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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

Next Generation IPTV Services and Technologies, By Gerard O'Driscoll

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.

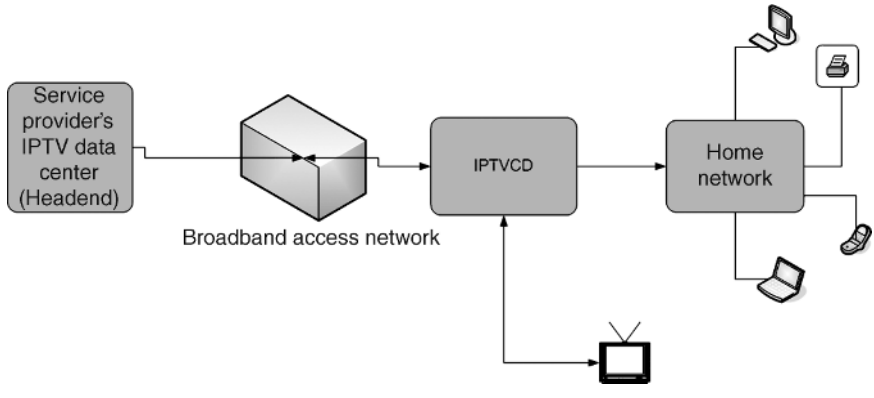

FIGURE 1.1 Simplified block diagram of an end-to-end IPTV system

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.

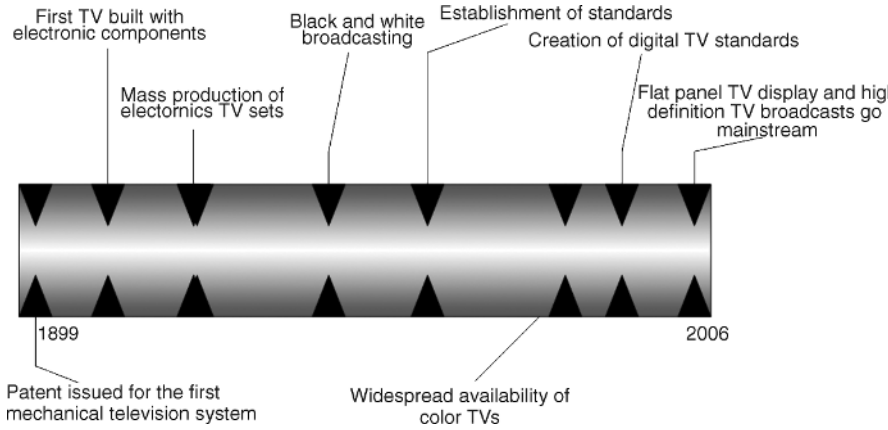

FIGURE 1.2 The evolution of TV

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.

1.5.1 The Digitization of Television

Most satellite, terrestrial, and cable TV providers have started to switch their delivery platforms from analog over to digital. In addition, most if not all of the video production studios are using digital technologies to record and store content. These factors have negated the need to support legacy analog technologies and encouraged the adoption of IP based video content.

1.5.2 Enhancements in Compression Technologies

The delivery of video content over an IP network is nothing new, with a number of Internet streaming video sites in operation for a number of years, at this stage. Traditionally, the quality of the material streamed over the Internet was poor due to limited bandwidth capacities. Increasing numbers of broadband subscribers combined with improvements in compression techniques for digital video content has in recent years changed the whole dynamic of sending TV content over IP connections.

1.5.3 Business and Commercial Drivers

Increased competition combined with declining revenue streams is forcing many telecommunication companies to start the process of offering IPTV services to their subscribers. These new IPTV services typically extend the current broadband, and telephony offerings to form a product bundle called a triple play. For both fixed and wireless telecommunication companies, the triple-play bundle of IP based products is identified as being a key part of growing their businesses in the years ahead.

1.5.4 Growth in Broadband Use

The pervasiveness of the Internet has brought the need for high speed, always on Internet, access to the home. This need is being satisfied through broadband access technologies such as digital subscriber line (DSL), cable, fiber, and fixed wireless networks. The adoption of broadband Internet access by many households in turn has become a very powerful motivation for consumers to start subscribing to IPTV services.

1.5.5 Emergence of Integrated Digital Homes

People's homes and lifestyles are evolving and undergoing a number of positive changes. Many of these changes are underpinned by a range of new technologies that are helping to make life easier in addition to keeping consumers entertained. Digital entertainment devices such as gaming consoles, multiroom audio systems, digital set-top boxes, and flat screen televisions are quite common. In addition, the dramatic reduction in the costs of PCs is increasing the number of households that own multiple PCs. All of these technologies have finally spawned the emergence of

a number of households that can be classified as "digital homes." The increase in these types of homes has started to drive demand for whole home media networking (WHMN) services such as IPTV.

1.5.6 A Wide Range of Companies Are Deploying IPTV

In addition to allowing traditional telephone companies to add video services to their product portfolios, IPTV also allows satellite and terrestrial companies to provide their customer bases with IP based pay TV services.

1.5.7 The Migration of Standard Definition (SD) Television to High Definition TV (HDTV)

HDTV has finally arrived and is here to stay. Demand from consumers is exploding, and improved adoption of digital networking technologies is enticing multiservice network operators to start offering HDTV channels to their program lineup. Additionally, the delivery of HDTV over IP broadband networks is now a required option for telecommunication providers.

The simultaneous combination of all of these drivers has made IPTV a practical reality that is both commercially and technologically successful.

1.6 MARKET DATA

IPTV is projected to be an extremely fast-growing sector over the next 5–10 years. Detailed market research data are set out in Table 1.2 and graphically illustrated in Fig. 1.3.

1.6.1 Messages in the Data

The following points should be noted from Table 1.2 and Fig. 1.3 and an analysis of related data:

- The Compound Annual Growth Rate (CAGR) for the global IPTV marketplace is projected to be 63.31% over this period.

TABLE 1.2 Global IPTV Forecast (Millions of Subscribers), 2005–2010

	2005A	2006A	2007E	2008E	2009E	2010E	5 Year CAGR
Units (millions)	3.22	4.84	10.12	16.4	26.8	37.4	63.31%

Courtesy: TVMentors (leading market research provider to the global IPTV industry).

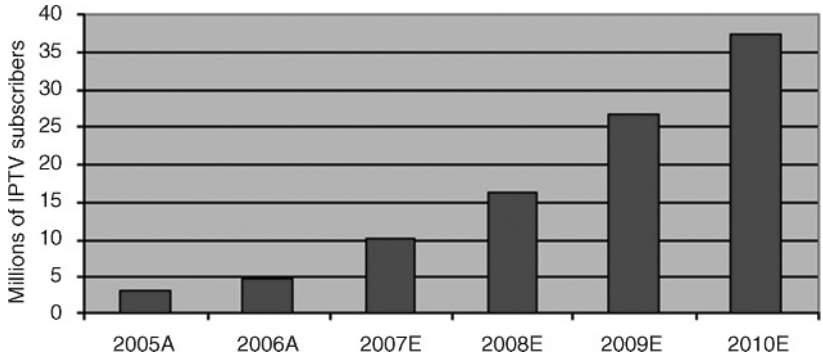

FIGURE 1.3 Worldwide IPTV forecast subscriber forecast, 2005–2010

- At the end of 2006, TVMentors estimated that approximately 4.8 million households around the world subscribed to an IPTV service. TVMentors forecasts that the number of households around the world subscribing to IPTV services offered by network carriers will reach 37.4 million in 2010.
- Over the long term, the number of households adopting IPTV will grow at a steady pace. In fact, TVMentors believes that IPTV services will start to become a mainstream product in 2009.

Note that TVMentors publishes reports and databases, periodically and methodologically, to forecast the number of global IPTV subscribers on an ongoing basis. Readers who are interested in this level of information are encouraged to visit www.tvmentors.com for further details.

1.7 INDUSTRY INITIATIVES TO STANDARDIZE IPTV

Similar to the cable and satellite pay TV sectors, the IPTV industry sector also requires a set of standards that will promote competition, lower costs for subscribers, minimize confusion in the market, and improve the delivery of compelling IPTV services. Standardizing IPTV is not an easy task because there are a whole range of components and systems from different vendors involved with building an end-to-end IPTV system. However, as with any emerging technology, a number of standard bodies and industry consortiums have got involved in standardizing IPTV.

1.7.1 DSL Forum

The DSL Forum is a nonprofit corporation organized to create guidelines for DSL network system development and deployment. The organization has created a

TABLE 1.3 Parts of MPEG-E Standard

Part Number	Part (API) Description
ISO/IEC 23004-1	Architecture
ISO/IEC 23004-2	Multimedia API
ISO/IEC 23004-3	Component model
ISO/IEC 23004-4	Resource and quality management
ISO/IEC 23004-5	Component download
ISO/IEC 23004-6	Fault management
ISO/IEC 23004-7	System integrity management
ISO/IEC 23004-8	Reference software

number of recommendations, which are particularly relevant to the IPTV industry sector. For more information visit www.dslforum.org.

1.7.2 Moving Pictures Experts Group

The Moving Picture Experts Group is a working group of ISO/IEC in charge of the development of international standards for compression, decompression, processing, and coded representation of moving pictures, audio, and their combination. The MPEG group is progressing a number of specifications that are relevant to IPTV. In addition to the various video coding standards, the group has also developed the multimedia middleware ISO/IEC 23004 (MPEG-E M3W) standard. MPEG-E comprises a number of application program interfaces (APIs), which are defined in eight separate parts (see Table 1.3).

For more information visit www.chiariglione.org/mpeg/.

1.7.3 European Telecommunications Standards Institute (ETSI)

ETSI formed a group called Telecoms & Internet converged Services & Protocols for Advanced Networks (TISPAN) in 2003 to develop specifications for next generation wireless and fixed networking infrastructures. TISPAN in turn has structured itself into groups that work to deliver specifications on topics that are particularly important to the IPTV industry sector ranging from home networks and security to network management and addressing. For more information on the various TISPAN specifications visit www.etsi.org/tispan/.

1.7.4 Open IPTV Forum

At the time of writing a group of network operators, network infrastructure equipment providers, and consumer electronic suppliers formed an IPTV standardization consortium called the Open IPTV Forum. The aim of this group is to work with existing standardization bodies to define end-to-end specifications for delivering IPTV services across a variety of different networking architectures. For more information visit www.openiptvforum.org.

1.7.5 Broadband Services Forum (BSF)

According to the organization's Web site "BSF is an international industry resource that provides a forum for dialogue and development, along with the tools and information to address the fundamental business and technology issues vital to the growth and health of the broadband industry." This consortium of companies has a particular focus with regard to IPTV and is promoting the industry through its participation in various industry conferences and trade shows. For more information visit www.broadbandservicesforum.org.

1.7.6 WirelessHD Consortium

The WirelessHD Consortium is a group of technology and consumer electronics companies that were formed in 2006. At the time of writing the group had started to work on a wireless digital interface specification that sends uncompressed IP- and RF-based high definition (HD) TV to HD display panels. When completed the technology is to be incorporated into a range of audio−video equipment types including IP set-top boxes and HD flat panel displays.

1.7.7 State Administration of Radio, Film, and Television (SARFT)

The Chinese state run organization SARFT in conjunction with the Ministry of Information is responsible in China for issuing standards related to the deployment of IPTV technologies in the country.

1.7.8 ITU-T FG IPTV

In the spring of 2006, the ITU established a focus group on IPTV, known as the IPTV FG, to coordinate and promote the development of global IPTV standards. The group is concentrating its energies in five key areas:

- Architecture
- DRM
- Quality of Service (QoS) metrics
- Metadata
- Interoperability and test

For more information visit http://www.itu.int/ITU-T/IPTV/index.phtml.

1.7.9 The Alliance for Telecommunications Industry Standard (ATIS)

ATIS is a telecom industry organization that includes more than 350 companies including the major service providers. To further the standardization work for the IPTV industry sector, ATIS has launched a subgroup called the IPTV Interoperability Forum (IIF). According to the group's Web site, the primary remit of the IIF is to

produce an overall reference architecture for deploying IPTV services, which focuses on four major areas, infrastructure equipment, content security, interoperability testing, and quality of service. The company recently published a number of guidelines in the areas of IPTV digital rights management and architecture:

- *ATIS-0800001:* This document defines the interoperability specifications associated with implementing IPTV DRM systems. The organization plans to use this document as a basis for creating an IPTV DRM/security interoperability specification in the future.
- *ATIS-0800002:* This document provides guidelines to content and service providers on the architecture required to deliver IPTV services.
- *ATIS-0800003:* Published in 2006, this document sets out a roadmap consisting of a number of phases for standardizing the architecture of IPTV systems.
- *ATIS-0800004:* This document defines a framework for monitoring QoS metrics for various types of IPTV services.
- *ATIS-0800005:* This technical document covers the topic of packet loss across IPTV networking infrastructures. In addition to identifying the various causes of packet loss the document also provides readers with a set of recommendations with regard to reducing the impact of packet losses in a live IPTV networking environment.

The organization has agreed to share these documents with other IPTV standard organizations such as the ITU-T FG IPTV to ensure interoperability between the various technologies. The organization also has plans to establish a certification process for IPTV hardware and software vendors in the future. For more information visit www.atis.org.

1.7.10 The Internet Protocol Detail Record Organization (IPDR)

IPDR.org is an industry consortium of service providers, and equipment suppliers exclusively focused on developing and driving the adoption of next generation IP service usage exchange standards worldwide. This organization has taken on the responsibility of defining interoperability standards for IPTV billing, network management, and back-office systems. For more information visit www.ipdr.org.

1.7.11 Internet Streaming Media Alliance (ISMA)

Founded in the year 2000, ISMA is a nonprofit industry alliance of companies, and since its inception, it has received wide industry support. Its mission is to facilitate and promote the adoption of an open architecture for streaming audio and video over IP networks. The organization has developed a number of specifications ranging from improving the channel changing times for IPTV systems to synchronizing graphics and data with streaming video content. All of its specifications produced to date make extensive use of open Internet standards that have been produced by the IETF. For more information visit www.isma.tv.

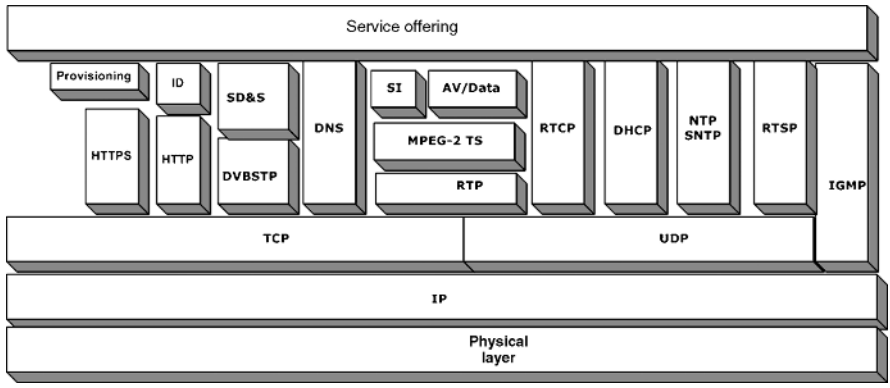

FIGURE 1.4 DVB-IPI protocol framework

1.7.12 DVB-IPI

To develop standards for the transmission of digital TV services over IP broadband networks the DVB organization has formed a group called the DVB Technical Module Ad Hoc Group on IP Infrastructure (DVB-IPI). The goal of the IPI group is to specify technologies that allow consumers to purchase a DVB-IP set-top box in any shop, connect it to a broadband network, switch it on and, without further ado start to receive DVB services over IP based networks. As shown in Fig. 1.4, the

TABLE 1.4 Five IPTV Principles Put Forward by the CEA and a Number of U.S. Telecom Operators

Principle name	Description
Nationwide compatibility	This principle aspires to defining a set of a nationwide (United States initially) common protocols that allow consumer electronics (CE) manufacturers to manufacture devices, which will interoperate with all home networks that run IPTV services.
Open standards	The establishment of a forum that drives the adoption of open standards for the sector.
Reasonable licensing terms	This principle hopes to introduce reasonable and non-discriminatory licensing terms that allow CE manufacturers and video service providers to include improved features in their IP based products.
Reasonable testing and certification procedures	As the name suggests the group is planning to establish a testing and certification process for products that support IPTV services.
Reasonable terms of service for consumers	This fifth and final principle aims to provide consumers a choice when deciding on a digital device to access their IPTV services.

DVB-IPI uses a number of existing and mature technologies to build a framework that supports the overall goal of DVB-IPI.

Note that all of the technologies and protocols, shown in Fig. 1.4, are explained later in the book.

1.7.13 IPTV "Principles" Initiative

The Consumer Electronics Association (CEA) in conjunction with a number of U.S. telecom operators have defined a set of five principles, designed to ensure the availability of digital devices that connect to networks that run IPTV services. The five principles are shown in Table 1.4.

Owing to the broad diversity of IPTV architectures around the world and the diversity of technologies associated with IPTV, the implementations of the above standards will typically vary from network to network.

SUMMARY

Digital TV technology offers fundamental improvements over analog services. For instance, where an analog signal degrades with distance, the digital signal will remain constant and perfect as long as it can be received. The advent of digital TV benefits the general public because of crystal clear pictures, CD quality sound and access to a range of new entertainment services. Depending on geographical location, analog television systems are based on either NTSC, PAL or SECAM standards. There are two main global digital TV standards, namely, DVB and ATSC. By using digital technologies to transmit television, service providers can carry more information than is possible with analog systems.

IPTV is a new method of transporting digital TV content over a network and is seen as part of the larger triple-play bundle that is typically on offer from network operators worldwide. IPTV is a term that describes a system that enables the delivery of real-time television programs, movies, and other types of interactive video content over an IP based network.

Consumers often do not realize that behind the simple end-user IPTV environment is a series of powerful components that seamlessly work together to make the delivery of TV over broadband networks possible. These components or subsystems include the processing of video, security, and the delivery platform. An end-to-end IP video network infrastructure can include some or all of the following elements:

- The IPTV data center that is responsible for processing and preparing content for distribution across a broadband network.
- An IPTV distribution network consisting of a mix of technologies that carry IPTV content from the data center to end users.
- IP digital set-top boxes or residential gateways that are installed at the subscribers home and provide connectivity between the TV and the IP based access network.

- A home network enabling the distribution of data, voice, and video between different consumer devices.

A recipe of increased broadband adoption combined with advancements in compression technologies and the need for telecommunication companies to offer video services to their customers is helping to grow the size of the global IPTV marketplace. A number of organizations are involved in developing technological standards and products to encourage consumers to adopt IPTV services, including SARFT, ITU, ATIS, DVB, IPDR, ISMA, and the CEA.