

THE FUTURE OF MULTIMEDIA DISTRIBUTED SYSTEMS

IPTV Frameworks

Oscar Martinez Bonastre, Lucas Lopez and Antonio Peñalver
*Operations Research Centre, Language & Computing Unit, Miguel Hernandez University
Avda, Universidad, Elx, Spain*

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Abstract: As distributed systems scale up and are deployed into increasingly sensitive settings, demand is rising for a new generation of communications middleware in support of application-level computing. Thus, knowledge of distributed systems and communications middleware has become essential in today's computing environment. Additionally, multimedia distributed systems are confronting a wide range of challenges associated with limits of the prevailing service oriented architectures and platforms. In this position paper, authors seek that the future of multimedia distributed systems will pass through new techniques to stream data at high rates to groups of recipients, e.g., collaboration systems, computer gaming, embedded control systems and other media delivery systems. In order to be more specific with promising applications for the future of multimedia distributed systems, authors have selected a hot topic like Internet Protocol Television (IPTV). Authors present Tele-ed IPTV, i.e., an author's tool they have developed to distribute multimedia content to TV sets. This position paper argues that future of multimedia distributed systems will pass through IPTV frameworks which interconnect systems that previously have been relatively incompatible.

1 INTRODUCTION

A distributed system consists of several resources that communicate over a network to coordinate the actions and processes of an application (Coulouris, G., 2000). Distributed systems techniques have attracted much interest in recent years due to the proliferation of the Web and other Internet-based systems and services. At present, application development for distributed systems relies more and more on middleware support through the use of software frameworks that provide higher-level abstractions such as distribution of multimedia objects (Birman, 2005). Few years ago, (Mattern, 2003) predicted that multimedia distributed systems should support multimedia data streams to heterogeneous devices, mobile code, user and device mobility. Then, scalability, quality of service, and robustness with respect to partial component failures have become key issues. In this new context dealing with multimedia distributed systems, authors have found out evidences in order to believe that one of most promising and emerging fields for multimedia distributed systems should pass through a hot topic like Internet Protocol Television (Alfonsi, B, 2005).

As a result, this position paper argues that the future of multimedia distributed systems will pass through Internet Protocol Television (IPTV) frameworks which interconnect systems that previously have been relatively incompatible.

The rest of the paper is organized as follows. Section 2 introduces the field of IPTV with associated data distribution techniques. Section 3 presents an author's application which distributes successfully multimedia contents through an IPTV campus network. Section 4 shows conclusions dealing with the future field of distributed systems.

2 RELATED WORK WITH IPTV

Over the recent years Internet Protocol Television (IPTV) has gained popularity among the new broadband services.

Concretely, IPTV is a somewhat new broadband service, but it is expected to grow rapidly over the next few years (Arberg, 2007).

Next, Figure 1 shows the anticipated increase in traffic over broadband access networks. As depicted, this increase will largely be driven by IPTV service.

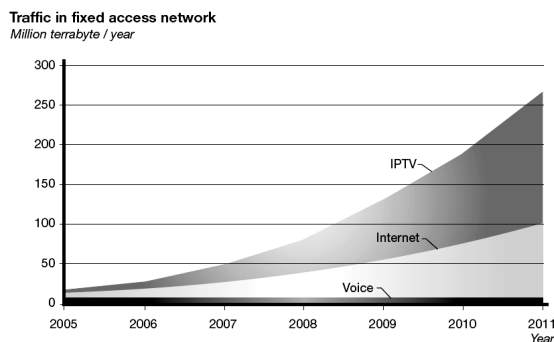


Figure 1: Traffic increase in broadband networks. Source (Arberg, 2007).

Although IPTV has been mentioned during the last couple of years, up to date some confusion exists around the meaning of what is or is not IPTV (Ellis, 2006). Because of this is a very hot topic (O’Driscoll, 2008), it appears to be impossible to clearly define IPTV it can actually be much uncomplicated. From a simple point of view, IPTV is TV distributed over IP. However, two services that are often mentioned as being part of the IPTV concept (Jennehag, 2007). They are: (i) linear TV distributed by multicast (*live-TV*) and (ii) Video on Demand (*VoD*).

Firstly, *live-TV* service is the one considered to be the normal TV service of today, that is, TV-programs are bundled together in a channel following a predefined schedule. In the IPTV deployments over the world at present, *live-TV* service is distributed generally by multicast (Minoli, 2008). In most cases the content is coded using MPEG-2 and multiplexed into a MPEG-2 TS. It is often not necessary to re-encode the video and audio since it they are often delivered to the IPTV playout location (head end) by either satellite or terrestrial transmission and are already coded in MPEG-2. However, since satellite and terrestrial Digital video transmission techniques often bundle several TV-channels together into one TS, i.e., it is necessary to re-multiplex the information associated with one TV-channel into a new TS. One TV-channel now resides inside its own MPEG-2 TS and is packetized into UDP/IP packets and sent to the multicast group.

Secondly, Video on Demand (*VoD*) is the other of the two mentioned IPTV services. *VoD* functions as a video rental store accessible through the TV-set. This sounds remarkable, but is actually quite easily implemented in its more basic forms. Several technologies exist which can assist the *VoD* distribution. Examples of this media distribution are Content Distribution Networks (Verna, 2002) or Akamai platform (Akamai, 2008) respectively.

3 NEXT GENERATION OF DISTRIBUTED SYSTEMS: IPTV FRAMEWORKS

IPTV is sometimes confused with Internet-TV which offers low resolution streamed TV content over the Internet, or even distributed systems such as youTube (youTube, 2008).

As said before, currently the border between what can be considered as Internet-TV and IPTV is not so simple (Ellis, 2006). These have a more TV-like user interface and in some cases a more developed and advanced distribution method. However, these services require the user to download and install some proprietary software before the service can be used. In this framework just arrived, authors argue that the future of multimedia distributed systems will pass through Internet Protocol Television (IPTV) frameworks which interconnect systems that previously have been relatively incompatible. According to this point of view, next subsection presents an author’s application which distributes successfully multimedia contents through an IPTV campus network.

3.1 Case Study: Tele-ed IPTV

Next, Tele-ed IPTV is presented as an IPTV author’s tool developed with open source completely. Framework model for Tele-ed IPTV is introduced as a television-learning (t-learning) service. Concretely, it provides a design basis for the development of this IPTV-based system. Due to the lack of space, in this position paper Tele-ed IPTV modelling is focused essentially in one of the two services mentioned before, i.e., *live-TV* service.

Firstly, the interoperability of Tele-ed IPTV with other traditional learning distributed systems is enabled by the introduction of several interfaces based on TV-set philosophy. To adapt to the limited display, control and input capability of TV devices, authors proposed new development methods of IPTV-Oriented learning resources (Bates, 2003; Rey-Lopez, 2006). In addition, authors proposed conversion strategies to Tele-ed IPTV platform for the vast amount of traditional web-based learning resources. With this process description, Tele-ed IPTV based learning system can provide interactivity function and television-lectures (t-lectures) distribution to the students.

Secondly, Tele-ed IPTV is based on a system of access keys which distinguish between different user profiles (see UML uses cases for student and teacher



Figure 2: Use Case for Student Role.

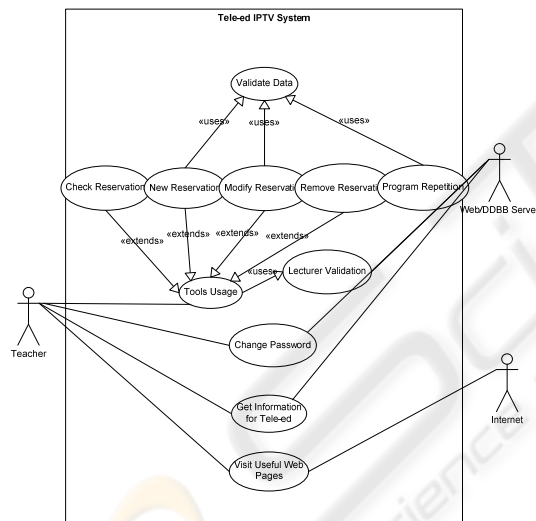


Figure 3: Use Case for Teacher Role.

at figure 2 and 3 respectively).

From the student side, Tele-ed IPTV visualizes subjects which student is enrolled, see figure 2. Student can be subscribed to assist real-time t-lectures or even also download past t-lectures to reinforce educational contents. From the teacher side, Tele-ed IPTV shows a personalized interface with matching courses in development allowing real-time t-lectures transmission or even recording of new pedagogical elements so constant updating is possible, see figure 3.

Thirdly, and perhaps the more important contribution, Tele-Ed IPTV distributes contents to

the network using Internet Protocol Television, i.e., IPTV (O’Driscoll, 2008). Tele-Ed IPTV offers an innovative way of distributing t-lectures through conventional televisions using set-top-box (STB) with an IP (Internet Protocol) network address and high-speed broadband technology. Recently there has been an intensive activity related to the development of IP multicast (Minoli, 2008, Birman, 2007, Eubanks, 2007). The result of these efforts promotes IP multicast on IPTV distributed systems even also with next IP generation (ITU, 2008). Also, Internet2 is approaching so next European Educational Framework promotes the use of technologies, e.g. multicast, which are able to offer real time education and collaboration to hundreds of students through distributed systems using TV sets (Bates, 2008, Arberg, 2007, Alfonsi, 2005). Thus, Tele-Ed IPTV deals with real time education requiring one-to-many communication which is efficiently supported by IP multicast (Kenneth, 1999). By this way multicast reduces the amount of duplicate traffic and improves the quality of IPTV distributed applications (Minoli, 2008). On the other hand, unicast is used whenever they’d request pedagogical contents on demand for last t-lectures. From this point of view, Tele-ed IPTV is implemented using the other service mentioned before, i.e., Video-On-Demand (VoD). Thus, Tele-ed works as a Content Distribution Network (Verna, 2002). Figure 4 depicts TV personalized interface for student side with matching courses in development allowing real-time t-lectures reception or even downloading on demand past t-lectures so constant information is available.

About streaming software, Tele-ed IPV has been programmed using VideoLAN software (Videolan, 2008) at server side. Also, Tele-ed IPTV distributes pedagogical contents using MPEG-2 video format.



Figure 4: TV personalized interface. Student side.

Concretely, Tele-ed IPTV matches different multicast addresses according to each video content delivery. Figure 5 shows a simple testbed scenario where Tele-ed IPTV has been tested successfully. This figure shows how Tele-ed IPTV source distributes video contents through a multicast campus network. Alternatively, receivers are TV devices which are able to receive this multicast traffic through their Set-Top-Box (STB).

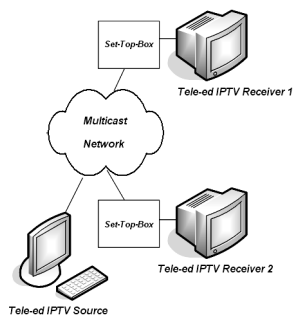


Figure 5: Testbed scenario for Tele-ed IPTV.

STB (Amino, 2008), is a device that connects to a TV. Then, an external source of signal (in this work an Ethernet cable) turns the signal into content which is then displayed on the TV set. Besides, each STB has been configured to receive multicast traffic, i.e., TV channels have been configured with a multicast address for each Tele-ed IPTV content.

4 CONCLUSIONS

In this position paper, the authors have tried to present an arguable opinion about a specific issue, i.e., close future field of multimedia distributed systems. Therefore, main goal has been to convince the audience that IPTV framework has been appeared as a hot topic (Alfonsi, B., 2005, Comms, 2008, O’Driscoll, 2008) to take into account for next multimedia distributed systems. Authors have tried to support their argument with evidence to ensure the validity of their claim. Concretely, they have presented Tele-ed IPTV as a promising framework for next generation of multimedia distributed systems. To conclude, authors maintain that IPTV frameworks are a challenge task to design multimedia distributed systems. About work in progress, authors are configuring Tele-ed IPTV as a real Content Distribution Network. More to the point, they maintain that the transition in learning system design and learning resource plan from traditional web-based learning platforms to IPTV-based learning one is not trivial.

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