Challenges of Interactive Digital Television for t-Learning

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Abstract

We are witnessing the transition from analogue to digital communication technologies and television is no exception. Since its introduction, television has served as an important medium also for education. Interactive digital television offers new potentials for learning. Paper presents challenges of interactive digital television from technological and pedagogical point of views. Research is conducted within ELU project (www.elu-project.eu).

1 Introduction

We would probably agree that television (TV) plays a major role in the society. TV is a familiar and reliable consumer device with 95-99% penetration in European households. It has an impact on nearly anyone from informing, entertaining and educating point of views. Through out the TV history television viewing was usually connected with entertainment. Therefore traditionally TV is perceived as a relaxation medium.

Interactive media users hunt for challenges as is the case for example in computer games, but can also be present in interactive television [1].

We expect that iDTV technologies will open a new era to e-learning using the mass-market broadband TV (Figure 2).

Household penetration of digital TV is high in some EU countries and growing in others, analogue switch-off is scheduled for period from 2007 to 2015 in EU member states.

Paper presents some of the latest advances in the use of iDTV for educational purposes offering learner to actively participate in the show. We explore the potentials to expand the power of iDTV by delivering interactive learning into the home.

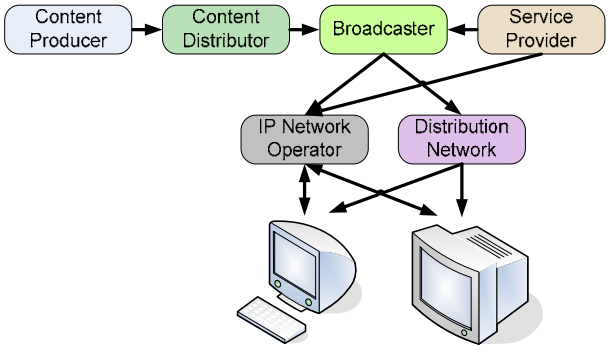

Figure 1. Content flow in the iDTV framework

2 t-learning overview

The t-learning (t- stands for TV) context has several specific features [2]. DTV offers high-quality video but limited interactivity by the remote control. In addition, we need to point out that only limited interactivity will be available for users with low-end STBs enabling only limited possibility for personalization (Table 1, Table 2).

Targeted users of t-learning content might belong to different categories such as looking for education programmes on TV, don't have or use PC, too young or too old to use PC, unable to afford buying PC, lacking motivation to use PC for learning, without Internet access.

Learner characteristics are very important in the process of t-learning. For this reason different target group profiles need to be defined [2] putting emphasis on the following attributes: family and household information, educational background, available technologies, TV viewing patterns, favourite TV shows accessibility issues, etc.

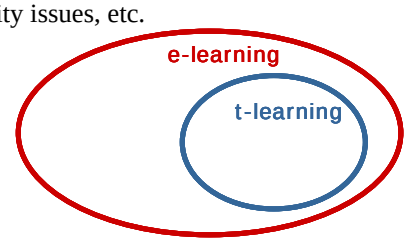

Figure 2. t-learning in the framework of e-learning

2.1 Potentials for learning

Interactive TV offers potentials for increasing learning opportunities at home, school and work. A direct impact on the pedagogical approach may be related to the availability of a return channel.

Traditional television broadcasts provide only one way information transmission. In addition, learner has to schedule his learning activities according to program schema. As a result, analog broadcasted TV is found to be insufficient medium for more engaged learning [2].

Currently two types of services which enable on-demand learning activities are available.

- Video or Content-on-demand services from remote servers.
- Home storage using personal digital video recorders.

Both methods have similar functions to that of a videocassette recorder - stop, start, pause, rewind and fast forward. It is even possible to stop a live broadcast and start it again at the point the viewer has left off.

Available content can be searched through menus or using keyword searching. The emerging solution where service or device learns viewer's preferences is called personalization.

Personalised TV with on-demand services offers big potential for informal learning, which could eventually lead onto more formalised learning.

Users with limited interaction possibilities will receive application through broadcast stream. DTV enables inclusion of data in broadcast stream along with the audio and video.

To reach all potential end-users ELU consortium has made a decision to use mainly broadcast content with limited interactivity possibilities. The idea is to make content accessible independently to technical capabilities of end user terminals [2].

2.2 Interactivity

Today interaction in terms of television refers to the use of remote control to request information over and above the show that is being broadcasted. End user is able to control and influence the subject of communication.

Bates in [3] divides interactivity according to the part of DTV system that is used. Local interactivity happens only between the user and the content held on the STB. While modern DTV systems are able to provide interaction between the end user and the broadcaster or service provider – global interactivity. This happens through the return channel.

Interactivity should be used selectively. In addition the user should have a choice to select the level of interactivity.

3 Interactive television

3.1 Return channel

Interactive services may require varying levels of interaction between the user and the service provider or the network operator. Since local interactivity can be achieved within the user terminal return channel is not required.

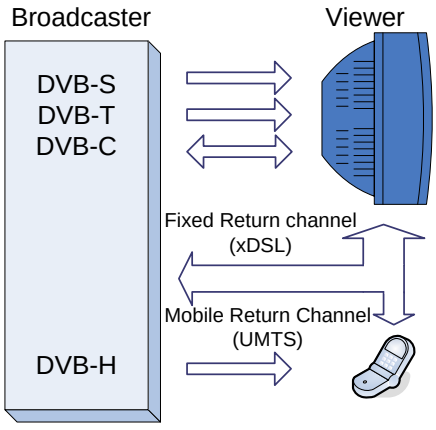

Figure 6. iDTV user point of view

The need for interaction channel across the transmission network (return channel) rose with desire to enable the user to respond to services. Furthermore the service provider or network operator is able to listen and possibly react to user's responds.

The user's response may take the form of some simple commands, like voting in a game show or for purchasing goods advertised in a shopping program (low interactivity). On the other hand, interactive services may require user to have full Internet access at the receiver. Moderate interactivity describes simple movies on demand without player controls. In high interactivity, for example, a TV viewer can actually affect the program watched [2].

3.2 Remote control

The remote control is the main physical element enabling the viewer to interact with a TV application. The traditional remote control is a standard TV interface that has been in use even before the advent of interactive TV and has mainly buttons1 to 9, up – down, left - right arrows, and an OK button. Many manufacturers have added to this four coloured buttons (red, yellow, blue and green).

As a result the remote controls today available on the market only allow simple and limited interactivity modes with a TV application. When compared with a PC we are missing the power of a mouse and of a key board. This implies that interactive TV applications must be designed very carefully in terms of interface in order to cope with limitations of a remote control.

3.3 Set-top-box

A set-top box (STB) is a device that enables a TV set to become a user interface to the Internet and TV. It is the gateway to provide digital information to the home. It acts as a tuner for TV, controls access to many channels such as pay-per-view, video gaming,…

In a home environment STB is a core element for iDTV. Its primary function is to decode broadcasted MPEG stream and transmits it to the television set. It also manages interactive applications placed in the MPEG stream beside audio and video signals. STB controls the interaction between the end user and the outside world. It handles user's requests and communicates with content provider through the return channel.

Elementary set top boxes enable only limited interactivity. Furthermore these STBs offer limited resources in terms of memory, interface and processing power.

On the other hand enhanced TV Set Top Box enable us to experience lots of new interactive services ranging from video shopping to network games, customized EPG…

Network	Return channel presence
IPTV	Yes
DVB-C	Yes
DVB-T	No
DVB-S	No

Table 1 Return channel presence in different DTV networks.

Market offers a variety of STBs with support either to standard definition or High Definition TV. The choice of specific type of STB and it's performances depends on the network operator and it's decision which features and services wants to offer to the end user.

DTV providers operating through different networks are dealing with difficulties at different levels. As for instance with DVB-C and IPTV broadband return channel is already available (Table 1). These network providers are dealing with questions which additional services for end users. Issues involve transport protocols, video decoding, audio format, IP protocol, network protocol, streaming media protocols, etc.

On the other hand ELU project is dealing with DVB-T protocol which in practice does enable the user the global interaction (Table 1). Return channel has to be implemented through IP supporting technology as for instance PSTN, Ethernet or xDSL. Furthermore technology has to be supported by a STB (Table 2).

With increasing user demands and evolving interactive television services the industry still has to overcome many technical and business blocks, nevertheless enabled interactivity radically alters the perception of TV watching in the next decade.

STB / RC	Low end	High end
PSTN	Optional	Yes
Ethernet	Optional	Yes
xDSL	No	Yes

Table 2. Return channel (RC) support with high end and low end STB currently available on the market.

3.4 DVB

The Digital Video Broadcasting Project [4, 5] is an industry-led European consortium of over 300 broadcasters, manufacturers and operators. DVB group succeeded well in creating common European transmission standard for satellite, cable and terrestrial broadcasting by the end of 1993.

DVB is the fastest growing digital television platform in Europe. Many European countries have already launched their digital television services using the DVB-Terrestrial (DVB-T) standard.

Thus, the DVB consortium has standardized a software layer (middleware) which offers to the application layer a common abstraction of the hardware and RTOS layers. This platform-independent middleware is the MHP stack.

What is commonly called MHP is actually the only DVB-MHP standard (based on the MHP 1.0.2 specifications) is the specification currently deployed over the world. Other specifications are currently in development, under the term MHP 1.1.X. These specifications are not standardised, particularly due to a lack of conformance test suite, so they are not deployed yet.

3.5 IPTV

These last years, IPTV follows an important development. The use of IP protocols to receive A/V streams offers new possibilities in term of service transmission. The IP-based platform offers significant advantages, including the ability to integrate television with other IP-based services like high speed Internet access and VoIP [6]. In a typical TV network, using broadcast video technology, all the content constantly flows downstream to all customers. The end user can choose and interact only with the content broadcasted to the set-top box.

A switched IP network works differently. Content remains in the network, and only the content that customer selects is sent into the customer's home.

The DVB project is working with ETSI to provide a standardised solution for IPTV called DVB-IPTV. Mainly, they agree on the necessity to provide IPTV middleware functions to support data broadcasting services such as MHP services from IPTV service providers. The use of a standard version of IPTV protocol would allow important enhancements [7].

4 ELU

The project ELU focuses on potential users' requirements from learning point of view within three main domains [2]: learning platform, learning content, learning processes.

4.1 ELU objectives

The main objective of the ELU project is to encourage the use of MHP and interactive TV. To achieve the goal the project partners will develop and validate the use of iDTV system for learning. In addition, we will research, develop and implement pedagogical scenarios for the use of iDTV.

The specific objectives are:

- Study the pedagogical and technological aspects of iDTV as the medium for learning.
- Develop new tools for creating content for learning to be used on iDTV.
- Develop enhancements to MHP to meet the t-learning needs.
- Share the knowledge in iDTV and t-learning.

4.2 Pedagogical framework of t-learning

The project formulates a new pedagogical approach exploiting the potential of iDTV.

On the pedagogical side, it will examine how to bridge the gap between "edutainment" and "engaged

learning" and how to turn a passive viewer into an active learner.
It will also provide solutions to integrate learning support systems (human and electronic) into its solutions. Therefore to test the effectiveness of iDTV, several types of content will be developed.

In the context of ELU project we propose three different pedagogical frameworks for t-learning:
- Instructional design based approach [8] targeting independent adult learners who do not expect competitive environment. In case of instructional design the aim is on the process of learning rather than on the process of teaching.
- Constructivism-based approach [8] targeting school and university age population. New knowledge must be built on the foundations of already existing frameworks, through problem-solving activity and feedback.
- Game-based approach [2] targeting children population. Games are considered as very promising for developing skills and promoting knowledge.

4.3 ELU technology

On the technological side, the content will be SCORM-compatible and will be delivered on the MHP open platform.

The technological part of the project will enhance the MHP. The ELU platform will include supporting facilities, such as knowledge retrieval and delivery systems. Those will be achieved by the use of immersion technologies and media convergence. User immersion enables "natural learning" while media convergence enables common-core content to be broadcasted to all viewers and personalised data to be transferred and exchanged individually.

The project includes major efforts to enhance MHP with new functionalities required for implementing appealing t-learning systems for the general audience.

The project will advance the state of the art in HCI for interactive digital TV by studying innovative HCI modalities, possibly adapting solutions from interaction with handheld devices.

The ELU platform will also include supporting facilities, such as knowledge retrieval and delivery systems.

Conclusion

iDTV technologies will open a new era to e-learning using the mass-market broadband TV.

Recent study has shown that there is a lack of iDTV pedagogy [2].

Major expected contributions from ELU project are renewing the pedagogical approach, exploiting the potential of iDTV in learning activities, testing the effectiveness of iDTV in the learning process and bridging "edutainment" and "engaged learning"‘.

Within the presented project we will develop and validate iDTV system for e-learning, develop pedagogical scenarios for the use of iDTV and run technology verifications and develop tools.

Interactive digital television (iDTV) is a promising platform for education since the technology can reach a large number of people and provide the user with computing and communication interactivity.

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