Interactive TV Show based on Avatars

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Abstract

The main purpose of the research and development activities presented in this paper is related to the content development techniques for the ITV. It deals with the development of a real-time immersive and interactive TV show based on a DVB-MHP technology. It is basically a TV quiz that can be played from home thanks to virtual avatars that simulate the behaviors of the players. In fact, the immersive and interactive dimensions require a new gaming concept that renders the viewers as active and participative actors. This work has been achieved under RTI-TVS ESA (European Spatial Agency) project.

1. Introduction

The world’s emerging multimedia market results from a process of convergence of three following industries that are: the computer industry, the television industry and the telephone industry. The actual convergence describes a process change in industry structures that combines markets through technological and economic dimensions to meet merging consumer needs. The multimedia meta-market generated by this progressive process comes to represent the “strategic field of action” where television operates in the digital era [7].

First of all, the growing integration trend between personal computer and digital TV determines the birth of new emerging markets for interactive TV broadcasting and Web TV. As a consequence we see a progressive convergence of television contents distributed by diverging platforms such as Personal Computer, TV set as well as 3G mobile phones. Television is currently the most important mass media with beside the World Wide Web that is showing another important mass media, which can easily provide interactivity [8]. The combination of the Web and the television can make the classical TV more attractive as well as more interactive. The arrival of the digital television will trigger the development of both television and web integration. Interactive television promises to combine broadcast video, computing power and broadband Internet access to provide a new participatory experience for viewers. Millions of homes in the world already enjoy interactive TV over satellite, cable and terrestrial broadcast services [5].

There are currently four strategies that seem to be revitalizing interest in ITV. The first is digital broadcasting. The second involves various combinations of the Internet and TV or Internet access via the TV. Since both digital broadcasting and the Internet are successes, although to different degrees, systems and services, which bring the two together, can be expected to succeed. Thus, the third strategy involves various combinations of the Internet and digital broadcasting. Finally, the fourth strategy is to provide PC-based Internet access over cable networks via a cable modem [6]. A number of public and private initiatives are being undertaken offering ITV, DTV and Internet TV, information appliances, or convergence technologies [1][2].

This paper is structured as following. Section 2 is devoted to the understanding of ITV development by presenting the technology and the related standards used in the framework of our case study. Then, we propose in section 3 the content development by presenting the architecture and main building blocks used in the different stages of the multimedia value chain. Section 4 is dedicated to TV quiz case study and presents the main results of the actual ITV show scenario and its development.

2. ITV Technology and standards

Interactive TV is essentially considered as a video programming which incorporates some style of interactivity that could be with data on video, graphics on video, video within video, or retrieving video programming and possibly recording it on a digital hard disk drive for further use. The enhancement aspect appears to the viewer as graphical and sometimes purely informational elements on the screen overlaying. In some cases, the viewer may want to access information that is irrelevant to the current
programming such as news, stocks, scores, weather, and so on.

Digital broadcasting is basically evolving with respect to content, programming, and functionality. Digital Video Broadcasting (DVB) will not only carry television and radio programming, but also multimedia objects, that is, combinations of images, sounds, text, and graphics. This takes the form of multimedia broadcasting of declarative content, i.e., media elements with a moderate degree of interactivity, such as the ability to jump from one object to another. Later, it will take the form of multimedia broadcasting of executable content, i.e., software downloaded via a digital broadcasting channel to the users TV receiver or set-top box, which makes it possible (e.g., with JAVA which was originally developed for set-top boxes) to perform calculations and other software functions in the viewer’s TV set or set-top box. The executable content or the application can then be used for different forms of local interactivity (in contrast to full, back to the source interactivity). In fact, the TV receiver becomes a computer and the content becomes computer programming or software. Some of the first and most common forms of executable applications with local interactivity are obviously Electronic Program Guides (EPGs), improved forms of teletext, and electronic games.

The following sub-sections will present the main technologies and the related standards in the context of ITV.

2.1 DVB MHP

The DVB-MHP consists of a software specification for implementation in set-of-boxes, integrating digital TV receivers, interactive appliances, and multimedia PCs. The MHP will consist the broadcast television, Internet computing, and telecommunications through these devices and their associated peripherals. Through this agreement, Java technology will be the foundation of the

MHP, allowing broadcasters and network service providers to create and offer compelling, cross-platform ITV services. The DVB Project selected Java for its digital ITV broadcasting standard. This led to the DVB-MHP specification, accelerating the availability of rich interactive content running on a wide variety of digital television products from many vendors.

The applications downloaded to the Set-top-box (STB) are Java™ applications, built on a suite of APIs tailored specifically for the interactive TV environment.

MHP 1.0.1 defines two profiles:

- Enhanced broadcast: The digital broadcast of audio and video services are combined with executable applications. These applications enable the viewer to interact locally. It does not require an interaction channel.
- Interactive Broadcast: In addition to the features provided by enhanced broadcasting this also enables a range of interactive services associated or independent from the broadcast services. This application area requires an interaction channel.

Although HTML support on the STB is an optional feature of the next version of MHP, MHP 1.1, this paper deals mainly with the second profile – interactive broadcast.

2.2 Java Technology for ITV

The Java platform, along with the Java TV API, provides a development and deployment platform for interactive services. Java provides content developers with a high degree of control and flexibility of the applications. It also offers security, extensibility, and portability across a diverse array of TV receivers [4]. The Java TV API is a part of a specification for a broadcast receiver. The digital TV receiver gets video, audio and data from the broadcast stream and processes them. The receiver gets the media in specific protocols and parses them with an engine. Protocols typically found on a digital TV receiver include the following:

- A broadcast protocol with flow selection;
- An Internet protocol stack with flow selection (UDP, TCP, or a real time protocol);
- A remote procedure protocol stack;
- A video decode protocol with facilities such as decryption;
- An image decode protocol;
- The Java virtual machine.

The Java API provides as abstraction that allows the application programmer to remain unaware of the details of the underlying hardware environment. The software environment on a digital receiver typically consists of the personal Java application environment, Java TV API, and a real time OS (RTOS).

3. Content Development

In order to provide the actual ITV services, the following main required building blocks as presented in Figure 1 will be described in the following sections.
Content
It consists of any source of material (e.g., movies, games, news, images, and sounds) that appears on the user’s TV or PC. For ITV, the media enhancement is required and new authoring tools are necessary in order produce sophisticated systems. Similar tools and skills are required to produce program content where the program is not just a simple film or TV show but a new concept such as interactive home shopping.

Compression
For digital systems, encoders are required to convert analog signals from audio sources to digital and store them in a highly compressed format. The main objective of the compression is to eliminate the temporal and spatial redundancy in TV that results in fewer bits to be transmitted. Many techniques are basically used such as H261 standard for video conferencing. The key compression standard at the moment is the ISO/MPEG standard [3].

Storage and Control System
Even after compression, videos require enormous amounts of storage space which one of the most important elements of ITV. The actual videos are mainly stored on a video server capable to serve many thousands of concurrent interactive sessions.

Transmission System
The digital transmission does not change the essential nature of broadcasting. Over the air broadcasting remains. There are other alternative means to deliver and receive real-time multimedia content, in addition to the usual broadcast delivery systems, namely terrestrial, satellite and cable. However, the traditional broadcasting becomes interactive. In this context, broadcast infrastructure is fully integrated to the Internet infrastructure.

Return Channel
In a fully interactive system, there needs to have a signal going back from the user to the control system taking into account the user’s requests. The return path for most of ITV applications does not to be very fast, since it is transmitting short control information. In traditional broadcast-type systems, the return path can be a telephone line or an Internet connection.

Set-Top-Box
Future televisions will require more intelligence than current TVs. For now an addressable communications box is needed to decode the signals as they arrive at the TV, namely a Set-Top-Box. Depending on the system used, it may also need to perform functions such as decompressing the digital signal or handling the return path.

Subscriber Management
Sophisticated systems for billing and encryption are required in order to ensure that users pay for the services they use and that copyrights are preserved. Conditional access systems ensure that people are paying for what they get. Credit card authentication and payment gateways are used to process purchases made through the television.

4. Immersive TV Show Case Study
The incorporation to real time TV show of an immersive and interactive dimension requires a new gaming concept that renders the viewers as active and participative actors, namely called avatars. Some aspects such as users motivations, commercial revenues, audiences, and technical feasibility have been taken into consideration. As a result the following gaming process has been envisaged (see Figure 1).

4.1 Application scenario
In order to allow a maximum of people to play in the interactive part of the game, a two steps selection process is proposed and a big final between virtual players and real players in the studio is organized. The show process is mainly performed as follows:

- The 1ˢᵗ selection process is, for instance, organized (ex: one week) before each show. Everyone can participate by using either a phone or a mobile (SMS) or a set-top box. The questions may be presented on the TV show and on pre-recorded
phone servers. Giving the right answers is what is asked for at this stage. As a result of this selection, the candidates with the highest scores are kept. If still too many then they will be sorted out randomly. The server based on criteria specified by the TV production team organizes the actual team making process. This process could be repeated for each show.

- The “N” virtual teams kept can participate to a second selection process during the show broadcast. Only the players of these teams can see the questions (displayed by the set top boxes), the common TV viewers are not concerned. During this part, the virtual players do answer some of the same questions as the real players in the studio, but they are not in competition with them directly. This process will repeat itself for each show until the final. At the end of the second selection, the virtual team that scores the highest is selected. It is this winning team that enters in competition with the real teams of the final show. At this phase, all the TV viewers, even those not having a set-top box, will see the show with the real players in the studio and the selected virtual team finalist projection (virtual avatars).

In order to reach potentially all the TV viewers, even those not having a set-top box, it is foreseen once the interactive show version is launched, that TV-café rooms with set-top boxes at major schools could be organized in order to use it.

4.2 Graphical interfaces

As part of the functional specification process, sets of graphical interfaces samples have been developed in order to better picture the targeted application. The graphical interfaces are grouped into two main categories; those addressing the TV viewers and those addressing the TV show producers.

❑ Viewers

The viewers essentially interact will the immersive and interactive application using their “remote control / TV Pad”. They will be able to select avatars to represent themselves, initiate behaviors and answer the quizzes. Quizzes may be presented and played in many different ways, both in terms of layout and in terms of interaction means.

Two developed examples of possible quiz displays and interactions are illustrated in Figure 2 and Figure 3 related to the second phase of screens selection.

In the 1st example of Figure 2, the viewer may read the question and answers; decide which one he thinks is the correct one and answer by pressing the corresponding “key number” of his TV pad. In the 2nd example of Figure 3, the user also reads the question, but he sees the answer scrolling one at a time. As soon as he thinks he has seen the right answer he must press any button of his TV PAD. Speed of reaction handling is different in the two cases.

The final phase is performed in the studio virtual projection.
Here we see the projection of the finalist virtual team in
the studio as shown in Figure 5. The virtual team will
be filmed in real time along with the “in the studio”
college team finalists.
This allows all the TV producers viewers to see the
virtual team play against the real teams in the studio.
The virtual team players will play from their homes
using their set-top boxes.

Producers

The producers are provided with a set of editing tools
through graphical interfaces in order to specify the
look and feel of the virtual show as well as the
challenges to be overcome by the viewers. Such an
environment is based on predefined templates and
multimedia objects that can be customized.

A range of screen samples, for illustration purposes
follows. It aims at better specifying the functional
requirements. Clearly the final prototype will have a
more comprehensive set of screens with an optimized
communication and navigation implementation.
The screen presented in
Figure 6 allows the producer to schedule a
show and to initiate the show definition.

Figure 6: Show scheduling

Figure 6 shows the scene customization screen that
enables a producer to select objects for a scene
(avatars, panels, furniture, etc.) and to customize the
look and feel, the behaviors, the triggering events, etc.
For each object type selected the appropriate
“properties customization” elements are displayed to
the producer so that he can apply them as desired. To
select different objects of a scene one only needs to
scroll left or right in the “objects display area”. In the
present snapshot a composed object is presented and
textures/colors may be applied to its different parts.

Figure 7: Scene customization

The screen presented in 7 enables a producer to specify
a question, to determine the number of choices, to
enter the answers and to specify the correct one(s).

Figure 8: Quiz instantiation

Production process

In order to produce the whole of data linked to a
broadcast program, a user must follow a certain
process. Here we will specify all the process of
production and to whom it may concern since the
“producer” is not the same person at each step of the
procedure.

First we consider the production of the data linked to
the elements that compose a scene: the avatars, the
sceneries and the desks. This production is performed
in 2 steps (see Figure 9).

• Artists like 3d-graphists, 2d-graphists, sound
designers, animators, … provides a set of data
using commercial tools like 3DsMax,
Photoshop, Sound Edit, Adobe premiere, … 
This step is dedicated to produce what we call raw data.
- Artists and developers provide a set of templates of the different actors that compose a scene.

In order to accomplish this task, we use the editor “Builder”, which is not software provided to the final client: we produce all the templates for the client.

![Figure 9: Production Process - Diagram 1](image)

Secondly, we consider now the production of the data relative to the broadcast program. Like previously achieved, this production is performed in 2 steps as presented in Figure 10.

The 1st step consists to produce the rules and the data linked to the trial performed during the program. In a second time we link these elements with a scene to produce a program that can be execute at a given date. For these 2 steps, the client uses an editor “Producer”. For now the editor supports only the trials based on “Question with multi-choices” concept.

5. Conclusion

The MHP TV Show demonstration gives a good vision of IDTV future applications. In fact, the DVB-MHP norm provides a standardized specification to use the return channel that can be exploited in order for instance to participate to a quiz show. The demonstration presented in this paper illustrates the main concepts in terms of reactivity, adaptability and high level of interactivity. The immersive and interactive dimensions required a new gaming concept that renders the viewers as active and participative actors. In fact, regarding to the initial profile of the player and his success in the quiz, appropriated media are selected. The next step under the actual development would be to integrate a team behavior based Avatars. The avatars will basically communicate to adopt team behaviors that illustrate collaborative and cooperative concepts of the gaming in real time.

![Figure 10: Production process - Diagram 2](image)

6. References