

# Chapter VI

## Transcoding vs. Scalability in Video Streaming for Heterogeneous Networks / Clients

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### **ABSTRACT**

Transcoding provides ad hoc solutions for every user's category by decompressing a video sequence and recompressing it into a different format where the frame size, colour representation, frame rate, quality, and other characteristics may change. Scalable coding allows implementing most of these operations in an easier and cheapest way, substituting decoding and re-encoding with simple selection and combination operations. In this case, the video is encoded once for all, but different users can access different instances of it according to their specific requirements, capabilities, and compatibilities. The aim of this chapter is to highlight the pros and cons of both techniques, presenting solutions based on layered coding and multiple description coding as a valuable alternative to transcoding, especially in those cases where network losses are not negligible.

### **INTRODUCTION**

Although the widespread use of video streaming services is rapidly increasing, some major problems are still to be solved when heterogeneous networks and terminals are concerned. Channel adaptation,

storage and computational power constraints, requirements in terms of quality of service, and real-time delivery are some of the main technological challenges, but the business model that lies beyond the service provision should also be considered. In fact, in most cases, the task of managing the channel/terminal adaptation is left to service providers, which need to tailor (statically or dynamically) contents and data formats to specific user categories and billing models.

The immediate consequence is an increased complexity and the need to introduce suitable mechanisms at both the server and network levels. Among various possibilities, transcoding and scalability can represent viable solutions to adapt visual contents to different services. In the first case, the video is converted into different formats by a (possibly partial) decoding and re-encoding mechanism to match the requirements of the receiver; in the second case, the video is coded once for all in a flexible format that allows accessing it in different ways (bit-rate, frame rate, resolution, etc.). The choice of whether to choose a transcoder or a scalable video coder certainly depends on the application to be developed, and there is no ultimate solution that allows developers to rapidly select between them. The purpose of this chapter is to comparatively analyze the two strategies in order to provide readers with some hints to understand the advantages and drawbacks of either approach.

What usually happens in multimedia delivery is that a video server must grant a service to various classes of customers, which usually can be grouped into categories, depending on the channel/terminal capacity. In general, we could identify a low-level user profile with an available bandwidth below 100kbps (portable devices over 2.5G mobile, devices connected by modem over PSTN), a middle-level profile at less than 500kbps (new generation mobile and PDA over 3G, PC devices connected to low-speed xDSL), and a high-quality model for all the applications that can afford broadband services (PC and set-top boxes over high-speed xDSL, fiber, 4G mobile, Wifi/WiMax). In transcoding approaches, the streaming server converts the stream into different compression standards or into different profiles of the same standard to fit the aforementioned requirements. Adaptation capabilities are also required at the network/transport layer. This means that transcoding can be seen as an intermediate layer that receives the high quality video as input and outputs a lower quality/resolution stream. This process requires an ad hoc conversion (see transcoders T1, T2, and T3 in Figure 1) each time a stream is sent over the network.

As an alternative, scalable video coders provide coding strategies and formats able to limit the amount of data to be processed in order to support fast conversion and rate adaptation implementing

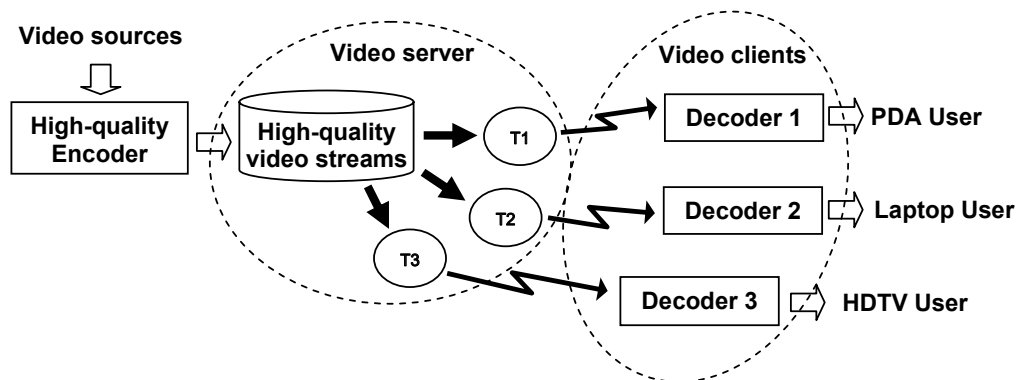


Figure 1. Example of transcoding-based video server; Ad hoc streams are generated for each user category.

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