Development and Deployment of a DVB-IP Scenario

Thesis of Laurea Specialistica

of

Telecommunication Engineering

University of Pisa

Author: Federico Granaiola

Supervisor: David Rincón Rivera

Michele Pagano

Flaminio Minerva

Stefano Giordano

A mio Babbo, il mio numero 1,

A mia Mamma, per avermi sempre sostenuto nei miei studi,

Alla Piccola, che mi è sempre stata vicina,

E a tutta la mia Famiglia.

INDEX

INTRODUCTION

Imagine using a single device to watch television, surf the Web and make video telephone calls. Once stuff of science fiction, now this capability is available on your PC thanks to the arrival of **DVB-IP**.

DVB-IP (Digital Video Broadcasting over IP), or also known as DVP-IPI (*IPI: IP Infrastructure*) and DVB-IPTV, is next-generation digital television delivered over a managed network: it describes a system capable of transmitting, delivering, receiving and displaying a video stream encoded as a series of Internet Protocol packets.

Depending on how robust the system is, DVB-IP can provide more than just video services; it can provide access to on-demand games, data services and digital music. Furthemore, it can provide a single stream to multiple clients simultaneously (multicasting, mandatory for massive *Live Media Broadcast* services such as those that will replace radio-based TV broadcasts) and also use unicast delivery for providing services to a single client (receiver) for applications such as *Content* (or *Video*) *On Demand*. (i.e., VCR-like functionality, where the user chooses a movie or a program and is able to watch it, repeat it, play forward and backward, or pause, without noticing that the the stream is coming from the network).

DVB-IP is currently defined for MPEG-2, but in the future will probably be extended to H.264 (and possibly to Microsoft's VC-1), using Transport Stream (TS) as encapsulation. For transmission DVB-IP might use the Internet, but many DVB-IP commercial deployments use Internet-like QoS-enabled networks. Furthermore, there are available error correction techniques (AL-FEC or RTP retransmission) to protect the transport of the contents.

DVB-IP can also offer great interactivity and virtually limitless programming. Only channels selected by the user are delivered to that user, as compared to many channels being delivered to the user and he/she then chooses which to watch, which is the paradigm used in radio-based transmissions (DVB-T -terrestrial, DVB-S –satellite- or DVB–C for cable). Essentially, DVB-IP offers a one-to-one signal, providing channels on-demand as opposed to the standard commercial television`s *'always on'* model. In this *'always on'* model of delivery, a huge number of channels are sent to the customer and the customer, via their remote, surfes through these delivered channels and decides which to watch. With DVB-IP, when a customer clicks on a channel, that is when the channel's content is sent for viewing.

DVB-IP and other IP-based broadband services can be sent to devices other than a set-top box including phones and portable media devices. The signals can be delivered over a variety of networks, including xDSL, WiMAX, WLAN, wired Ethernet, and more. In fact, with DVB-IP, it is possible for example that the router beams the signal to a Wi-Fi

laptop or desktop computer in that room or even in another room. In this way, instead of being delivered through traditional radio frequency broadcast, satellite signal and cable television (CATV) formats, you can watch all TV services just connecting to Internet with your ADSL connection.

The goal of this project is to build a complete scenario where servers and clients can work as they really were inside a DVB-IP environment, following the implementation the last DVB standard ([1]). The project has been carried out at the i2CAT Foundation [35], an IP-centered research institute located at the Technical School of Castelldefels [36] of the Universitat Politècnica de Catalunya (UPC-BarcelonaTech) [37] in its Castelldefels Campus [38]. The testbed included the following elements:

- *UPC/i2Cat network*: it is a Ethernet LAN with IP connectivity (unicast and multicast); the address of the network is 147.83.0.0, but we use just a subnet, specifically 147.83.113.0.

- *2 satellite dishes*: a dish is a type of parabolic antenna designed to receive microwaves from communications satellites, which transmit data transmissions or broadcasts; these antennas are able to receive the channels of the "*satellite*" television (like *SKY*) transmitted with DVB-S.

- *1 terrestrial antenna*: it is a type of antenna able to capture the signal of every channel of terrestrial local and national television; with it, channels transmitted with DVB-T in the Barcelona metropolitan area like *TV3*, *Telecinco*, *Barça TV* and more are available to the vision.

- SERVER-1 (or SERVER-DVB): a PC that we used as our main server: its operating system is Ubuntu 8.04 and its network address is 147.83.113.48.

- SERVER-2: another PC recently set up, that should be the "*backup server*" of SERVER-1, but it hasn't completed yet.

- CLIENT-DVB: it is my laptop and it has been the only client in the network; the operating system we used is Ubuntu 9.04 and its network address is 147.83.113.46.

So in our system we have this situation: the signal, containing all available channels, is captured by the terrestrial and satellite antennas (each one will capture from different frequencies); then that signal arrives at two servers that will be able to extract, through specific cards and DVB API, MPEG-2 TS packets from it, containing video and audio signals, and data tables. At that moment the servers, after a part of network configuration of the client and SD&S, will send the specified content to the client.

The figure shown below presents the entire DVB-IP scenario, used in our project.

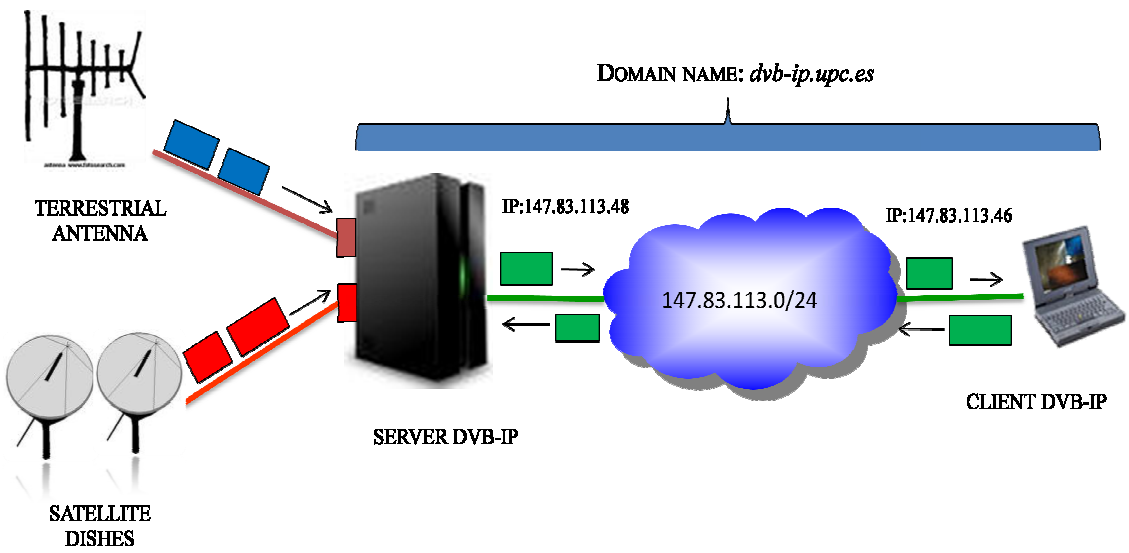

Figure I.1: DVB-IP scenario of the project

To set up the scenario, we have exclusively worked in Linux distributions (*Ubuntu*) and we have made the most of programs in C (except two of them in *php*). This document has been organized in chapters in this way:

Chapter 1: this chapter will be a short introduction to DVB-IP: which areas it covers, used protocols, MPEG-2 TS encapsulation...

Chapter 2: this chapter will examine how the scenario has been made and the subdivision of the whole design.

Chapter 3: this chapter will show what we mean as Network Configuration and how it has been implemented.

Chapter 4: this chapter will describe SD&S - Service Discovery and Selection (i.e. the discovery of the available services and the selection of that one you want to watch).

Chapter 5: this chapter will present all that regarding the transport of content and its protection against packet losses.

Chapter 6: this chapter will describe both the modules of the server and client.

Chapter 7: this chapter will present the project conclusions and the remaining topics still to solve and develop.

This thesis is a part of a UPC/i2Cat project, as described in the paper "*Desarrollo y despliegue de servicios DVB-IP con software open source*", which has been submitted to JITEL 2010 conference (*Jornadas de Ingeniería Telemática*, *Valladolid*, *Spain*, *Septiember 2010*).