NEXT GENERATION IPTV SERVICES AND TECHNOLOGIES

GERARD O'DRISCOLL

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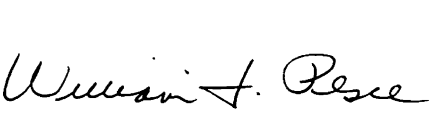

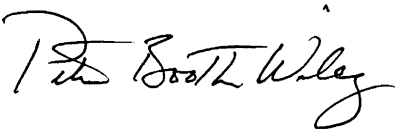

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This book is dedicated to my loving wife Olive and our three precious children; princess number 1 (Aoife AKA our Baby Fifes), princess number 2 (Ciara our little rascal), and of course the new boss in the house baby Ger (AKA Gerdie). Also a big dedication goes to my mother and father living in Dear Old Skibbereen, County Cork; my two young Celtic Cub brothers — Owen and Brian; Sarah Maddie, Ruairi, and baby Alice (sister-in-law, nieces and nephew); and finally, for my old drinking buds in *Electronic Production*!

CONTENTS

PREFACE

The highly anticipated IPTV industry sector has become a reality. Commercial deployments of IPTV services by telecommunication companies around the world continue to increase.

Not only has IPTV become a proven technology that allows telecom companies to deploy advanced services such as high quality multicast IPTV channels, IP based HDTV, and Whole Home Media Networking (WHMN) services but it also provides providers with new streams of revenue. Other advantages of evolving IPTV services include personalization and immediate access to a wide variety of on-demand digital content.

For wireline and wireless telcos that have already moved into the video services' sector, IPTV has the potential to generate additional revenue stream.

Although cable and satellite providers have already made significant investments into non-IP-based set-top boxes, networking infrastructure, and headend equipment, the migration to an IPTV platform is expected to accelerate over the next decade.

The deployment of IPTV services poses a host of unique operational challenges for telecoms, cable, and satellite TV providers. First and foremost, service providers have to make difficult decisions when choosing between the myriad of encoding, Digital Rights Management (DRM), set-top box, networking infrastructures, and security solutions.

Second, a commercially viable IPTV system needs to be streamlined and effectively supported on a day-to-day basis.

Finally, today's IPTV systems require technologies that deliver video content to end users in a manner that provides high quality of experience levels during the consumption of TV services.

These three primary challenges come against a backdrop where customer expectations are at an all-time high.

The mission of this book is to aid its readers in addressing these challenges and meeting the demands of designing, implementing, and supporting end-to-end IPTV systems.

Furthermore, the publication provides global sectors with a detailed technical analysis of deploying and managing end-to-end IPTV systems.

ORGANIZATIONAL AND TOPICAL COVERAGE

IPTV is a new method of delivering digital video and audio content across an IP broadband network. Chapter 1 defines IPTV and presents an overview of the networking infrastructure typically used by IP based video services. Growth drivers, 5-year market forecasts, and industry initiatives for the sector are also outlined.

A wide variety of network delivery technologies are available to provide IPTV services to end users. The second chapter focuses on the six types of broadband access networks commonly used to transport IPTV services and applications.

Encoding is one of the core functions associated with preparing video content for transmission across an IP network. Chapter 3 addresses readers who wish to gain an in-depth understanding of the various compression technologies used by IPTV systems. This chapter also details the communication protocols used by end-to-end IPTV networking systems.

In multicasting a number of users can receive the same video through a single stream with the help of routers and industry standard protocols. Chapter 5 covers the various logical and physical components required to deploy multicasting services across both IPv4 and IPv6 networks. The final section of this chapter deals with issues that affect the channel changing process and identifies various techniques, which may be used by service providers to speed up channel changing times.

The latest IPTV Consumer Devices (IPTVCDs) include a confluence of several new technologies, including, multicore processors, and hard disks, not to mention high capacity home networking interfaces. The fifth chapter in this book deals extensively with several contenders in the IPTVCD marketplace—residential gateways, IP set-top boxes, game consoles, and media servers.

The development of open interactive and IPTV standards has started to pave the way for the deployment of a whole range of next generation interactive IPTV based services. Many of the existing interactive TV standards are being extended to support the delivery of IPTV services. Chapter 6 overviews these standards—DVB's MHP, CableLabs' OCAP, the GEM specification, and ATSC's Digital ACAP.

Content security is a critical issue for the IPTV industry sector. From a service provider's perspective it is no longer acceptable to simply deploy a conditional access system to ensure that only authorized subscribers can access IPTV VoD and broadcast TV services. Content providers are now insisting that service providers incorporate advanced DRM systems into their end-to-end IPTV networking platforms, which will ensure that the content delivered to consumers is

done so in a protected format. A DRM system is used by service providers to maintain control over the distribution IPTV content. Chapter 7 examines the hardware and software architectures required to implement both of these security systems.

Adding WHMN applications to a home network dramatically increases the demand for higher transmission rates. There are a number of interconnection technologies available that allow service providers to effectively implement WHMN services across their subscriber's in-home networks. Chapter 8 takes a detailed look at six of these competing technologies—GigE, 802.11N, HomePlugAV, UPS-DHA, HomePNA, and MoCA.

IP VoD is a core IPTV service that allows end users access a library of on-demand content. In addition to receiving immediate access to various on-demand titles, IP-VoD also allows end users to perform VCR functions on the video streams. IP-VoD is one of the most important services offered by IPTV service providers and is covered in Chapter 9.

Technology advancements in compression, backend servers, security, and IP set-top boxes combined with increased consumer demand are increasing the number of HDTV over IP broadband networks across the globe. Chapter 10 describes the building blocks that comprise an end-to-end IP HDTV system.

The two way capabilities of next generation IPTV networks allows for the deployment of a range of interactive TV applications. Chapter 11 describes 16 of the most popular interactive IPTV applications including caller ID for TVs, EPGs, and IPTV e-mail services.

To ensure that IPTV services compare favorably with existing pay TV providers and to ensure that quality of the viewing experience for end-users of the service is high, IPTV providers need to effectively manage their networking infrastructure. This is a major challenge, which needs to be met through the use of sophisticated network administration methodologies. Chapter 12 outlines a number of engineering and operational functions that are an essential part of delivering high quality video services to end users.

WHO SHOULD READ THIS BOOK

Job title	Role within the organization
System Integrators	There are a variety of companies offering turnkey IPTV system integration services ranging from the large telecommunications manufacturers firms such as Alcatel, Motorola and Lucent to the smaller software based companies that provide professional services to the smaller telco operators. Typical job functions for engineers working with these companies range from integrating encoders and conditional access systems at the headend to deploying video servers and IP video monitoring tools.

Job title	Role within the organization
Engineering directors and managers	These are people who work in telecommunication and cable TV companies who are responsible for overseeing the technical and operational aspects of deploying an IPTV networking infrastructure.
Technicians and engineering staff	The *Next Generation IPTV Services and Technologies* book will be a useful reference book for technicians who are involved in installing, maintaining, repairing, and troubleshooting the hardware and software functionality of IPTV products.
IPTV project managers	These are people who have responsibility for developing and launching IPTV and interactive television applications across broadband networks.
Software engineers	This group of engineers are typically involved in developing interactive TV applications for Film and TV companies that produce content for delivery over IP based networks.

Students and academics on postgraduate courses related to telecommunications, especially networking or IP protocols, will also find the *Next Generation IPTV Services and Technologies* book ideal for supplementary reading.

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Espial product and technical documentation—www.espial.com

European Telecommunications Standards Institute (ETSI) technical specifications—www.etsi.org

ABOUT THE AUTHOR

Gerard O'Driscoll, is an accomplished international telecommunications expert, entrepreneur, and globally renowned authority on emerging technologies. Over the past 15 years Gerard has served in a variety of management, engineering, and commercial positions. He has worked across the full spectrum of technology equipment and services, including broadband, digital TV headend systems, IP networks, home networking, and enterprise IT systems.

O'Driscoll is a frequent commentator on industry trends in the cable, telecoms and digital home industry sectors and has been quoted in a number of premier business publications. In addition, he speaks regularly at leading telecommunication industry events. Gerard's other professional achievements include authoring of books on topics ranging from set-top boxes to home networking technologies and the publication of several market research reports related to the IPTV industry section.

Gerard holds electronics and information technology qualifications from the University of Limerick in Ireland. Author contact details are available at www.tvmentors.com.

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IPTV: THE ULTIMATE VIEWING EXPERIENCE

Digital Television, also known as Digital TV, is the most significant advancement in television technology since the medium was created over a century ago. Digital TV offers consumers more choice and makes the viewing experience more interactive. The analog system of broadcasting television has been in place for well over 60 years. During this period, viewers experienced the transition from black-and-white sets to color TV sets. The migration from black-and-white television to color television required viewers to purchase new TV sets, and broadcasters had to acquire new transmitters, pre, and post production equipment. Today, the industry is going through a profound transition, migrating from conventional TV to a new era of digital technology. Most TV operators have upgraded their existing networks and have deployed advanced digital platforms in an effort to migrate their subscribers away from traditional analog services to more sophisticated digital services. A new technology called Internet Protocol-based television (IPTV), has started to grab headlines across the world with stories about several large telecommunication, cable, satellite, terrestrial, and a slew of Internet start-ups delivering video over an IP based service. As the name suggests, IPTV describes a mechanism for transporting a stream of video content over a network that uses the IP networking protocol. The benefits of this mechanism of delivering TV signals vary from increased support for interactivity to faster channel changing times and improved interoperability with existing home networks. Before describing the various technologies that make up an end-to-end IPTV system, this chapter will start by defining IPTV. The growth drivers for the industry sector are then examined, and

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the chapter concludes with a review of the main organizations developing standards for the industry.

1.1 DEFINING IPTV

There is a lot of buzz and excitement at the moment with regard to IPTV. The technology is growing in importance and is starting to have a disruptive effect on the business models of traditional pay TV network operators.

But what does the IPTV acronym mean and how will it affect TV viewing? For a start, IPTV, also called Internet Protocol Television, Telco TV, or broadband TV, is about securely delivering high quality broadcast television and/or on-demand video and audio content over a broadband network. IPTV is generally a term that is applied to the delivery of traditional TV channels, movies, and video-on-demand content over a private network. From an end user's perspective, IPTV looks and operates just like a standard pay TV service. The official definition approved by the International Telecommunication Union focus group on IPTV (ITU-T FG IPTV) is as follows:

> IPTV is defined as multimedia services such as television/video/audio/text/graphics/data delivered over IP based networks managed to provide the required level of quality of service and experience, security, interactivity and reliability.

From a service provider's perspective, IPTV encompasses the acquisition, processing, and secure delivery of video content over an IP based networking infrastructure. The type of service providers involved in deploying IPTV services range from cable and satellite TV carriers to the large telephone companies and private network operators in different parts of the world.

IPTV has a number of features:

- *Support for interactive TV*—The two-way capabilities of IPTV systems allow service providers to deliver a whole raft of interactive TV applications. The types of services delivered via an IPTV service can include standard live TV, high definition TV (HDTV), interactive games, and high speed Internet browsing.
- *Time shifting*—IPTV in combination with a digital video recorder permits the time shifting of programming content — a mechanism for recording and storing IPTV content for later viewing.
- *Personalization*—An end-to-end IPTV system supports bidirectional communications and allows end users personalize their TV viewing habits by allowing them to decide what they want to watch and when they want to watch it.
- *Low bandwidth requirements*—Instead of delivering every channel to every end user, IPTV technologies allows service providers to only stream the channel that the end user has requested. This attractive feature allows network operators to conserve bandwidth on their networks.

- *Accessible on multiple devices*—Viewing of IPTV content is not limited to televisions. Consumers often use their PCs and mobile devices to access IPTV services.

1.2 DIFFERENCES BETWEEN IPTV AND INTERNET TV

IPTV is sometimes confused with the delivery of Internet TV. Although both environments rely on the same core base of technologies, their approaches in delivering IP based video differ in the following ways.

1.2.1 Different Platforms

As the name suggests Internet TV leverages the public Internet to deliver video content to end users. IPTV, on the contrary, uses secure dedicated private networks to deliver video content to consumers. These private networks are managed and operated by the provider of the IPTV service.

1.2.2 Geographical Reach

Networks owned and controlled by the telecom operators are not accessible to Internet users and are located in fixed geographical areas. The Internet, on the contrary, has no geographical limitations where television services can be accessed from any part of the globe.

1.2.3 Ownership of the Networking Infrastructure

When video is sent over the public Internet, some of the Internet Protocol packets used to carry the video may get delayed or completely lost as they traverse the various networks that make up the public Internet. As a result, the providers of video over the Internet content cannot guarantee a TV viewing experience that compares with a traditional terrestrial, cable, or satellite TV viewing experience. In fact, video streamed over the Internet can sometimes appear jerky on the TV screen and the resolution of the picture is quite low. The video content is generally delivered to end users in a "best effort" fashion.

In comparison to this experience, IPTV is delivered over a networking infrastructure, which is typically owned by the service provider. Owning the networking infrastructure allows telecom operators to engineer their systems to support the end-to-end delivery of high quality video.

1.2.4 Access Mechanism

A digital set-top box is generally used to access and decode the video content delivered via an IPTV system whereas a PC is nearly always used to access Internet

TV services. The type of software used on the PC will depend on the type of Internet TV content. For instance, downloading to own content from an Internet TV portal site sometimes requires the installation of a dedicated media player to view the material. A robust digital rights management (DRM) system is also required to support this access mechanism.

1.2.5 Costs

A significant percentage of video content delivered over the public Internet is available to consumers free of charge. This is however changing as an increasing number of media companies are starting to introduce fee based Internet TV services. The costing structure applied to IPTV services is similar to the monthly subscription model adopted by traditional pay TV providers. Over time, many analysts expect Internet TV and IPTV to converge into a central entertainment service that will ultimately become a mainstream application.

1.2.6 Content Generation Methodologies

A sizeable portion of video content generated by Internet TV providers is user-generated and niche channels, whereas IPTV providers generally stick with distributing traditional television shows and movies, which are typically provided by the large and established media companies.

1.3 OVERVIEW OF AN IPTV NETWORKING INFRASTRUCTURE

Figure 1.1 shows the typical high level functional requirements of an end-to-end IPTV system.

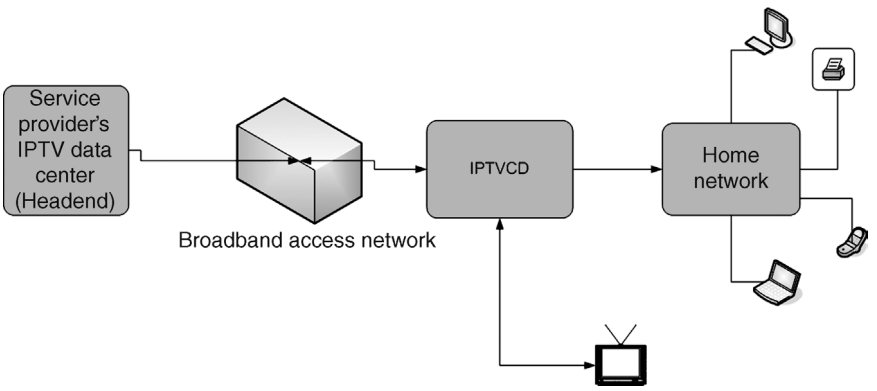

FIGURE 1.1 Simplified block diagram of an end-to-end IPTV system

1.3.1 IPTV Data Center

Also known as the "headend," the IPTV data center receives content from a variety of sources including local video, content aggregators, content producers, cable, terrestrial, and satellite channels. Once received, a number of different hardware components ranging from encoders and video servers to IP routers and dedicated security hardware are used to prepare the video content for delivery over an IP based network. Additionally, a subscriber management system is required to manage IPTV subscriber profiles and payments. Note that the physical location of the IPTV data center will be dictated by the networking infrastructure used by the service provider.

1.3.2 Broadband Delivery Network

The delivery of IPTV services requires a one-to-one connection. In the case of a large IPTV deployment, the number of one-to-one connections increases significantly and the demands in terms of bandwidth requirements on the networking infrastructure can be quite large. Advancements in network technologies over the past couple of years now allow telecom providers to meet this demand for large amounts of bandwidth networks. Hybrid fiber and coaxial based cable TV infrastructures and fiber based telecommunication networks are particularly suited to the delivery of IPTV content.

1.3.3 IPTVCDs

IPTV consumer devices (IPTVCDs) are key components in allowing people to access IPTV services. The IPTVCD connects to the broadband network and is responsible for decoding and processing the incoming IP based video stream. IPTVCDs support advanced technologies that minimize or completely eliminate the effect of network problems when processing IPTV content. As broadband starts to become a mainstream service, the functionality of IPTVCDs continues to change and increase in sophistication. The most popular types of IPTVCDs (residential gateways, IP set-top boxes, game consoles, and media servers) are detailed in Chapter 5.

1.3.4 A Home Network

A home network connects a number of digital devices within a small geographical area. It improves communication and allows the sharing of expensive digital resources among members of a family. The purpose of a home network is to provide access to information, such as voice, audio, data, and entertainment, between different digital devices all around the house. With home networking, consumers can save money and time because peripherals such as printers and scanners, as well as broadband Internet connections, can be easily shared. The home networking market is fragmented into a range of different technologies, which will be covered in Chapter 8.

1.4 KEY IPTV APPLICATIONS AND SERVICES

The two key IPTV applications typically deployed by service providers are broadcast digital TV and content on demand (CoD).

1.4.1 Broadcast Digital TV

Before going into the world of ones and zeros it is important to take a perspective of where television has come from over the past number of years. The history of television started in 1884 when a German student, Paul Gottlieb, patented the first mechanical television system. This system worked by illuminating an image via a lens and a rotating disk (Nipkow disk). Square apertures (small openings) were cut out of the disk, which traced out lines of the image until the full image had been scanned. The more apertures there were, the more lines were traced and hence the greater the detail.

In 1923, Vladimir Kosma Zworykin replaced the Nipkow disk with an electronic component. This allowed the image to be split into many more lines, which allowed a higher level of detail without increasing the number of scans per second. Images could also be stored between electronic scans. This electronic system was patented in 1925 and was named the *Iconoscope*.

J.L. Baird demonstrated the first color (mechanical) television in 1928. The first mechanical television used a Nipkow disk with three spirals, one for each primary color (red, green, and blue). At the time, very few people had television sets and the viewing experience was less than impressive. The small audience of viewers was watching a blurry picture on a 2- or 3-in. screen.

In 1935, the first electronic television system was demonstrated by a company called Electric Musical Industries (EMI). By late 1939, sixteen companies were making or planning to make electronic television sets in the United States.

In 1941, the National Television System Committee (NTSC) developed a set of guidelines for the transmission of electronic television. The Federal Communications Commission (FCC) adopted the new guidelines and TV broadcasts began in the United States. Television benefited from World War II, in that much of the work done on radar was transferred directly to television set design. One area that was improved greatly was the cathode ray tube.

The 1950s were an exciting time period and heralded the golden age of television. The era of black-and-white television commenced in 1956 and prices of TV sets eventually dropped. Toward the end of the decade, U.S. manufacturers were experimenting with a range of different features and designs.

The 1960s began with the Japanese adoption of the NTSC standards. Toward the end of the 1960s, Europe introduced two new television transmission standards:

(1) Systeme Electronique Couleur Avec Memoire (SECAM) is a television broadcast standard in France, the Middle East, and parts of Eastern Europe.

(2) Phase Alternating Line (PAL) is the dominant television standard in Europe.

The first color televisions with integrated digital signal processing technologies were marketed in 1983. At a meeting hosted in 1993, the Moving Picture Experts Group (MPEG) completed a definition of MPEG-2 Video, MPEG-2 Audio, and MPEG-2 Systems.

Also in 1993, the European Digital Video Broadcasting (DVB) project was born. In 1996, the FCC established digital television transmission standards in the United States by adopting the Advanced Television Systems Committee (ATSC) digital standard. As of 1999, many communication mediums have transitioned to digital technology. In recent years, a number of countries have started to launch standard definition and high definition TV services and are acting as the primary driving force behind a new type of television systems—liquid crystal display (LCD) panels and plasma display panels (PDPs). A summary of significant historical TV developments is shown in Table 1.1 and illustrated in Fig. 1.2.

1.4.1.1 DTV Formatting Standards The standard for broadcasting analog television in most of North America is NTSC. The standard for video in other parts of the world are PAL and SECAM. NTSC, PAL, and SECAM standards will all be replaced over the next 10 years with a new suite of standards associated with digital television. Making digital television a reality requires the cooperation of a variety of industries and companies, along with the development of many new standards. A wide variety of international organizations have contributed to the standardization of digital TV over the past couple of years. Most organizations create formal standards by using specific processes: organizing ideas, discussing the approach, developing draft standards, voting on all or certain aspects of the standards, and then formally releasing the completed standard to the general public.

TABLE 1.1 TV Development History

Year	Historical Event
1884	Paul Gottlieb, patented the first mechanical television system.
1923	Vladimir Kosma Zworykin replaced the Nipkow disc with an electronic component.
1925	The first TV electronic system was patented.
1935	The first electronic television system was demonstrated by EMI.
1941	The NTSC developed a set of guidelines for the transmission of electronic television.
1956	The era of black and white television commenced.
1993	The European DVB project was founded.
1996	The FCC established digital television trans mission standards in the United States.
1999	Implementation of digital TV systems across the globe.

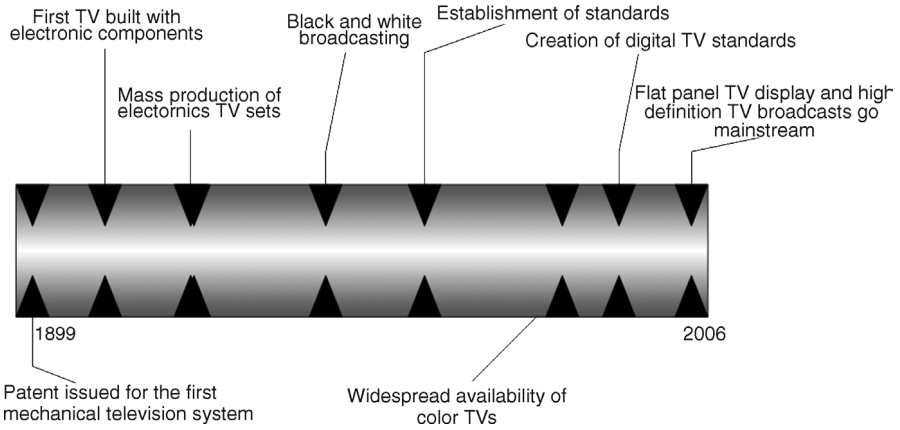

FIGURE 1.2 The evolution of TV

Some of the best-known international organizations that contribute to the standardization of digital television include:

- ATSC
- DVB
- Association of Radio Industries and Businesses (ARIB)

ATSC The ATSC is an organization that was formed to establish a set of technical standards for broadcasting television signals in the United States. ATSC digital TV standards cover a number of different key broadcasting techniques including the delivery of high definition, standard definition, and satellite direct-to-home signals to homes across the United States. The ATSC was formed in 1982 by the member organizations of the Joint Committee on Intersociety Coordination (JCIC): the Electronic Industries Association (EIA), the Institute of Electrical and Electronic Engineers (IEEE), the National Association of Broadcasters (NAB), the National Cable and Telecommunications Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). Currently, there are approximately 200 members representing the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries. ATSC has been formally adopted in the United States where an aggressive implementation of digital TV has already begun. Additionally, Canada, South Korea, Taiwan, and Argentina have agreed to use the formats and transmission methods recommended by the group. For more information on the various standards and specifications produced by this organization visit www.atsc.org.

DVB The DVB project was conceived in 1991 and was formally inaugurated in 1993 with approximately 80 members. Today DVB is a consortium of around 300 companies in the fields of broadcasting, manufacturing, network operation, and

regulatory matters that have come together to establish common international standards for the move from analog to digital broadcasting. The work of the DVB project has resulted in a comprehensive list of standards and specifications that describe solutions for implementing digital television in a variety of different environments. The DVB standards cover all aspects of digital television from transmission through interfacing, security and interactivity for digital video, audio, and data.

Because DVB standards are open, all the manufacturers making compliant systems are able to guarantee that their digital TV equipment will work with other manufacturers' equipment. To date, there are numerous broadcast services around the world using DVB standards. There are hundreds of manufacturers offering DVB compliant equipment, which are already in use around the world. DVB has its greatest success in Europe; however, the standard has its implementations in North and South America, China, Africa, Asia, and Australia. For more information on the various standards and specifications produced by this organization visit www.dvb.org.

ARIB As per the organization's Web site, ARIB conducts studies and research and development, establishes standards, provides consultation services for radio spectrum coordination, cooperates with other overseas organizations, and provides frequency change support services for the smooth introduction of digital terrestrial television broadcasting. The organization has produced a number of standards that are particularly relevant to the digital TV sector, including the video coding, audio coding, and multiplexing specifications for digital broadcasting (ARIB STD-B32). For more information on the various standards and specifications produced by this organization visit http://www.arib.or.jp/english/.

1.4.1.2 Benefits of Digital TV Transmissions When compared to analog technology the broadcasting of television in computer data format provides digital TV viewers and service providers with a number of benefits.

Improved Viewing Experience The viewing experience is improved through cinema quality pictures, CD quality sound, hundreds of new channels, the power to switch camera angles, and improved access to a range of exciting new entertainment services, additionally, any of the picture flaws that are present in analog systems are absent in the new digital environment.

Improved Coverage Both analog and digital signals get weaker with distance. However, while the picture on an analog TV system slowly gets worse for viewers that live long distances away from the broadcaster, a picture on a digital system will stay perfect until the signal becomes too weak to receive.

Increased Capacity and New Service Offerings By using digital technologies to transmit television, service providers can carry more information than is currently possible with analog systems. With digital TV, a movie is compressed to occupy just a tiny percentage of the bandwidth normally required by analog systems to

broadcast the same movie. The remaining bandwidth can then be filled with programming or data services such as

- Video on demand (VoD)
- E-mail and Internet services
- Interactive education
- Interactive TV commerce

Increased Access Flexibility Traditionally, it was only possible to view broadcast quality analog content on a TV set. With the introduction of digital technologies, video is accessible on a whole range of devices ranging from mobile phones to standard PCs.

Note that eventually, all analog systems will be replaced with digital TV. The transition from analog to digital will be gradual to allow service providers to upgrade their transmission networks and for manufacturers to mass produce digital products for the buying public. In development for more than a decade, the digital TV system that has evolved today is the direct result of work by scientists, technologists, broadcasters, manufacturers, and a number of international standard bodies. Till a couple of years ago it was only practical to use radio frequency (RF) based signal technologies to deliver digital TV to consumers. Recent advancements in compression and broadband technologies are however changing this situation, and many service providers have started to use IP based networks to deliver broadcast digital TV services to their customers.

1.4.2 Video on Demand (VoD)

In addition to allowing telecommunication companies to deliver linear TV channels to their subscribers, IPTV provides access to a wide range of downloadable and VoD based content. In contrast to traditional TV services where video programs are broadcasted according to a preset schedule, VoD provides IPTV end users with the ability to select, download, and view content at their convenience. The content delivered through an IPTV VoD application typically includes a library of on-demand movie titles and a selection of stored programming content.

Facilitating access for VoD is a pretty major challenge for all telecommunication companies. For a start, broadband subscribers that regularly access on-demand content consume huge amounts of bandwidth. On top of this the server architecture required to stream video content to multiple subscribers is quite large.

Chapter 9 provides a more detailed insight into the various VoD types supported by next generation IPTV systems.

1.5 GROWTH DRIVERS FOR IPTV

A confluence of forces has brought us to this point.