Chapter 3.8
Present and Future of Software Graphics Architectures for Interactive Digital Television

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ABSTRACT

This chapter aims to define a research agenda regarding the software graphics architecture for interactive digital television (iDTV). It is important to note that by iDTV we do not refer to the provision of a return path, but rather to the potential impact the user has over the television (both video stream and applications) content. We can differentiate three major topics to be included in the agenda: (1) to define a suitable declarative environment for television receivers, (2) to research television input (as multiple input devices) and output (multiple display devices) capabilities, and (3) to rethink the models of television distribution and post-distribution (e.g., peer-to-peer [P2P] networks and optical storage technologies). This

chapter elaborates on these topics.

INTRODUCTION

Digital television receivers are starting to show a reasonable level of maturity and their market penetration is becoming significant (e.g., Italy, Finland, UK, and Korea). A number of multimedia home platform (MHP) (European Telecommunications Standards Institute [ETSI], 2003, 2005) compliant receivers exist and regional standardization initiatives have joined forces by creating the Globally Executable MHP (GEM) standard (ETSI, 2004).

Still, a number of questions regarding the graphics engine (that is, the low-level software presentation control engine) and the interactive capabilities of next-generation receivers arise from both the research community and the industry. Some of the research topics include:

- Definition of a suitable declarative environment for digital television receivers, such as the synchronized multimedia integration language (SMIL) and the World Wide Web Consortium (W3C) recommendation (Bulterman & Rutledge, 2004).
- Integration of other standards, such as Moving Picture Experts Group (MPEG)-4, and Multimedia and Hypermedia information coding Expert Group (MHEG) in current standardization efforts.
- Interaction/visualization using other devices than the remote control/television set (e.g., mobile devices, tablet augmenters).
- Definition of new distribution and post-distribution models, such as P2P and optical storage devices, apart from the typical broadcast model.

This chapter is structured as follows. First, section 2 discusses the state of the art in terms of the broadcast environment, the receiver middleware, and services. Then, based on the state of the art, section 3 identifies relevant research topics in the area. Next, section 4 proposes a research agenda, and section 5 concludes the chapter.

STATE OF THE ART

Jensen (2005) has written an interesting study that categorises and defines iDTV services. He differentiates three different iDTV forms:

- **Enhanced:** Enhanced information that is sent via the broadcast channel (e.g., banners)
- **Personalized:** Automatic selection of programs by the receiver (recommendations) and personal digital recording (PDR) capabilities such as play/pause
- **Complete Interactive:** Return channel provision

He points out that, currently, only "low-technology discount solutions," referring to Nielsen usability evaluation methods, are provided. The most important discount solution today is SMS mobile phone return channel, which can evolve in the future to multimedia messaging service (MMS) solutions.

The following subsections describe the state of the art in terms of broadcast environment, software middleware, and services.

Broadcast Environment

Figure 1 depicts a typical example of a terrestrial digital television broadcast system.[1] It is composed of the following components: MPEG2 encoder, digital video broadcasting (DVB) asynchronous serial interface (ASI) internet protocol (IP) link pair, gateway server, remote control/monitor unit, object carousel, multiplexer, modulator/transmitter, and antenna.

First, the audiovisual stream is encoded with