# Overview of current trends in IPTV related FP7 projects

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***Abstract*—IPTV is a new trend in the area of Information and Communication Technology providing endless opportunities for advancement in both science and industry. In this paper we give an overview of recent research and technology development in the area, appropriate architectures and design issues, and features and functionalities which are hot research topics. For this purpose we have analyzed relevant FP7 projects (European research area).**

***Index Terms*—IPTV; ViSTA-TV; OptiBand; Full-duplex EAS.**

## I. Introduction

A lot of different opportunities for exploiting the advantages of the IPTV technology arise due to the rapid growth in the field of information technologies enabled by the ubiquitous presence of broadband Internet connections. The usage of this relatively new technology can significantly improve the advancement in the area of socio- economics, medicine etc.

To achieve the anticipated improvement, the overall IPTV quality of service must be taken to a whole new level, by enhancing the data transmission rates and minimizing overall losses during transmission. Thus, the motivation for this paper are these opportunities which IPTV as a technology can provide in order to make a step forward into the future in many different areas.

Although we have analyzed a lot of FP7 projects related to IPTV, we selected the ones which provide novel contribution to the technology. The selection includes realization of the following projects: ViSTA-TV [1], OptiBand [2], W3TV [3], Vital Mind [4], NAPA [5], My-E-Director 2012 [6] and I2WEB [7].

In Section II we explain the meaning of IPTV, its service architecture and standardization. An overview of recent related FP7 projects is given in Section III. We believe that they represent state of the art exploitation of IPTV as a technology. Finally, the discussion and conclusions presented in Section IV will elaborate on future intentions and trends in the explained area of interest.

## II. Background

### A. Definition of IPTV

In this section we explain the benefits of IPTV as a promising technology, and start with elaboration of basic concepts on what it actually represents. Mittal and Mittal [8] defined the Internet Protocol Television as a service intended to deliver broadcast TV, movies on demand and other interactive multimedia services, over a secure, end-to-end operator managed broadband IP network. It is important to say that this broadband IP network provides the desired level of quality of service for the end users, because of the fact that it relies on a broadband Internet connection. In other words, this technology uses the Internet Protocol as a mean to deliver multimedia to the end-users.

The emerging of such a promising convergent service is a result of the fast advancement in the telecommunication broadcast technology, thus becoming attractive for service providers as well as end users across the world [9]. The Internet Protocol television technology term is seen as a set of two main components- the Internet Protocol (IP), which specifies the format of packets and addressing scheme for a network, and Television (TV) in the role of a medium of communication that operates through the transmission of pictures and sounds [8]. By delivering this ubiquitous service with the IP protocol, the service providers are able to offer additional services, such as linear and on-demand programming, which takes the standard TV watching to a next interactive level where the end users have the final saying in what services they will be consuming and when. Thus, the IPTV technology implies a two-way communication through images and sound, which is placed in an IP data network.

The main difference between IPTV and the standard terrestrial broadcasting TV is the two-way interactivity which characterizes IPTV, meaning that the end users are able to send their requests to the service providers, who then deliver them their requested services. This technology fully utilizes the advantages of packet data transmission, which leads to more efficient use of the network and overcomes the lack of channel dedication availability problem that usually occurs in channel data transmission [10].

### B. IPTV Service Architecture

The ITUs IPTV NGN architecture considers four main roles which comprise the IPTV reference service model [11], as depicted in Fig 1. The basic constitution modules are the following:

- *Content provider*. The entity which owns/sells the content which the end-users wish to consume.
- *Service provider*. Responsible for providing the IPTV service comprised of content which comes from the Content provider.

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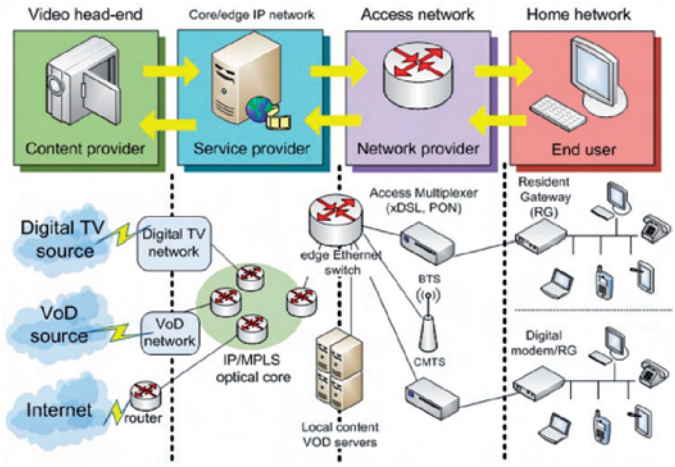


Fig. 1: Generic IPTV system architecture [8],[12]

- *Network provider*. Assures the connection between the Service provider and the End user.
- *End User*. The entity which consumes the IPTV service.
- *Video Head-End*. A point in the network which captures and formats linear and on-demand content for distribution over the IP network.
- *Video Server*. Computer-based devices connected to large storage systems, which store the video content to be broadcast over the network.
- *Service Provider Core/Edge Network*. Transports the grouping of encoded video streams representing the channel lineup.
- *Access Network*. Links the service provider to the individual household, accomplished by using various transmission technologies.
- *Home Network*. Distribution of the IPTV service throughout the home of the end users.
- *Middleware*. The infrastructure which connects the components of an IPTV solution.
- *Set Top Box (STB)/Terminal*. An electronic device that adapts IPTV data into a format accessible by the end user.
- *Content Security/Conditional Access System (CSA)/ Digital Rights Management (DRM)*. Protection of content and control of real-time viewing [8].

### C. IPTV Services

Cruz et al. observed that the offered IPTV services can be divided into two main categories, continuous stream transmission and the delivery of VoD content [11]. Due to the interactive platform for multimedia distribution, IPTV is capable of providing the following new and innovative services:

- **Digital broadcast TV** - traditional TV, multiple-view TV and pay-per-view services in SD/HD quality. While conventional broadcast, cable and satellite TV provides all channels simultaneously, IPTV delivers only those channels which are being viewed by the subscriber, which gives the consumers freedom to control what and when they want to watch.

TABLE I: Advantages and challenges of IPTV [8]

| Advantages | Challenges |
|---|---|
| Advanced multimedia program guide | Assured quality of service |
| Integrated broadcast, VoD and DVR | High network availability for always-on services |
| Fast scrolling and navigation | Single infrastructure for multi play and future services |
| Live picture-in-picture | Simplified service and network provisioning |
| Channel slide show | Scalable design for growth and changes |
| Multiple picture-in-picture | Security against attack |
| Instant channel changing | Lowest costs- focus on the access network |
| Quick EPG for HDTV and SDTV | Regulatory issues |
| Integrated Web based services | Competition with cable operators |

- **VoD** - a service which provides TV programs per demand of the subscribers, who can interactively request and receive TV channels. Thus, VoD has some additional available features, such as anywhere TV service, global TV channels, personal media channels (PMC) and privacy and security [8].

Table I [8] depicts the advantages and challenges of IPTV, in comparison with standard digital broadcast TV.

## III. Overview of the Latest IPTV Related FP7 Projects

In this section we present relevant recent FP7 projects which exploit the benefits of the IPTV technology in order to contribute to the overall European society progress. These projects have been funded by the European Commission under the Seventh Framework Programme for Research and Technological Development. They both include IPTV as a tool to easily achieve their specific targets.

In terms of the specific goals these projects intend to achieve, we have divided them into two categories- technology and application driven projects. The former address basic concepts and design issues to support the existing IPTV architecture, or add a value with new design ideas upgrading the organization of such a implementation, while the latter relate to possible usage domains defining relevant aspects of implementation, addressing the technology assisted living, realization of business activities, etc. In this case they are either classified by a specific target population, or by a scientific or business discipline.

### A. ViSTA-TV (Video Stream Analytics for Viewers in the TV Industry)

The ViSTA-TV project is a two-year collaborative research project about linked open data (LOD), statistics and recommendations for live TV, involving online TV viewing data,

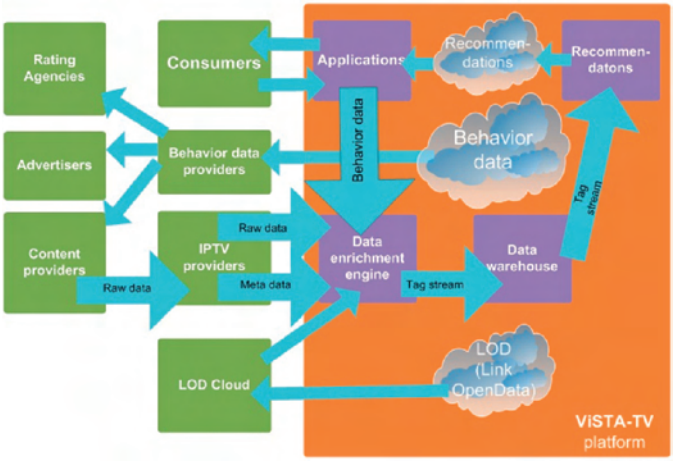


Fig. 2: The ViSTA-TV approach [1]

program metadata and other external data sources. The motivation for this project was the continuously increasing live video content consummation over broadband IP networks, which is an addition to traditional TV broadcasting.

ViSTA-TV proposes to gather consumers anonymized viewing behavior and the video streams from broadcasters/ IPTV transmitters to combine them with enhanced EPG information as the input for a holistic live-stream data mining analysis. Furthermore, the final product consisted of this information will benefit broadcast transmitters and IPTV service providers in terms of having a more clear picture of what the viewers requirements are, as they will be able to use that knowledge while creating the content to be streamed to satisfy them in the future. This will also provide a wider range of choice for the viewers themselves, as more and more service providers will keep trying to offer them exactly what they wanted to watch on TV.

The ViSTA-TV approach has been depicted in Fig 2 [1].

### B. OptiBand

Since IPTV gives telecommunication operators the opportunity to compete in the video streaming market more successfully by providing HD and VoD TV services which challenge the existing CATV and SAT providers, the motivation of this FP7 project was to optimize the bandwidth, and more importantly, the access line rates (predominately ADSL) for the delivery of multiple HD streams over a single ADSL line, and by that enabling multiple HD channels per household.

Due to the fact that cost optimisation and investment protection are mandatory requirements for any business decision in the global economy environment, the key to the success of OptiBand is leveraging the European and worldwide existing ADSL deployments and providing seamless integration to existing solutions and encryption schemes. Key role players in the consortium are consisted of leading operators, vendors and research entities in order to consider both academic and economical aspects of the specific area.

Project objectives include: providing more HD video over existing access technologies and IPTV networks, providing scalable personalized quality of experience, as well as a content aware data drop algorithm, and most importantly, achieving all of these objectives while maintaining the existing IPTV ecosystem intact. In order to achieve all these goals, the development of this project is segmented in five phases, such as requirements, research, development, integration and live testing.

By achieving its own goals, the OptiBand project meets the requirements of the FP7 calls- gaining leadership in key scientific and technology areas, developing and strengthening the human potential of European research etc [2].

### C. W3TV

The W3TV project aims at providing a set of software engineering methodologies and tools to develop market- competitive web applications for Internet- enabled TV Consumers Electronics and IPTV, as well as migrating them across different platforms (TV-CE products, product customizations and IPTV services platforms.) The Consortium includes five SME associations which promote the W3TV tools and methodologies, two SMEs that specialize in applications development, as well as three RTD performers with impressive credentials. Benefits include software engineering tools investment reduction, new sales channels and new revenues, no need for personnel training and specialization in IPTV service architectures etc [3].

### D. Vital Mind

The goal of this project is enabling the elderly to actively participate in mind fitness exercises while watching TV by using a combination of cognitive psychology, the TV medium and advanced interactive ICT. The Consortium includes a total of 8 partners, 4 of which are technology providers. Benefits include design and development of elderly cognitive activities, development of new methods for users control, production of Authoring and Production tools for IDTV STB and the development of usage of USB Flash-Device-UFD as an alternative to a broadcast delivery system [4].

### E. Network-Aware P2P-TV application over wise Networks (NAPA-WINE)

As we already stated, the massive deployment of IPTV platforms offers the opportunity to change the paradigm of current TV broadcasting. However, IPTV services can be provided either by exploiting IP multicast functionalities or relying on a P2P (peer-to-peer approach). The advantage of the P2P approach is that it overcomes the limit of using only a closed network infrastructure by offering a scalable infrastructure. Thus, this project aims at providing suggestions for P2P developments and Internet providers regarding the design of systems that minimize the impact on the underlying transport network, and the cost actions that can be taken in order to better exploit the network bandwidth respectively. This was achieved by creating a software library containing the studied algorithms, as well as releasing a network- aware P2P-TV application [5].

*F. Real-time context-aware and personalized media streaming environments for large scale broadcasting applications (My-E-Director 2012)*

The main goal of this project was to develop a unique interactive broadcasting service enabling end users to select focal actors and points of interest within real-time broadcasted scenes. The service resembles an intelligent director who operates with minimal human intervention. It is being implemented in the scope of large- scale multi actor, multi-target environments and high-activity scenes. The delivery of personalized video streams to the end users is supported by a variety of channels including IPTV, DVB-T, DVB-H and mobile networks. The final product is a prototype context-aware broadcasting platform, offering personalized streaming experiences to individual users or whole user communities and enabling fixed and mobile users to enjoy a diverse range of media services [6].

*G. Inclusive Future-Internet Web Services (I2WEB)*

This projects aims towards developing an inclusive future Internet service front-end to address the challenges of web, media convergence and user- generated content by using user-centered design. The goals include developing compliance tools for inclusive services usable by the broadest range of users, and providing search for such services. These developments are prototyped with inclusive services in: Social Networking/Web 2.0, Ubiquitous /Mobile Web and IPTV/iTV. The I2WEB tools are delivered as Open Source ontologies and SOA interfaces. This project delivers high-added-value inclusive services, particularly by disabled and older users [7].

## IV. Discussion, Conclusion and Future Work

Deeper analysis of the selected FP7 projects, leads to a conclusion that IPTV is an new emerging technology that represents a possible direction of future ICT ubiquitous and pervasive computing solutions. We have presented basic IPTV features and functionalities, the service architecture and types of services that IPTV offers with analysis of the impact of relevant FP7 projects.

Almost all research projects build the basic functionalities and upgrade with added value, such as enhanced EPG information as the input for a holistic live-stream data mining analysis (ViSTA-TV), providing video services with scalable personalized quality of experience, as well as a content aware data drop algorithm (OptiBand), designing market- competitive web applications for Internet- enabled TV Consumers Electronics and IPTV, which can be migrated across different platforms (W3TV), enabling the elderly to actively participate in mind fitness exercises by using advanced interactive ICT (Vital Mind), the design of a two-way emergency alert system (EAS) with very high availability which implements IPTV STB devices, reducing energy consumption in the IPTV network etc.

Most of the recent FP7 projects related to IPTV are technology based, meaning that the main goal is to define new concepts and architecture design issues. The others are application oriented, addressing different areas, where the IPTV might generate added value, making it not just a promising technology support, but also a respected innovation.

Having learned that IPTV can rise many opportunities for overall ICT growth, and technology assisted living, our future work will be aimed towards implementing the functionalities in new concepts and application areas, such as medicine, economics, industry etc.

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