

Interactive Online Marketing Via Digital Terrestrial Television

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Abstract

Background/Objectives: This paper proposes architecture for the development of interactive online marketing services via Digital Terrestrial Television. It allows reaching customers through their television, from the comfort of their homes. **Methods:** This job used 4+1 view model based on Unified Modeling Language for explaining the architecture. It describes two aspects that enable the online marketing services: television contents transmission and interactive contents transmission. **Findings:** For the first, it considers the path that makes the package from the programmers to consumers, to explain conceptually how it behaves during the tour. For the second, it described the transport of the packages by return channel. The interactive package characteristics and the server/client interactivity are too described. Later, a case study shows an online marketing scenario developed on a university television channel. **Novelty:** The description of interactivity, in a novel way explains how it is possible to do online marketing services taking advantage of the wealth of multimedia content offered by digital television.

Keywords: Architecture, Digital Television Transmission, Interactivity, Online Marketing

1. Introduction

Digital Terrestrial Television (DTT) is an important Technology of contents diffusion¹, because it allows the radio spectrum ideal use, with the help of other telecommunications infrastructure (cable network, mobile network, ADSL networks, etc.). DTT allows full user interactivity, thus opening a lot of services and applications²: interactive TV^{3,4}, e-learning communities⁵, e-commerce communities (data services, payments, interactive advertising, among others).

Interactivity^{2,6} enables users to set up relationships to communicate and share information, knowledge and resources. In the case of interactivity on DTT, it relies on the return channel to the Internet, which enables the exchange of diverse multimedia rich content.

Digital television offers a channel with great potential for products commercialization. Recently, many countries are promoting the use of digital television technologies, which creates a great opportunity for the commercial

activities development⁷. However, the process of implementing mechanisms of interactivity has been a little slow. This is not enabling the online marketing activities⁸ development through DTT.

The small supply of marketing solutions via DTT is not allowing the great potential that this channel can offer in the process of connecting demand and supply. These solutions can boost the market of products that viewers could comfortably access from their homes and which television stations or third parties offer. For example, online marketing on DTT could allow a viewer to buy accessories displayed in their favorite TV series. A commercial partner of the Television Stations could offer these accessories.

This job contributes an experience developed in the Television station of the University of Cartagena (Colombia), which allows implementing services of online marketing through DTT. This paper explains the interactive content transmission based on the transmission standard DVB-T2^{9,10}.

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Initially in the document, we mentioned the method used to develop the work. Continuing the document shows a conceptual model that describes the interactive content package transmission. Next, an architecture that follows the guidelines defined model. Subsequently, a case study presents an online marketing application. Finally, we did get conclusions.

2. Materials and Methods

The Television Station of the University of Cartagena (Colombia) was the place of the case study. Documents review, technical observation visits and participation in forums, allows get design requirements and model information.

The documentary information found in the literature on the subject and expert's consultation in the field of DTT allowed identifying functional requirements that should have online marketing systems via DTT. With the information and data collected, we find concepts for a domain model construction using the UML modeling language¹¹.

The guide used to describe the system architecture is 4 + 1 views¹². It chose 4+1 views, because it uses multiple views, which can address the interests of the various "stakeholders" system: end users, content developers, administrators, and others. Scenarios define the views of the architecture and the processes developed. After defining the architecture, we implemented an online marketing case study via DTT. To analyze traffic and bandwidth consumed, we have used the following tools: Wireshark (<https://www.wireshark.org/>) as sniffer for evaluation of traffic and NetworkMiner (<http://www.netresec.com/?page=NetworkMiner>) to study the contents of the packet transmitted interactive content.

3. Results and Discussion

This section initially describes a conceptual model of interactive content transmission. Next, it shows an architecture that enables the interactive content transmission and follows the guidance of the conceptual model; Finally, the document presents a case study of online marketing via DTT.

3.1 Conceptualmodel: Transmission of Interactive Contentpackages

A conceptual model is the basis to explain the context or domain of a system. The conceptual model helps the understanding of the interactive content system domain.

In this section, the conceptual model describes the behavior of interactive content packages. When talking about behaviors refer to the transport and scenarios that this package must cross to reach the viewer.

For simplicity, the model has two sub-models, for ease of understanding and reading: transmission sub-model of TV content, which explains the transport of audiovisual programs by spectrum, and transmission sub-model of interactive content, which explains the transport of interactive content for the return channel.

3.1.1 Transmission of Content Supported by DVB-T2

A transmitter sends a signal to a receiver and it allows the contents' transmission process in Figure 1. TV channel sends contents that travel through the spectrum to be received by a receiving antenna that takes the signal viewed by the TV audience.

Initially programmers assemble your package programmatic content they convey; they reach the transmission channels according to its coverage area. In the channel programming, a grill outside the program (trade-marks, logos, extra information) data and programs from different broadcasters is armed.

After arming the content, it follows to a compression process to encode and digitize the signal. DTT allows issue on the same frequency in the spectrum multiple channels; this is called multiplexing^{3,4}. After multiplexing, the contents are ready to send to viewers, these are transported to the central to deliver them through a transmitter, which propagates the signal through the radio spectrum, i.e. through the set of frequencies that propagate through the air and carry the signal wirelessly.

An antenna receives the signal and feeds the decoder who are responsible for checking permits visibility and later demodulation of the signal to displayed on TV; finally, the viewer can see the programming broadcast by the programming. Significantly, in the same frequency can travel diversity of content from different broadcasters.

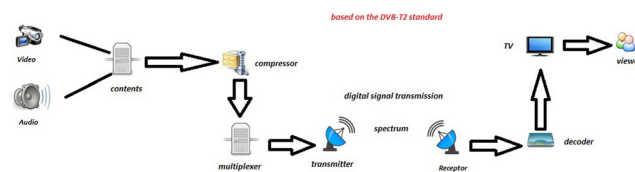


Figure 1. Transmission of contents.

3.1.2 DTT Interactivity through Return Channel

This section explains the interactivity and the contents transport: sending and receiving through the return channel in Figure 2. In the interactive component of DTT¹³, the viewer can interact with TV content through an Internet connection provided by your provider and based on the TCP / IP protocol. When the user requests could start the interactive application via the return channel, which can be any medium used today and connecting to the repository in which are housed and delivered the contents. This in turn performs the management between the applications and the interactive television, allowing the viewer to receive or send information related to the content that is currently watching through his TV. For that reason, it could select contents and acquired via DTT.

3.2 Transmission of Interactive Content via DTT in Online Marketing

In DVB-T2 each service can have associated audio, video and data. The multiplexing of various services forms a Transport Stream (TS).

The Architecture in Figure 3 shows that, the administration module content or broadcast center, delivering

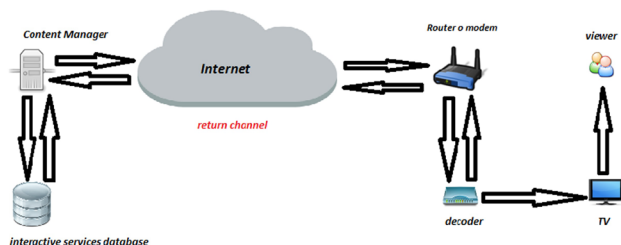


Figure 2. Interactivity on DTT.

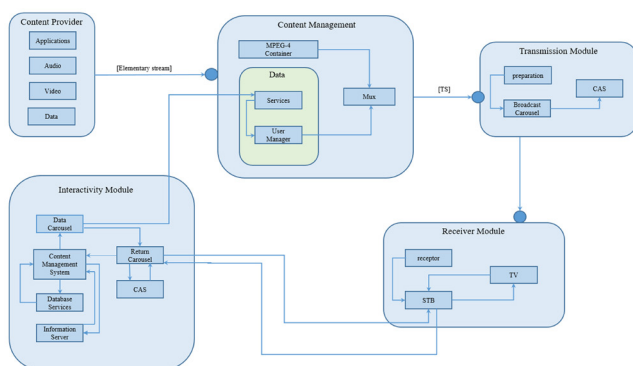


Figure 3. System architecture.

a transport stream transmission module. This transport stream is obtained from the multiplexing of services. Next, each of the components of the architecture is described:

- **Content Provider:** This component generates contents with which it will work, emphasizing how shall consist each, based on the DVB-T2 standard.
- **Content Management:** When the audio and video are sent in analog form from the content provider, it is necessary to take this module coding equipment based on the DVB-T2 standard, in which the video must be encoded in MPEG 4 standard¹⁴. These requirements may vary by country, depending on the regulations.

Continuing with the above, it should do a flow generation packaging and the transport of encrypted service in which setting an identifier or header to the packages. The transport stream is generated in the multiplexer; which segments the packets to be sent more easily and safely.

- **Interactivity Module:** Here, interactive applications are stored. Aided by software generated cyclically, transport flows according to the standard, as well as sending transport stream packets, also called data carousel^{3,4}. You can also appreciate an information server, which supplies information to applications hosted on the content repository. This module takes into account the return channel, which enables that there is an interaction between the user and the content. The return channel may be an Internet network. This component is where we see the attractiveness of DTT.
- **Transmission Module:** This component takes into account the modulator and transmitter devices. They are devices for encode and modulate the multiplex scheme in OFDM - Orthogonal frequency-division multiplexing¹⁵. The Transmission to viewers of the modulated and coded multiplex is via radio frequency.

In the DVB-T2 standard, the modulation and transmission devices need a Gateway to adapt and chaining different input streams (MPEG-2 TS, GS - Generic Stream, GSE - Generic Encapsulated Stream, GCS - Generic Continuous Stream, GFPS - Generic Fixed-length Paquetized Stream). E.g. in Colombia, the DTT signal transmission is performed according to standard DVB-T2 April 2012, with a bandwidth of 6MHz.

- **Receiver Module:** This component sees that there are televisions and decoders, which are in the ability to tune digital signals based on the standard of DTT. These take the signal from the spectrum, and decode it

for understandable by the user. In the interactive component, the decoder must join the same middleware where the application was developed. The decoder must have an Ethernet port for applications requiring return channel or Internet connection.

The system is decomposed into some key abstractions, mainly taken the problem domain in the form of objects or classes of objects. This decomposition is done not only to enhance the functional analysis, but also serves to show mechanisms and common design elements to various parts of the system. Figure 4 shows how the viewer requests a service of interactive content to the decoder; it sends the request through the router, which travel the return channel to the CMS, which will give the information requested by the same route up to the viewer or final consumer; thus, the cycle between client and server is. Figure 5 shows the processes in the system and the way in which the actors communicate; i.e., shown from the perspective of system integration, workflow step of the business and operations of the components that make up the system. Figure 6 shows the requirements to enable online marketing via DTT.

3.3 Case Study: Online Marketing Experience via DTT in Cartagena University TV Station

A change like that involving the digital terrestrial television and the interactivity opens the door to a new range of services and content that will undoubtedly change the current market. This will not only need that the different actors involved in these technological changes generate this technology, but also must come to redefine their business model.

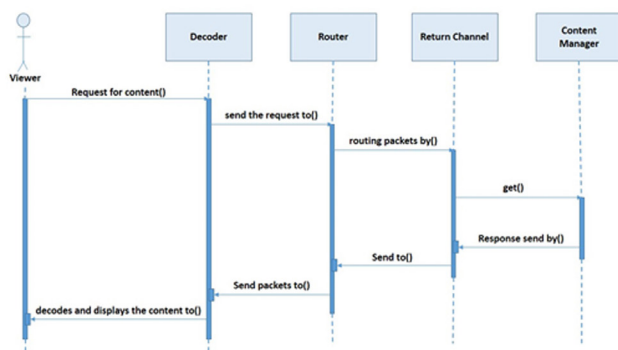


Figure 4. Sequence diagram of interactive content transmission.

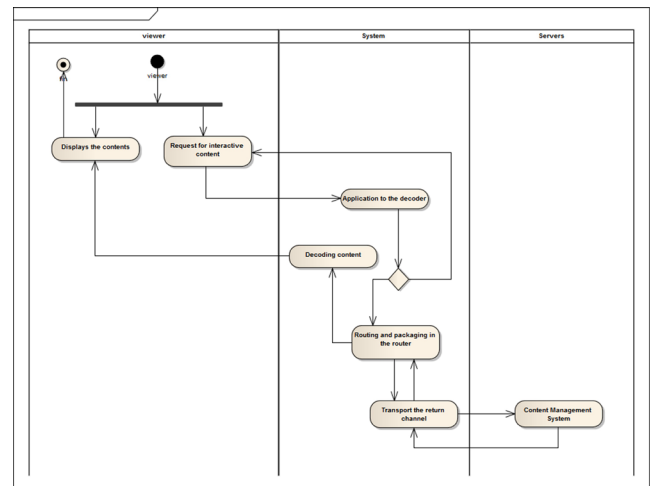


Figure 5. Activity diagram describing interactivity.

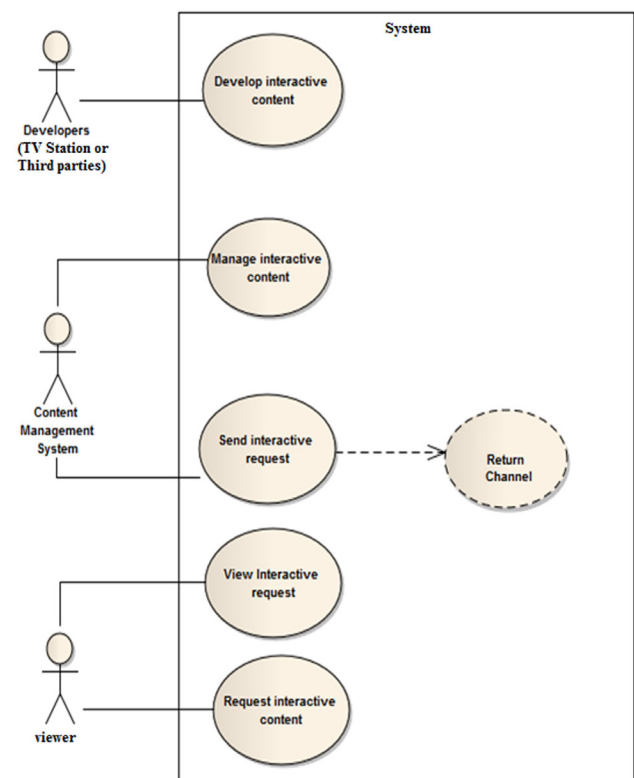


Figure 6. Use cases diagram - interactivity.

The TV can become one of the principal means to make purchases and electronic transactions, so we are optimistic on the potential growth of this market. For example, a TV commercial shows a product of pleasure for the viewers. They could get access to more information about this product and even buy from the comfort of their homes from the TV in Figure 7.

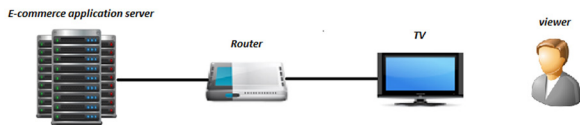


Figure 7. Case study scenario.



Figure 8. Product information (Spanish language) via DTT.

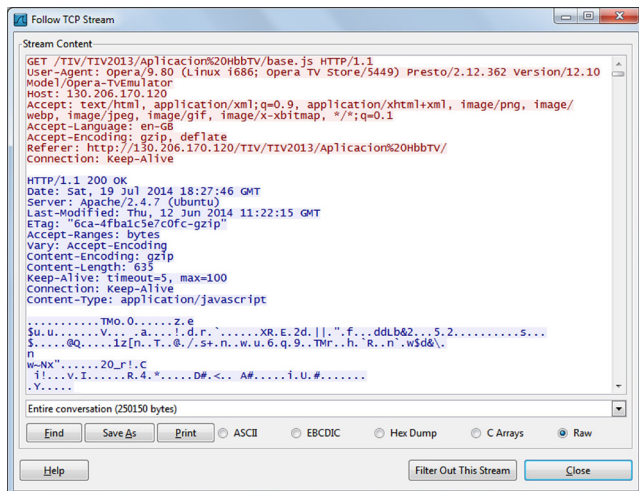


Figure 9. Network traffic - online marketing process.

The case study shows a scenario where a television series is broadcast. In it, they seem actors with accessories like spectacles, cellular and rings. The viewer needs one of these accessories. Through his TV, he asks for information about it and he could buy it. All the above is possible via DTT due to the return channel to the Internet that allows interactivity. The television series was broadcast for academic purposes. That is why payment gateways were not activated; only the accessory request process is performed when the viewer selects the object of interest.

The Computing equipment used as a server for simulation case study had GNU LINUX operating system, in this case UBUNTU (www.ubuntu.com), which functions as an interactive application server, database server and server information. MYSQL (www.mysql.com) is the

Database server and Apache/ 2.4.7 is the Application Web Server. FireHbbTv (<http://firehbbtv.iptv.aw.atos.net/>) emulates the television with the characteristics necessary to online marketing.

When running the application on the TV, it shows the different products offered, in this case the viewer chooses a mobile phone. The TV shows product information and price in Figure 8.

When you run the application, a report of the network traffic evaluation using a sniffer, shows the follows in Figure 9:

You can find that there is communication between the server and the client [Figure 9]. You see the User-Agent: HbbTV, which belongs to the emulator TV and decoder used for research; and Server: Apache / 2.4.7 (Ubuntu), which shows the characteristics of the server.

It identifies that there is successful communication since the package was delivered successfully, showing HTTP / 1.1 200 OK and can be viewed on the product and prices. This allows development of multiple online marketing activities.

4. Conclusions

This work is important to support studies on DTT, analyzing how interactivity on DTT is given. DTT is a relatively new technology in many countries like Colombia and therefore contributes to their understanding, through a conceptual model and architecture that helps to make services.

Initially, the document explained the audiovisual content transmission. Subsequently, the interactive content transmission was described; this shows conceptually how the packets are transported from the programmer to the end-user. This offers basis to find system architecture requirements. The study of the traffic generated and the analysis bandwidth consuming an interactive application achieved conclude that a Colombian home with one broadband mega may have a full interactivity, since the results of the simulation shows that they consume less than 10% of the bandwidth. Today the average Colombian households that have Internet access have a bandwidth equal to or greater than 1MB.

The proposed architecture that considers the interactive part is useful when assembling the transmission system of interactive content. The simulated tests were successful without the use of advanced and own equipment for assembly, giving satisfactory results that can be played in commercial scenarios.

This is important for the design and supply of new online marketing services via interactive digital television, as the case of online buying solutions, which projects with a high tendency of national development.

Finally, the case study shows the opportunity for generating diversity of online marketing solutions, Making it easier for consumers, to purchase in the comfort of their home and enabling the generation of new global markets accessible via DTT.

5. Acknowledgement

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