IP Television Basics: Technology, Operation, Economics, and Services provides an understanding of how IPTV technology operates, what applications it can offer, the costs & benefits of packetized video systems, and how to develop and install IP Television systems.

This book explains why and how companies are using IP television equipment and to provide television services over IP data networks. You will discover what IPTV is, why companies and people are converting systems and selecting IPTV services. The different types of IPTV systems including managed and unmanaged IPTV systems are explained. Discover why companies are choosing to use IPTV systems to deliver television services over traditional television broadcast system.

You will learn how IPTV can allow users to access to a million TV programs virtually anywhere in the world. Discover how IPTV systems can offer new types of content including community created content, personal media channels and unique sponsored programming where content owners pay the IPTV operator to make their content available to viewers.

IPTV video technology is explained including video compression and how IP video transmission is different than broadcast video. IP audio technology is described including audio compression (MP3, AAC) and how IP audio is transmitted along with IP video. Find out how and why IPTV systems use MPEG. You will learn about the different types of MPEG compression (MPEG-2, MPEG-4, H.264/AVC) and how MPEG uses profiles to adapt the media to the many types of user devices that can display IPTV media.

The functional parts of IPTV systems are described along with their operation and the key protocols that are used to manage IPTV networks. Learn about the different types of premises distribution networks (e.g. home networks) and how they are used to distributed IPTV signals within the home.

Explains:
- The different types of IP television systems
- How IP television systems work
- New services are possible through the use of IPTV
- IP Video compression, formats and transmission
- IP Audio compression, formats and transmission
- MPEG technology, options and profiles
- IPTV network components and protocols
- Distributing IPTV in the Home using Home Networks
- IPTV Viewing Devices

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IPTV Basics

By Lawrence Harte
About the Author

Mr. Harte is the president of Althos, an expert information provider which researches, trains, and publishes on technology and business industries. He has over 29 years of technology analysis, development, implementation, and business management experience. Mr. Harte has worked for leading companies including Ericsson/General Electric, Audiovox/Toshiba and Westinghouse and has consulted for hundreds of other companies. Mr. Harte continually researches, analyzes, and tests new communication technologies, applications, and services. He has authored over 80 books on telecommunications technologies and business systems covering topics such as mobile telephone systems, data communications, voice over data networks, broadband, prepaid services, billing systems, sales, and Internet marketing. Mr. Harte holds many degrees and certificates including an Executive MBA from Wake Forest University (1995) and a BSET from the University of the State of New York, (1990).
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Summary:
This IPTV book explains what IPTV is, why companies and people are converting systems and selecting IPTV services. The different types of IPTV systems, including managed and unmanaged IPTV systems, are explained. Discover why companies are choosing to use IPTV systems to deliver television services over traditional television broadcast systems.

Covers:
- The Types of IPTV Systems
- How IP Television Systems Work
- New TV Services
- IP Video Compression Formats
- IP Audio Compression Formats
- MPEG Technology and Profiles
- IPTV Network Components
- Home Media Distribution
- IPTV Viewing Devices
- DRM for IPTV

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*Best Value*
Chapter 1

Internet Protocol Television (IPTV)

IPTV is a process of sending television signals over IP data networks. These IP networks can be managed (e.g. DSL or Optical) or they can be unmanaged (e.g. broadband Internet). If the television signal is in analog form (standard TV or HDTV) the video and audio signals are first converted to a digital form. Packet routing information is then added to the digital video and voice signals so they can be routed through the Internet or data network.

The viewing devices or adapters convert digital television signals into a form that can be controlled and viewed by users. Broadband access providers supply the high-speed data connection that can transfer the digital video television signals. Service providers identify and control the connections between the viewing devices and the content providers (media sources). Media content providers create information that people want to view or obtain.

To get IPTV you need these key parts:

- Viewing devices or adapters
- Broadband access providers
  - IPTV service providers
- Media content providers
The key types of IPTV viewing devices include multimedia computers, television adapter boxes, multimedia mobile telephones and IPTVs. Multimedia computers have video processing and audio processing capabilities. Television adapters convert digital television signals into standard television RF connections that allow standard televisions to watch IPTV channels. IP televisions are devices that are specifically designed to watch television channels through IP data networks without the need for adapter boxes or media gateways.

Figure 1.1 shows several types of IPTV viewing devices. This diagram shows that some of the options for viewing devices include multimedia computers, television adapters, IP televisions and mobile telephones. Multimedia computers (desktops and laptops) allow some viewers to watch Internet television programs without the need for adapters provided they have the multimedia browsers that have the appropriate media plug-ins. Television adapters (set top boxes) connect standard television RF or video and audio...
connectors to data jacks or wireless LAN connections. IP televisions can be
directly connected to data jacks or wireless LAN connections. Mobile tele-
phones that have multimedia play capabilities along with broadband wire-
less services and the necessary media gateways.

Broadband access providers transfer high-speed data to the end users. The
type of technology used by broadband access providers can play an impor-
tant part in the ability and/or quality of IPTV services.

Figure 1.2 shows the key types of broadband access providers that can be
used to provide Internet television service. This diagram shows that some of
the common types of broadband access systems that are available include
powerline data distribution, cable modems, digital subscriber lines (DSL)
and wireless local area network systems (3G wireless, WLAN, MMDS, and
LMDS).

Figure 1.2, Broadband Access Providers
Internet television service providers (ITVSPs) help customers find Internet television channels and manage connections between media sources. While it is possible in some cases for end users to directly connect to a media source by using an IP address or even a web link, Internet television providers may simplify (and limit) the programming guide choices. Internet television service providers may also provide connections to subscription controlled television sources. For this role, the IPTV service provider makes a business relationship with the media source. The IPTV service provider may pay the content provider a fixed fee or share the revenue from funds it collects from their end user.

Figure 1.3 shows that Internet television service providers (ITVSPs) are primarily made of computers that are connected to the Internet and software to operate call processing and other services. In this diagram, a computer keeps track of which customers are active (registration) and what features and services are authorized. When television channel requests are processed, the ITVSP sends messages to gateways via the Internet allowing television channels to be connected to a selected media gateway source (such as television channels). These media gateways transfer their billing details to a clearinghouse so the ITVSP can pay for the gateway’s usage. The ITVSP then can use this billing information to charge the customer for channels viewed.

![Figure 1.3, IPTV Service Providers](image-url)
Content providers create different types of television media programs that are distributed through a variety of media distribution channels. Common program distribution channels include movie theaters, pay per view, airlines and specialty channels, video rentals, and television networks. Traditional television network content sources include movies, television programs, sports channels, news services and other information sources.

Television networks have traditionally been a closed distribution system where the television network determined which program sources could reach viewers. Television networks such as cable television, satellite systems and VHF/UHF transmission systems have a limited number of channels (up to several hundred channels).

IPTV systems can be provided through broadband communication systems that can reach content providers and viewers in any part of the world. This allows IPTV service providers to offer many new content programs that have not been available for standard television distribution systems. New types of content sources include personal media channels, global television channels, interactive media, public video sources and private video sources.

Personal media channels allow viewers to create their own television channel, upload their content (such as pictures and videos) and share their content with other IPTV viewers. IPTV systems provide access to television channels throughout the world. Some of the more popular global television channels that are available on IPTV include news channels, business channels and music television. IPTVs may provide access to interactive media such as games, chat rooms and e-commerce shopping. Governments and public groups have begun providing real time video access to public sources such as courtrooms, popular public places and public web cams. Private video sources are provided by companies or people who are willing to provide and pay to have their signals available on television. Some common private television channels include religious groups, education sources and sports channels.

Figure 1.4 shows some of the existing and new types of IPTV content providers. This diagram shows that IPTV content includes traditional television content sources such as movies, news services, sports, education, reli-
gious and other forms of one-way information content. New types of IPTV content include personal media, global television channels, interactive media, public video sources and private video sources.

Why Consider IPTV and Internet Television Services

There are three key reasons why people and companies are adding to or converting their existing television systems to television over data network capabilities:

1. More channels
2. More control
3. More services
More Channels

To provide IPTV service, a service provider only needs to manage one connection between the end viewer and the media source (such as a television channel). IPTV service providers simply connect (through a switch) to the media source that the viewer has selected at their distribution location. Because IPTV channels can be routed through data networks (such as the Internet), this allows an IPTV service provider to offer thousands or tens of thousands of channels.

IPTV systems can connect viewers to media sources and the media sources can be located anywhere in the world. All that is needed to provide high-quality television channels is a media server, a 2 Mbps to 4 Mbps data connection and a viewing device. Some channels may be provided free of charge while others require payment for viewing options.

Figure 1.5 shows that Internet television offers virtually an unlimited number of media channels. This example shows an Internet television service provider that offers access to more than 10,000 media channels. The viewer is first provided with the option to select which country to select. Once a country has been selected, the available Internet television channels are shown along with the cost of accessing these channels. For some selections, the channel is free and for other selections, the user will be charged a fee (units of service in this example). This user has 148 units remaining for viewing channels this month.

More Control

IPTV viewers can have more control over their television services. They can choose from multiple service providers rather than a single television service provider that is located in their area. IPTV systems may allow the customer to setup their own IPTV service (instant activation) through a web page. The customer can add and remove features when they desire.
Because IPTV has the capability of having multiple channels, it is possible to have multiple channels for each media program allowing intelligent filtering of content such as restricting channels with unacceptable video or audio.

Figure 1.6 shows how IPTV allows viewers to have more control over their television services. This diagram shows that the customer can select from several alternate service providers and Internet television systems have the capability of allowing new viewers to instantly subscribe to services and select features. This example shows that a local telephone company offers television over a managed DSL connection which provides a guaranteed quality of service and access to local television channels. The Cheap TV
provider offers access to many free channels throughout the world. The Premier TV company provides high quality television and access to movie channels.

![Image of television services diagram]

**Figure 1.6, More Control over Television Services**

**More Services**

Television service is the providing of television information to customers by a common carrier, administration, or private operating agency using voice, data, and/or video technologies. IPTV systems have new capabilities that allow service providers to offer new services to viewers.

IPTV systems deliver information that has been converted to a standard digital form. This allows IPTV systems to individually address video sources to specific users and to allow for interactive two-way services. Some of the
advanced services made possible for IPTV include addressable advertising messages, interactive multiplayer gaming, advanced electronic programming guides, personal media channels, shopping channels, and global television channels.

Figure 1.6 shows how IPTV systems can provide new services that are not possible with traditional television systems. This example shows that almost any type of digital media can be addressed to specific television devices and the viewer can interactively respond to prompts and initiate control requests (two-way capability). This allows service providers to offer new media sources such as ads that are sent to specific viewers that have a matching profile or dynamic programs that allow the user to select or change the content that is presented to them. Viewers may be given access to public video (such as traffic video monitors) or private video (such as security video cameras at home and day care locations). Two way control services could allow users to interactively search for programs they want to view, access games and community media centers, web commerce and advertising messages that offer the viewer a selection of options such as more information or to be redirected to an infomercial. This example shows a program that allows the user to select the ending of a scene where a gunman is threatening a woman with a gun. The user can select a happy ending (the girl gets away) or a sad ending (the girl gets shot).

**How IPTV and Internet Television Systems Work**

Understanding the basics of how IPTV and Internet television service works will help you make better choices and may help you to solve problems that can be caused by selecting the wrong types of technologies, equipment and services.
Digitization - Converting Video Signals and Audio Signals to Digital Signals

A key first step in providing IPTV service is having the media in digital form. If the video is in analog form, the video and audio signals are converted into a digital form (digitization) and then compressing the digitized information into a more efficient form.

Digitization is the conversion of analog signals (continually varying signals) into digital form (signals that have only two levels). To convert analog signals to digital form, the analog signal is sampled and digitized by using an analog-to-digital (pronounced A to D) converter. The A/D converter periodically senses (samples) the level of the analog signal and creates a binary number or series of digital pulses that represent the level of the signal.

Digital Media Compression – Gaining Efficiency

Digital media compression is a process of analyzing a digital signal (digitized video and/or audio) and using the analysis information to convert the
high-speed digital signals that represent the actual signal shape into lower-speed digital signals that represent the actual content (such as a moving image or human voice). This process allows IPTV service to have lower data transmission rates than standard digital video signals while providing for good quality video and audio. Digital media compression for IPTV includes digital audio compression and digital video compression.

Figure 1.7 shows the basic digital speech compression process. In this example, the word “HELLO” is digitized. The initial digitized bits represent every specific shape of the digitized word HELLO. This digital information is analyzed and it is determined that this entire word can be represented by three sounds: “HeH” + “LeL” + “OH.” Each of these sounds only requires a few digital bits instead of the many bits required to recreate the entire analog waveform.

Figure 1.8 demonstrates the operation of the basic digital video compression system. Each video frame is digitized and then sent for digital compression. The digital compression process creates a sequence of frames (images) that start with a key frame. The key frame is digitized and used as reference
points for the compression process. Between the key frames, only the differences in images are transmitted. This dramatically reduces the data transmission rate to represent a digital video signal as an uncompressed digital video signal requires over 270 Mbps compared to less than 4 Mbps for a typical digital video disk (DVD) digital video signal.

![Digital Video Compression Diagram](image)

**Figure 1.8, Digital Video Compression**

**Sending Packets**

Sending packets through the Internet involves routing them through the network and managing the loss of packets when they can’t reach their destination.

**Packet Routing Methods**

Packet routing involves the transmission of packets through intelligent switches (called routers) that analyze the destination address of the packet and determine a path that will help the packet travel toward its destination.
Routers learn from each other about the best routes for them to select when forwarding packets toward their destination (usually paths to other routers). Routers regularly broadcast their connection information to nearby routers and they listen for connection information from neighboring routers. From this information, routers build information tables (called routing tables) that help them to determine the best path for them to forward each packet to.

Routers may forward packets toward their destination simply based on their destination address or they may look at some descriptive information about the packet. This descriptive information may include special handling instructions (called a label or tag) or priority status (such as high priority for real time voice or video signals).

Figure 1.9 shows how blocks of data are divided into small packet sizes that can be sent through the Internet. After the data is divided into packets (envelopes shown in this example), a destination address along with some description about the contents is added to each packet (called in the packet header). As the packet enters into the Internet (routing boxes shown in this
diagram), each router reviews the destination address in its routing table and determines which paths it can send the packet to so it will move further towards its destination. If a current path is busy or unavailable (such as shown for packet #3), the router can forward the packets to other routers that can forward the packet towards its destination. This example shows that because some packets will travel through different paths, packets may arrive out of sequence at their destination. When the packets arrive at their destination, they can be reassembled into proper order using the packet sequence number.

Packet Losses and Effects on Television Quality

Packet losses are the incomplete reception or intentional discarding of data packets as they are sent through a network. Packets may be lost due to broken line connections, distortion from electrical noise (e.g. from a lightning spike), or through intentional discarding due to congested switch conditions. Packet losses are usually measured by counting the number of data packets that have been lost in transmission compared to the total number of packets that have been transmitted.

Figure 1.10 shows how some packets may be lost during transmission through a communications system. This example shows that several packets enter into the Internet. The packets are forwarded toward their destination as usual. Unfortunately, a lighting strike corrupts (distorts) packet 8 and it cannot be forwarded. Packet 6 is lost (discarded) when a router has exceeded its capacity to forward packets because too many were arriving at the same time. This diagram shows that the packets are serialized to allow them to be placed in correct order at the receiving end. When the receiving end determines a packet is missing in the sequence, it can request that another packet be retransmitted. If the time delivery of packets is critical (such as for packetized video), it is common that packet retransmission requests are not performed and the lost packets simply result in distortion of the received information (such as poor video quality).
Packet Buffering

Packet buffering is the process of temporarily storing (buffering) packets during the transmission of information to create a reserve of packets that can be used during packet transmission delays or retransmission requests. While a packet buffer is commonly located in the receiving device, a packet buffer may also be used in the sending device to allow the rapid selection and retransmission of packets when they are requested by the receiving device. Packet buffering is commonly used in IPTV systems to overcome the transmission delays and packet losses that occur when viewing IPTV signals.

A packet buffer receives and adds small amounts of delay to packets so that all the packets appear to have been received without varying delays. The amount of packet buffering for IPTV systems can vary from tenths of a second to tens of seconds.
Figure 1.11 shows how packet buffering can be used to reduce the effects of packet delays and packet loss for streaming media systems. This diagram shows that during the transmission of packets from the media server to the viewer, some of the packet transmission time varies (jitter) and some of the packets are lost during transmission. The packet buffer temporarily stores data before providing it to the media player. This provides the time necessary to time synchronize the packets and to request and replace packets that have been lost during transmission.

**Converting Packets to Television Service**

IPTV data packets are converted back to television signals via gateways. Gateways may interconnect IPTV service to a television network (such as a hotel television system) or they may convert the signals directly to a television signal format (such as a NTSC or PAL analog television signals).
Gateways (Adapters) Connect the Internet to Standard Televisions

A television gateway (an adapter box) is a communications device or assembly that transforms audio and video that is received from a television media server (IPTV signal source) into a format that can be used by a viewer or different network. A television gateway usually has more intelligence (processing function) than a data network bridge as it can select the video and voice compression coders and adjust the protocols and timing between two dissimilar computer systems or IPTV networks.

Figure 1.12 shows how a media gateway connects a television channel to a data network (such as a broadband Internet connection). This example shows that the gateway must convert audio, video and control signals into a format that can be sent through the Internet. While there is one communication channel from the gateway to the end viewer, the communication channel carries multiple media channels including video, audio, and control information. The gateway first converts video and audio signals into digital form. These digital signals are then analyzed and compressed by a coding processor. Because end users may have viewers that have different types of coders (such as MPEG and AAC), the media gateway usually has available several different types of coding devices. This example shows that the media gateway receives requests to view information (the user or network sends a message to the media gateway). The gateway may have a database (or access to a database) that helps it determine authorized users and the addresses to send IPTV signals.

Managing the Television Connections

Middleware software controls the setup, connection, feature operation, and disconnection of television channels connected through the data network. Middleware controls the media servers and gateways that provide media to the viewing devices. IPTV systems manage the downloading or streaming of IPTV signals to the consumer and may manage the selection (switching) of the media source.
Downloading

Downloading is the process of transferring a program or a data from a computer server to another computer. Download commonly refers to retrieving complete files from a web site server to another computer. Downloading movies requires the storage of the entire file on a hard disk or other type of memory storage for playback at a later time.

One of the key advantages of downloading is that the data transmission rate can vary and operate at any speed. If the user is willing to wait long enough, the entire file can be downloaded for future playback on any connection. Key disadvantages to downloading are the need to wait until the entire file is transferred before being able to view and the need to have enough storage room to hold the entire video (about 4 GB for a 2 hour movie).

Figure 1.13 shows how to download movies through the Internet. This diagram shows how the web server must transfer the entire media file to the media player before viewing can begin.
Streaming

Streaming is a process that provides a continuous stream of information that is commonly used for the delivery of audio and video content with minimal delay (e.g. real-time). Streaming signals are usually compressed and error-protected to allow the receiver to buffer, decompress, and time sequence information before it is displayed in its original format.

Figure 1.14 shows how to stream movies through an IP data network. This diagram shows that streaming allows the media player to start displaying the video before the entire contents of the file have been transferred. This diagram also shows that the streaming process usually has some form of feedback that allows the viewer or receiving device to control the streaming session and to provide feedback to the media server about the quality of the connection. This allows the media server to take action (such as increase or decrease compression and data transmission rate) if the connection is degraded or improved.
Switching (Connecting) Media Channels

IPTV systems may set up connections directly between IPTVs or IP set top boxes and media servers or it may use a video switching system to connect the viewer to one of several available media sources. When the media connection is set up directly between the media server and the viewer, this is known as soft switching.

Figure 1.15 shows how a basic IPTV system can be used to allow a viewer to have access to many different media sources. This diagram shows how a standard television is connected to a set top box (STB) that converts IP video into standard television signals. The STB is the gateway to an IP video switching system. This example shows that the switched video service (SVS) system allows the user to connect to various types of television media sources including broadcast network channels, subscription services, and movies on demand. When the user desires to access these media sources, the control commands (usually entered by the user by a television remote control) are sent to the SVS and the SVS determines which media source the user desires to connect to. This diagram shows that the user only needs one video channel to the SVS to have access to virtually an unlimited number of video sources.
Multiple IPTVs per Home

Each household may have several users that desire to watch different programs. This requires the bandwidth to be shared with each individual IPTV.

Households may have a combination of several multimedia computers, set top boxes or IPTVs in each home. When viewers are watching television channels (different channels), the bandwidth of each IPTV signal must be added.

Figure 1.16 shows how much data transfer rate it can take to provide for multiple IPTV users in a single building. This diagram shows 3 IPTVs that
require 1.8 Mbps to 3.8 Mbps to receive an IPTV channel. This means the broadband modem must be capable of providing 5.4 Mbps to 11.4 Mbps to allow up to 3 IPTVs to operate in the same home or building.

Transmission

IPTV channel transmission is the process of transferring the television media from a media server or television gateway to an end customer. IPTV channel transmission may be exclusively sent directly to a specific viewer (unicast) or it may be copied and sent to multiple viewers at the same time (multicast)
Unicast

Unicast transmission is the delivery of data to only one client within a network. Unicast transmission is typically used to describe a streaming connection from a server to a single client.

Unicast service is relatively simple to implement. Each user is given the same address to connect to when they desire to access that media (such as an IPTV channel). The use of unicast transmission is not efficient when many users are receiving the same information at the same time because a separate connection for each user must be maintained. If the same media source is accessed by hundreds or thousands of users, the bandwidth to that media server will need to be hundreds or thousands of times larger than the bandwidth required for each user.

Figure 1.17 shows how IPTV systems can deliver the same program to several users using unicast (one-to-one) channels. This example shows that each viewer is connected directly to the media server. Because each viewer is receiving 3 Mbps, the media server must have a connection that can provide 9 Mbps (3 Mbps x 3 viewers).
Multicast

Multicast transmission is a one-to-many media delivery process that sends a single message or information transmission that contains an address (code) that is designated to allow multiple distribution nodes in a network (e.g. routers) to receive and retransmit the same signal to multiple receivers. As a multicast signal travels through a communication network, it is copied at nodes within the network for distribution to other nodes within the network. Multicast systems form distribution trees of information. Nodes (e.g. routers) that copy the information form the branches of the tree.

The use of multicast transmission can be much more efficient when the same information is sent to many users at the same time. The implementation of multicast systems is generally more complex than unicast systems as more control is required to add and remove members of multicast groups. Multicast recipients generally submit requests to a nearby node within a multicast network to join as part of an active multicast session.

For multicast systems to operate, nodes (routers) within the network must be capable of multicast sessions. Because of the complexity and cost issues, many Internet routers do not implement multicast transmission. If the multicast network is controlled by a single company (such as a DSL or cable modem data service provider), all the nodes within the network can be setup and controlled for multicast transmission.

Figure 1.18 shows how an IPTV system can distribute information through a switched telephone network. This example shows that end users who are watching a movie that is initially supplied by media center that is located some distance and several switches away from end users (movie watchers). When the first movie watcher requests the movie, it is requested from the telephone end office. The telephone end office determines that the movie is not available in its video storage system and the end office switch requests the movie from the interconnection switch. The interconnection switch also determines the movie is not available in its video storage system and the movie is requested from the distant media source. When the movie is trans-
IPTV Basics

Sent from the media center to the end customer, the interconnecting switches may make a copy for future distribution to other users. This program distribution process reduces the interconnection requirements between the switching distribution systems.

![IPTV Multicast Transmission](image)

**Figure 1.18, IPTV Multicast Transmission**

**Viewing IPTV**

IPTV media can be viewed on a multimedia computer, standard television using an adapter, or on a dedicated IPTV.
Multimedia Computer

A multimedia computer is a data processing device that is capable of using and processing multiple forms of media such as audio, data and video. Because many computers are already multimedia and Internet ready, it is often possible to use a multimedia computer to watch IPTV through the addition or use of media player software. The media player must be able to find and connect to IPTV media servers, process compressed media signals, maintain a connection, and process television control features.

Control of IPTV on a multimedia computer can be performed by the keyboard, mouse, or external telephone accessory device (such as a remote control) that can be connected to the computer through an adapter (such as an infrared receiver). The media player software controls the sound card, accessories (such as a handset), and manages the call connection.

IPTV signals may be able to be displayed on a multimedia provided it has enough processing power (processing speed) and the necessary media player protocols and signal decompression coders. IPTV signals contain compressed audio and video along with control protocols. These signals must be received, decoded and processed. The processing power of the computer may be a limitation for receiving and displaying IPTV signals. This may become more apparent when IPTV is taken from its small format to full screen video format. Full screen display requires the processor to not only decode the images but also to scale the images to the full screen display size. This may result in pixilation (jittery squares) or error boxes. Using a video accelerator card that has MPEG decoding capability may decrease the burden of processing video signals.

A media player must also have compatible control protocols. Just because the media player can receive and decode digital video and digital audio signals, the control protocols (e.g. commands for start, stop, and play) may be in a protocol language that the media player cannot understand.
IP Set Top Boxes (IP STB)

An IP Set Top box is an electronic device that adapts IP television data into a format that is accessible by the end user. The output of an IP set top box can be a television RF channel (e.g. channel 3), video and audio signals or digital video signals. IP set top boxes are commonly located in a customer's home to allow the reception of IP video signals on a television or computer.

An IP STB is basically a dedicated mini computer which contains the necessary software and hardware to convert and control IPTV signals. IP STBs must convert digital broadband media channels into the television (audio and video signals) and decode and create the necessary control signals that pass between the television and the IPTV system.

IP Televisions

IP televisions are display devices that are specifically designed to receive and decode television channels from IP networks without the need for adapter boxes or media gateways. IP televisions contain embedded software that allows them to initiate and receive television through IP networks using multimedia session protocols such as SIP.

An IP television has a data connection instead of a television tuner. IP televisions also include the necessary software and hardware to convert and control IPTV signals into a format that can be displayed on the IP television (e.g. picture tube or plasma display).

Mobile Video Telephones

Mobile telephones with multimedia capabilities may be able to watch television channels. Mobile telephones have limited information processing power, limited displays, and may have restricted access to Internet services.

Multimedia mobile telephones contain embedded software that allows them to initiate and receive multimedia communication sessions through the
Internet. Because of the limited bandwidth and higher cost of bandwidth for mobile telephones, mobile telephone media players in mobile telephones may use compression and protocols that are more efficient than are used by standard IPTV systems. To increase the efficiency, mobile telephone data sessions may be connected through gateways that compress media signals and convert standard control protocols to more efficient and robust control protocols. This may cause some incompatibilities or unexpected operation for mobile television systems.
Chapter 2

IPTV Services and Features

IPTV services are the providing of multimedia services (e.g. television) to customers by a common carrier, administration, or private operating agency using voice, data, and/or video technologies. In addition to providing the basic television services and features, IPTV can provide advanced features and services that are not possible with traditional broadcast television systems.

Television Programming

Television broadcast services are the transmission of television program material (typically video combined with audio) that may be paid for by the viewer and/or by advertising. Television programming may be live, scheduled or on-demand programming. Live television broadcasting is the transmission of video and audio to a geographic area or distribution network in real time or near-real time (delayed up to a few seconds). Scheduled programming is the providing of television programs in a pre-selected time sequence. On demand programming is providing or making available programs that users can interactively request and receive.

IPTV television programming sources include traditional broadcast sources such as television networks, syndicates and local stations along with new content sources such as international (global) programs, sponsored programs, community content and personal media channels.
Enterprise (Company) Television

Enterprise programming is media that is created and managed for viewing by a company or for visitors it authorizes to view its programming content. Company television may be produced for the public and/or for internal communication purposes. Public company television channels may provide information about products, services or applications of the products or services that are of interest to the public. Internal (“in-house”) company television programs may be used to provide employees with educational and company specific information (such as the location of a company meeting or party). Employees, vendors or others who are provided with access may distribute company television programs to monitors within company buildings or for distribution to multimedia computers that are only accessible by company employees.

Gaming

Gaming is an experience or actions of a person that are taken on a skill testing or entertainment application with the objective of winning or achieving a measurable level of success. Gaming services provided by IPTV systems may include game program distribution (downloading games), online gaming service, multi-user network gaming or gambling.

Security Monitoring

Security systems are monitoring and alerting systems that are configured to provide surveillance and information recording for protection from burglary, fire, water hazard, and other types of losses. Video surveillance is the capturing of video for the observation of an area or location at another location.

Traditional (legacy) security systems use proprietary sensing and transmission equipment, have limited control processing capabilities, and have interconnections that are limited to local geographic areas. The use of IPTV systems connected through standard data networks allows for the sending of media (such as digital video), powerful security system processing in a server, and wide area connectivity (such as through the Internet).
IPTV access devices (such as set top boxes) may contain connection points (such as USB connections) that allow for digital video signals to be sent through the IPTV system to a monitoring system. These monitoring systems can be owned and operated by the IPTV system operator or they can be monitoring stations operated and managed by other companies (such as police station central monitoring facilities).

Figure 2.1 shows how a variety of security accessories can be integrated into an IPTV based communication system. This example shows how a police station can monitor multiple locations (several banks) through the addition of digital video and alarm connections. This example shows that when a trigger alarm occurs at a bank (such as when a bank teller presses a silent alarm button), the police can immediately see what is occurring at the bank in real-time. Because the images are already in digital format, it may be possible to send these pictures to police cars in the local area to help identify the bank robbers.

![Figure 2.1., IPTV Security Monitoring](image-url)
Advertising

Advertising is the communication of a message or media content to one or more potential customers. One of the most complicated areas for IPTV can be the management of advertising services. Advertising management is the process of creating, presenting, managing, purchasing and reporting of advertising programs. Because advertising services on IPTV systems can range from broadcast advertising (to all people in a geographic area) to customized addressable advertising (custom ads for specific viewers), advertising management can be a complex but yet a very profitable process.

An advertising program typically begins by setting up advertising campaigns. Advertising campaigns define the marketing activities such as the specific advertising messages that will be sent to customers who are classified into certain categories (target market segments) about products, services, and options offered by a company.

Advertising messages may be in the form of interstitial, mixed media or interactive media. An interstitial ad is an advertising message that is inserted “in between” program segments. Interstitial ads can also be pop-ups (when selecting a new channel) and pop-downs (when exiting a selected program). Mixed media advertising is the combining of advertising media along with other video and text graphics on a television or video monitor. Interactive advertising is the process of allowing a user to select or interact with an advertising message.

Figure 2.2 shows how IPTV advertising messages can be in the form of interstitial broadcast messages, mixed media messages or interactive ads. In example A, a network operator provides a program with advertising messages already inserted (interstitial) into the program. Example B shows how an advertising message may be overlapped or merged into the underlying television program. Example C shows how an advertising message may change based on the selections of the viewer.
Television commerce (t-commerce) is a shopping medium that uses a television network to present products and process orders. The processes used in t-commerce include advanced product offering catalogs (video catalogs), order processing, exchanging of order information between companies in near real-time and the ability to offer multiple forms of payments that may be collected by different companies. Key issues for IPTV t-commerce billing include transferring accounting records through multiple systems that transfer between multiple companies that allow for presentation, processing and payment of orders.

Figure 2.3 shows how a television program can use mixed media to provide product offers to qualified consumers at specific times in a display location that is noticeable but not intrusive. This picture shows that during a news
program, the viewer is presented with a pizza icon from a local pizza restaurant. This example shows that when the user selects the icon, a small window appears with the pizza offer details.

Vendors of products that are sold on IPTV systems may be allowed to directly interact with their product offers as they know their customers better than IPTV service providers. This means that t-commerce systems will likely offer management portals. Offer management portals will allow the vendor to add new products, configure their presentation options for the product (e.g. mixed media) and define the product or service offers for specific market segments.
IPTV Basics

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Helpful Resources:

IPTVDictionary.com: Over 10,000 IPTV related terms and definitions

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