

THE NEW DIGITAL TELEVISION AND THE INTERACTIVITY IN ITS MULTIMEDIA APPLICATIONS

Finding the Interactivity Using a Low Cost Solution

José Luis Redondo García, José Luis González-Sánchez, Alfonso Gazo Cervero
and Javier Corral-García

Department of Computer Science, Universidad de Extremadura, Escuela Politécnica, Cáceres, Spain
jluisred@unex.es, jlgs@unex.es, agazo@unex.es, javiercg@unex.es

Keywords: Interactive Digital Television, DVB, DVB-H, MHP, Return Channel, OpenTV, IP Television, iDesigner, Osmosys.

Abstract: The new interactive digital television, based on transmission standards like DVB-T, offers an interesting variety of services to both producers and consumers. This technology requires special decoders (STB's), which implement an intermediary software layer (MHP) that is able to execute applications. In order to achieve the interactivity of these applications, STB's must have what is known as return channel. To implement all this theoretical content we have created a scenario for interactive MHP applications using the decoder Strong SRT 5510, trying to show that it is possible to build low cost solutions. With this infrastructure, UEX-TVi has been developed. Students at university can use it to access to the topics of every subject, make test and quizzes, and see Web Pages on TV. The potential of the iTV is clearly demonstrated. Finally, the role that MHP will play in the future has been analysed, as well as the importance of the arrival of the new IP Television.

1 INTRODUCTION

In only a few years, television has become the most important media without any doubt. Watching television is one of the most frequent activities we usually do every day. All this issues are turning television into the third factor of socialization together with family and school.

Changes in the world of telecommunications, improvements of satellite Networks, the new interactive digital TV, etc. are doing that we cannot think in the same terms that we did in the past.

Specifically, innovations that have more impact in this global society may be interactive applications on the TV, use of Internet with the remote control or access to on-line demand programs (VOD), which will allow the user to choose what he wants to watch at any given time. This rapid development of technology brings us to a world of amazing opportunities with great potential for interactivity and participation.

In this context, this paper tries to evaluate the available tools for the development and deployment of these technologies, and test their ability to bring us the promised services at a low cost. Also with the work we have done (the most important, UEX-TVi

implementation) the different degrees of interactivity on television existing today are showed, and interesting conclusions will be found.

2 CONSIDERED SCENARIOS

Before starting this research it is important to choose the topology for the scenario where interactive TV applications will be loaded. The aim is to create an infrastructure where we can execute and debug programs. In our case these programs will be developed for MHP platforms although other alternatives like OpenTV has been considered (Fagerqvist & Marcussen, 2000). Available options are varied, but almost all of them are too expensive for the university. However we have found average solutions for working with these technologies without paying an exorbitant amount of money.

2.1 Professional Equipment

They are the highest-quality devices and allow us to make test like service providers really do. They are much more reliable than the rest of alternatives, and

we can make real measurements of range, bandwidth channel, noise, quality of signal... that cannot be made with lower cost materials.

In the list of devices of this group there are multiplexers, object carousel generators, modulators, amplifiers... The modulator costs around 3000 € and the other has similar prices. It's very expensive for research groups.

2.2 PCI Cards + Carrousel Generators

This option has the advantage of supporting a great number of the capabilities offered by professional equipments. There is a decrease in the costs associated to this alternative because we do not use some devices such as amplifiers, and other ones are simplified, like modulators (multiple entries not required). They are unnecessary to work in a laboratory where the emitter is so near to the receiver. But the price is still considerable.

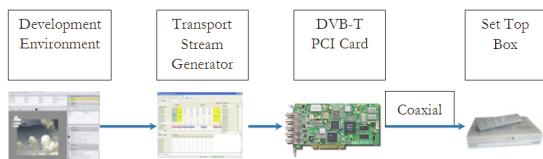


Figure 1: PCI card scenario.

Let us see the parts of this scenario:

- Software for application development: Java development environments like Eclipse.
- TS Generators: they are software multiplexers. There are free alternatives like JustDVB-IT 2.0 (Cineca, 2009) or Opencaster.
- Modulators DVB-H: they receive multiplexed data, then module and sent it over the coaxial cable connector.

2.3 Serial Port Connection

Trying to achieve lower costs, we will reduce the necessary hardware for the scenario. For this, we have found an alternative that does not need the mentioned PCI card, and uses a RS-232 port from our PC.

A clear disadvantage is that the serial cable interface is an old technology, that has a very low transfer rate in order to transmit audio / video.

Also we only send the MHP applications; the audio / video is captured directly from the TV signal that reaches our homes. This issue explain the fact that there is no possible synchronization between applications and video/audio.

However, we will be able to debug and run MHP applications properly, and it is a cheap solution (we

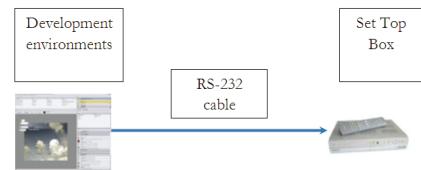


Figure 2: Serial port.

will only have to buy the receiver an the serial cable because the great majority of computers is provided with this type of connection.)

2.4 Using Emulators

STB emulators are programs designed to simulate the internal workings of a conventional STB, and display the TV output on the screen of our PC.

The advantage is that it is the cheapest option of all. Applications are loaded quickly and safely.

But it is not possible to study real parameters like loading times and delivery times like in a real STB. There are also some incompatibilities between the different implementations of the MHP standard.

If we want to choose one of the emulators available today, we may use the proprietary ones (usually included with a development environment and they only work for applications that have been created in it), like Osmosys SDK, NSD MHDK, IDesigner... By the other hand there are free Emulators that can be a good starting point to work with MHP. But they are insufficient when more serious applications are executed (e.g. XletTVView).

2.5 Using Ethernet Interface

This is a solution very similar to using the serial port, but in this case the applications are sent to the STB by an Ethernet cable.

But before using the return channel, we need to send (using the signal input of conventional coaxial cable) a page containing an index, which lists all the services and applications available via Ethernet.

The basic advantage is that most computers have this type of connection. Also, hardware costs are reduced dramatically and the bandwidth of the Ethernet cable is bigger than in the old RS-232 interface.

But many STB's on the market do not have

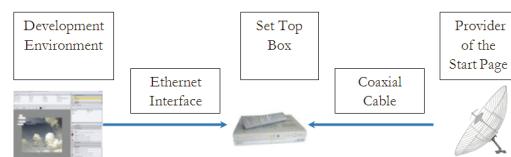


Figure 3: Showing Ethernet scenario.

Ethernet. Also, as the first index page has to come before anything else to our receiver via the TV signal, we are still dependent on a scheme of conventional emission. Finally, there are security problems: applications that come to our STB from the Ethernet interface are allowed to execute on it.

2.6 Virtual Test Centers

Thanks to the MHP-KDB project (MHP-KDB group, 2009) there are some centres where we can test our developments. It is possible to send applications to these remote laboratories to be executed in any of the available STB's.

A main advantage of this alternative is that it is free of charge. Also all the process is performed in real STB's so the results are more reliable.

Therefore this option is important for debugging tasks and never for complete implementations because we have to apply for using the service, and there is limited time of use per day.

3 CREATING THE SCENARIO

Once we have done the necessary inquiries about possible schemas to use, we are going to explain the process of build the scenario that will be used to develop the applications (UEX TVi) and perform appropriate tests.



Figure 4: A full view of our scenario.

3.1 The Set Top Box

As was previously advanced, we have chosen the SRT 5510 distributed by Strong.

There are many reasons for choosing this brand and model. One of them is that the STB is among the



Figure 5: Decoder used for the research.

few in the market with MHP 1.1.X. Also, it supports e-cards, and the return channel is based on Ethernet. It has an average price (about 85 €).

3.2 Sending Data to the Receiver

Osmosys SDK has some applications to load MHP programs using the serial port. Decoders that are internally compatible with Osmosys libraries can use this software. Our STB is one of them.

This software consists of two separate but related programs:

- The first one, "STBProxy", creates a proxy on the serial port to send data from PC to STB.
- The second one, "STBUpload" is the responsible for sending all the files of the application we want to execute, pause, stop... We will see more details later.

This program has a license that is acquired when buying any ABD development decoder or the SDK Osmosys. Luckily, we are allowed to use it by Osmosys under non-distribution conditions and for research purposes. It only works on Windows platforms, so a possible starting point for future researches can be the development of a free version of this product to run in other platforms.

3.3 Other Necessary Components

Apart from the decoder, we need a TV with euro-connector (in our case a Sony Bravia) a PC for sending the data to the decoder, and a TV aerial to receive TV signal.

3.4 Connection of the Components

Here are listed the steps to be done:

- Connect the cable between the STB and the television input.
- Connect the coaxial cable (with the TV signal), into the appropriate port on the back of the STB.
- Connect the serial cable at the back of the STB, and the opposite end at the RS-232 port of our computer.
- Connect the STB to a router or gateway.

3.5 Configuration of the PC

First, the STBProxy program must be executed:

```
stbproxy.exe -com 1 -port 4403 -log milog.txt
```

In this case there are three parameters:

- The serial port number where STB is connected (e.g. COM 1).
- The port number of the machine to mount the proxy on (e.g. 4403).
- A log file to store a list of the actions performed on the proxy.

Then, when trying to send an MHP application, program STBUpload is used:

```
stbupload.exe localhost:4403
test.descriptionfile application -exec
```

The parameters of this command are:

- Number of the port where the proxy has been mounted previously.
- Configuration File. Some of the parameters are: name, control, bound, priority, visibility, main class...
- Folder where the MHP application to load is located.

3.6 Setting up the STB

We must modify a flag stored inside the STB, which indicates the mode of execution of MHP applications. If it is enabled, the decoder sends by the serial port all console messages (errors, exceptions, printed codes...) that are produced during the lifetime of the application. The instructions to enable "Debugging Mode" are fairly simple. First of all, run the program STBProxy and then, load STBconfig with "-debug" flag:

```
stbconfig.exe localhost:4403 -debug
```

A message will appear on the console showing the success of this operation.

4 RESULTS: UEX-TVI

Reading some papers (Peng & Vuorimaa, 2000) and other documentation, especially Steve's Web Page (Morris, 2009) we have implemented our own application, UEX-TVI. These are the main objectives:

- Obtaining a useful application for students at university. They will be able to access to the documents of any particular course using the iTV, make quizzes about these contents, and view Web pages on TV.
- Promoting new iTV researches in this university.
- Checking the functionality provided by the standard profile: we must be able to run multimedia applications in the MHP STB. This will be demonstrated by creating the menu that shows the content of every course.
- Checking the functionality provided by enhanced interactivity profile and interactivity profile. The objective is studying how a user sends information back to the station provider. We will do this by implementing a test to evaluate the contents they have learned before.

- Checking the functionality provided by Internet profile. We will do this by implementing a simple Web browser.

4.1 Economic Viability Study

Development environments (Eclipse) and libraries "MHPstub" (Steven Morris, 2000) are free. The Osmosys application has been gently provided for research purposes, the computer used belongs to the university, and there is a TV in our research group's lab; no additional money is needed for these issues.

Despite this, the decoder costs approximately 80 €. We also need a RS-232 null modem cable (10 €), and a SCART one (€ 3). 93 € is really a very little amount of money, what is very positive.

It is clear that researchers do not receive any remuneration for their work. But if any software company had developed this project, this would be very different. Taking into account that we have been working approximately 1320 hours:

$$1320 \text{ hours} \times 20 \frac{\text{Euros}}{\text{hour}} = 26400 \text{ Euros} \quad (1)$$

This gives an idea of the work we have made.

4.2 Showing the Results

Now we are going to show UEX-TVI. On this way we can clearly verify if the objectives proposed in the early stages have been achieved. A console for debugging appears after the application is loaded:

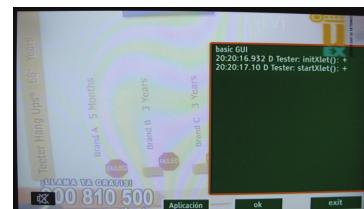


Figure 6: Debug console.

If we press the loading button, the main menu will be shown. Now we can choose the more suitable option between the alternatives (Theoretical content, Quiz, Web Browser, Video Mode and Exit.)

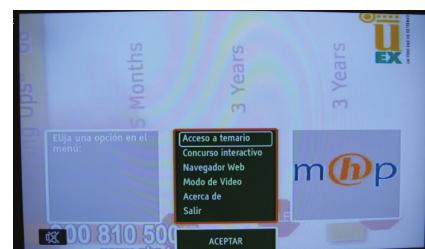


Figure 7: Main Menu.

Selecting the “theoretical content” option, some pages about the world of interactive television will be displayed. For future works it is easy to change the contents maintaining the same structure.



Figure 8: Theoretical contents (full screen mode).

If we choose the “Quiz” option, we have to try to answer every question on the TV screen. All of them are related to the theoretical contents that users have read previously. There is also an explanatory picture.

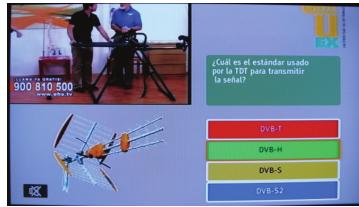


Figure 9: Screen showing the quiz (1/4 screen mode).

The users can choose the option they consider the best by clicking on one of the four buttons on the right. The application will automatically show a message (wrong or right answer) and continue with the next question.



Figure 10: Message showing the answer was good.

“Theoretical content” and “Quiz” menus can be executed in two video modes: full screen mode (figure X-1), and 1/4 screen mode (figure X). We can change from one to another mode with “Video Mode” button.

Finally we have the Web browser. To call it “viewer” rather than “web browser” is more appropriate, because it is not yet capable of managing the HTML hyperlinks so we cannot jump from one document to another. However, it allows the user to look up pages on Internet, and display them on the TV screen, interpreting simple line breaks, horizontal lines, headers and labels. First of

all when clicking on the “Open Web Page” a text box and a virtual keyboard (MHP-KDB, 2009) will appear on the screen. We must enter a valid URL and then the website will be displayed.

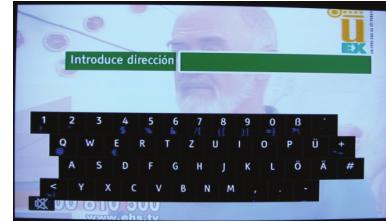


Figure 11: Virtual Keyboard for HTML viewer.

5 CONCLUSIONS

As we can see, we have fulfilled the desired objectives:

- We have got an iTV application that runs on most of the STB's, with a professional multimedia graphic interface.
- With the implementation of “Theoretical contents” and “The Quiz” menus we have demonstrated that we can create useful educational tools for the new iTV scenario.
- We have also worked with the interactivity that digital television platforms promise: the answers introduced by the user during the Quiz are sent back to the same computer that served the iTV application previously. In this machine all the data can be saved and used in various ways, e.g. modifying the application we are broadcasting depending on the results.
- The Internet has been brought to television. It has been a very rudimentary experiment, but it is valid to convince us that soon we will visit any Web page using the remote control of our STB.

The problem comes when realizing that MHP does not have enough support in most of countries. For example the Spanish government can offer new services using iTV, like applications for finding jobs. It would be also interesting to reduce the prices of Interactive STB.

Furthermore, MHP allows conditional service access: so you could enjoy football channels, good series, etc. paying a small fee. This idea is working well in Italy, because many corporations consider this kind of business interesting. Other options are trying to finance some developing groups to make tutorials and better resources. Also, a part of the frequency spectrum can be reserved for testing purposes. On this way licenses to researchers would be easier to obtain.

6 IDEAS FOR THE FUTURE: IPTV + MHP

The unidirectional transmission schema of the terrestrial TV cannot support the new services that are going to arrive.

By other side, words like IPTV are starting to appear everywhere. IPTV is the acronym for Internet Protocol Television. This definition is used to refer to the transmission of the TV signal using IP, the Internet's network protocol. How will they change the world of digital television?

6.1 IPTV

IPTV environments are similar to pay-per-view platforms, like cable or satellite ones. The network operator controls the service. It is responsible for ensuring that the end user is receiving the signal. This allows the service provider to manage and control the signal quality, the kind of the offered services, and the access to them.

To have or not to have the control over the quality of the signal becomes one of the most important elements that differentiates IPTV from Internet Television. This allows the service provider to ensure both signal quality and bandwidth minimum (best services, no cuts, no pixelled images, etc). However, to ensure this signal quality, the operator must use a closed network infrastructure. This involves big economical investments.

6.2 Internet Television

The technologies used by Internet Television are basically the same than in IPTV environments (MPEG4, WMV, etc.). The main difference is that contents are delivered from the provider to the end user via the Internet. Therefore, there is no control over the transport network. This gap makes it difficult to develop a conventional business model like it could be done in the IPTV World.

Then, Internet Television is an open model in which anyone can create contents (film, home video, advertisement, etc.) and make them available to other users in the way they want.

6.3 MHP in this New Approach

These IP technologies are getting more important day by day, but MHP has still a very interesting role providing an adequate platform to execute the Internet protocols that IPTV and Internet Television use. First, some parameters can be loaded using the terrestrial channel as it used to be. Then, MHP

applications can establish a connection using the TCP / IP return channel with any of the providers of digital IP television.

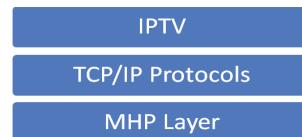


Figure 12: IPTV and MHP in the future.

ACKNOWLEDGEMENTS

Special thanks to organizations and companies that have contributed to the success of this investigation:

- Atos Origin. (www.es.atosorigin.com/es-es/)
- Maat Knowledge. (www.maat-g.com)
- Mit-Xperts (www.mit-xperts.com/)

REFERENCES

- C. Peng and P. Vuorimaa, 2001. "Digital Television Application Manager" Conference for IEEE in 2001.
- M. Fagerqvist and A. Marcussen, 2000. *Application and System Migration from OpenTV to DVB-MHP*. PhD Thesis.
- WiMAX Forum, 2005. *Fixed, nomadic, portable and mobile applications for 802.16-2004 and 802.16e WiMAX networks*. www.wimaxforum.org
- MHP Group, Accessed 2009. *The MHP guide*. www.mhp-knowledgebase.org/publ/mhp-guide.pdf
- Steven Morris, Accessed 2009. *The MHP Tutorial*. <http://interactivetvweb.org/>.
- MHP-KDB project group, Accesed 2009. *The MHP Knowledgebase*. www.mhp-knowledgebase.org/
- Cineca, Accessed 2009. JustDvb-It 2.0. www.cineca.tv/labs/mhplab/JustDVb-It2.0.html