which can be adapted to the different constraints of the mobile devices at delivery time. Media resource adaptation can be applied to standalone information (e.g., multimedia streaming) or to structured content (e.g., *HiperText Markup Language (HTML)* objects).

Figure 1 gives an overview of resource adaptation components and concepts (that will be explained in detail in next sections). Adaptation needs information both on the original content (resource metadata) and the destination consuming the media (usage environment). The media content consists of the multimedia resources and the related metadata containing their properties. *Usage Environment Description (UED)* provides information on the entities as follows:

- The terminal capabilities.
- The network characteristics.
- The special requirements and preferences of the person requesting the content.
- The characteristics of the natural environment.

The *Adaptation Decision Taking Engines (ADTE)* controls the adaptation process; its task is to determine the parameters of the adapted multimedia resources. Good selection of the adaptation parameters may highly increase the satisfaction of the users. *Adaptation Engine (AE)* executes the transformation in accordance with the adaptation parameters coming from the output of the adaptation decision. ADTE should be aware of the capabilities of AE (which parameters can be adapted, what is the range of their possible values, what kinds of transformations are possible, what is the performance of the AE). A general adaptation framework is interoperable with different usage environments and in principle, it can process media resources with arbitrary feature values.

Moving Picture Experts Group (MPEG) developed MPEG-21 standard aiming at creating a multimedia adaptation framework (Burnett et al., 2003; Bormans & Hill, 2002). Since many elements are already standardized (e.g., codecs), the standard intends to integrate the already existing components, discover the parts where standardization is still needed and specify additional tools to complete the adaptation framework. It specifies

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