INTERNET PROTOCOL TELEVISION

SEMINAR REPORT

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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ABSTRACT

We live in the age of the digital packet. Documents, images, music, phone calls - all get chopped up, propelled through networks, and reassembled at the other end according to Internet protocol. So why not TV?

Today, IPTV (Internet Protocol Television) is creating headlines all over the world. This mass publicity is the result of numerous instances and stories depicting its humble deployments and its future. IPTV is a very useful system, through which you can receive both TV and video signals along with other multimedia services by means of your Internet connection. In a nutshell, it is nothing but a broadband connection and a system to deliver various programs of television using the Internet protocol (i.e., language) over computer networks.

It is important to remember that IPTV is not like any ordinary television program broadcast through the Internet, but rather it is unique in itself. Its contour is represented by a closed, proprietary TV system which is similar to the cable services present today. But, in contrast, the delivery of IPTV is made via IP-based secure channels, which result in a sharp increase in content distribution control.

The role of IPTV is to integrate numerous ways to scrutinize and trace choices of users. Its role is also to mark out the preferences and selections
Brief History—What led to IPTV?

The first digital revolution began a decade ago with the mass adoption of internet and the World Wide Web and the launch of digital television services via cable, satellite and terrestrial networks. These two remarkable developments in communication coincided, but failed to converge. Several attempts were made to marry broadcast television with the internet, but even as analog television began to give way to digital, the medium and the TV screen remained resolutely detached from the PC and the global network of the internet.

Historically, television was either transmitted from a tower, or distributed over a cable system, or beamed directly from a satellite. Today, as we enter the second digital revolution, as a result of high bandwidth and high speed internet access, it has become possible to transmit television and other audio and video services over broadband data networks over a single connection. That could be over a cable television system but it could equally be over a telephone line.

In earlier days, the speed of the Internet did not suit the television transmission concept and, as a result, it affected the voice and video services. In recent times, the speed of Internet and bandwidth has increased considerably, making IPTV prevail and become reasonably successful. Also, first generation Set Top Boxes were prohibitively expensive. Technology costs now permit a viable business model.
INTRODUCTION

What is an IPTV?
IPTV is not an application per se; it is a host of applications centered on IP, user choice, and rich content.

DEFINITION:
IPTV, essentially, has two components:

Part 1: Internet Protocol (IP): specifies the format of packets and the addressing scheme for a network. Most networks combine IP with a higher-level protocol. Depending on the vendor solution, user datagram protocol (UDP) is the most typical higher-level protocol. The protocol establishes a virtual connection between a destination and a source. IP allows you to address a package of information and drop it in the system, but there’s no direct link between you and the recipient.

Part 2: Television (TV): specifies the medium of communication that operates through the transmission of pictures and sounds. We all know TV, but here we are referring to the services that are offered for the TV, like linear and on-demand programming.

ADD THE TWO COMPONENTS TOGETHER (IP+TV) AND YOU HAVE: IPTV: SPECIFIES THE MEDIUM OF COMMUNICATION OF PICTURES AND SOUND THAT OPERATES OVER AN IP NETWORK.

IPTV is hence a system used to deliver digital television services to the consumers who are registered subscribers for this system. This delivery of digital television is made possible by using Internet Protocol over a broadband connection, usually in a managed network rather than the public Internet to preserve quality of service guarantees. Often, this service is provided together with Video facility on demand. In addition to this, there is provision to include Internet services such as web access and Voice over Internet Protocol (VoIP). In cases when internet service is also provided, it may be called Triple Play.
What is not an IPTV?

IPTV is distinctly different from “Internet Video” that simply allows users to watch videos, like movie previews and web-cams, over the Internet in a “best effort” fashion with no end-to-end service management and quality of service considerations. Following are not IPTV:

- Video streaming over internet
- Watching TV on your PC(Personal Computer)
- Best Efforts video services
- Unproven Business models for media and TV services.
Why IPTV?

Consumers always want more and high quality. Now days most of TV are analog with one way data transmission and limited channel. IPTV provides all digital, two ways connected, unlimited channels, integrated (DRV, HDTV, PIPs, VoD) and personalized TV. IPTV enhances the TV offer and delivers in a new way to provide better experience to watch TV in a Simple, Personalized and in an advanced way.

**Simple**

*EPG (Electronic Program Guide) that allows easy navigation, quick program informations, PIP (Picture in Picture) and PPV (Pay Per view) capabilities.*

**Personalized**

IPTV enables you to personalize your view, profile and events. You can attach your TV with other devices such as Digital cam to view personal pictures or photos on your TV. You can also personalize your profile, parental controls, and television and account settings.

**Advanced**

With the help of EPG your DVR or PVR can be schedule for recordings of your programs either once or on a recurring basis. Get live TV notifications such as Caller ID, SMS and e-mail notification while you watch TV. It also provides program search capabilities. To enhance the quality IPTV provides following advanced features:

- Advanced Multimedia Program Guide
- Integrated Broadcast, VOD and DVR
- Fast scrolling & navigation
- Live picture-in- picture.
- Channel slide show
- Software-based tuning
- Advanced Video Applications with multiple PIP(Picture-In-Picture)
Instant channel changing with richer navigation
Quick and Responsive EPG for HDTV and SDTV
Integrate Web based services
Cross device applications and services

**IPTV’S IMPACT**

The impact that IPTV will have on the industry can be categorized into three areas:

**Content** – IPTV technology promises to make more content available, make it easier to access and make it portable (while maintaining security).

**Convergence** – The utilization of an IP network will allow applications to be run over multiple end-user devices, all over a single service delivery network.

**Interactivity** – The two-way nature of the IP network will enable unprecedented interaction among subscribers, content providers and service providers. Additionally, new personalized or custom advertising

And e-commerce capabilities are also made possible.

Since IPTV is enabled by the availability of network technology, the network used to deploy IPTV is important. Content delivery requires bandwidth, performance, and security not only in the last mile (the access network), but also in the edge and core of the network, in the customer premises, and with the video head-end/server locations. The IPTV service model, and its market advantages, is not a new concept. However, recent developments have enabled the delivery of IPTV service in an increasingly secure, scalable and cost-effective manner. These recent Developments include:

- the proliferation of Gigabit Ethernet
- the ability of IP networks to offer higher security and QoS
the development of high-performance IP routers and Ethernet switches designed for IPTV networks
the creation of advanced middleware applications that manage the delivery of video over the network
High capacity, Ethernet-based access technologies.

How does IPTV Work?

Before we get into the internal details of the way the IPTV network is configured to provide transmission of television signals, we see what are the various steps followed to convert the audio and video feed signals into a suitable form to be transmitted in the form of IP (Internet Protocol) packets, which forms the basis of the whole concept of IPTV and how they are received on the other side as television signals.

Digitization - Converting Video Signals and Audio Signals to Digital Signals
A key first step in providing Internet Protocol Television service is converting the analog audio voice signals 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) co 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. Analog signals are converted into digital signals because they are more resistant to noise (distortion) and they are easier to manipulate than analog signals. For the older analog systems (continuously varying signals), it is not easy (and sometimes not possible) to separate the noise from the analog signals. Because digital signals can only have two levels, the signal can be regenerated and during this regeneration. Process, the noise is removed. Television signal digitization involves digitization of both the audio and video signals.
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 IP television service to have lower data transmission rates than standard digital video signals while providing for good quality video and audio. Digital media compression for IP television includes digital audio compression and digital video compression.
Digital speech 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 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.

Packet transmission

Gateways Connect the Internet to Standard Televisions

A television gateway is a communications device or assembly that
transforms audio and video that is received from a television media server (IP television 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 IP Television networks.

**IP Television Gateways**

This diagram shows that the gateway must convert audio, video and control signals into a format that can be sent through the Internet. 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. The gateway may have a database (or access to a database) that helps it determine authorized users and the addresses to send IP television signals.

**Transmission**

IP Television channel transmission is the process of transferring the television media from a media server or television gateway to an end customer. IP television channel transmission may be exclusively sent directly to 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 IP television 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.

**IPTV Unicast Transmission**

**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.

IPTV Multicast Transmission

The IPTV Network Elements

An IPTV system is made up of four major elements; all are generic and are common to any vendor’s (or combination of vendors’) infrastructure. This is a high-level overview and, in reality, many IPTV subsystems and networking solutions are required to make each incarnation of IPTV unique and of varying complexity.

Figure above also illustrates the two-way nature of an IPTV network, which contributes to many of the advantages IPTV has over traditional television service delivery models. It should be noted that the IPTV network elements combine to form an
architecture known as switched digital video (SDV): Switched digital video (SDV) – Referencing the network architecture of a television distribution system in which only the selected channel(s) are distributed to the individual connected household. This enables the service provider to have no theoretical maximum linear channel count. IPTV vendors will have different variants of the SDV architecture. This is another advantage to using IP multicast for the broadcast television streams. The most common protocol used for switching channels in a SDV environment is IGMP (IP Group Membership Protocol).

**IPTV System Architecture:**

Figure below illustrates a generic IPTV system architecture to support applications such as digital (broadcast) television and Video on Demand (VoD). The generic IPTV architecture is utilized here as a baseline reference to discuss IPTV distribution in-home networks. Major components are:

- Headend (encoders and streamers)
- VoD Server
- CAS system and DRM agent
- IP service provider and access network, IP based middleware,
- DSL modems and IRDs

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**Generic IPTV System Architecture**

IPTV operators receive digital satellite channels by satellite antenna and digital terrestrial Services by UHF antenna. The channels are routed to the transmission center’s signal Converter equipment, which converts the television content to an IP network-compatible Format and transmits it into
homes via operators’ broadband backbone and access Networks. In homes, IPTV services are received by an IP STB whose software and Updates are managed by a configuration server located in the transmission centre.

**IPTV Components:**

**Video Head End**
As with a digital cable or digital satellite television system, an IPTV service requires a video head end. This is the point in the network at which linear (e.g., broadcast TV) and on-demand (e.g., movies) content is captured and formatted for distribution over the IP network. Typically, the head end ingests national feeds of linear programming via satellite either directly from the broadcaster or programmer, or via an aggregator. Some programming may also be ingested via a terrestrial fiber-based network. A head end takes each individual channel and encodes it into a digital video format, like MPEG-2, which remains the most prevalent encoding standard for digital video on a worldwide basis. Broadband service providers are also beginning to use MPEG-4-based encoding, which has lower bit-rate requirements for encoding television signals.

After encoding, each channel is encapsulated into IP and sent out over the network. These channels are typically IP multicast streams, however, they may be IP unicast streams as well. IP multicast has several perceived advantages because it enables the service provider to propagate one IP stream per broadcast channel from the video head end to the service provider access network. This is beneficial when multiple users want to tune in to the same broadcast channel at the same time (e.g., thousands of viewers tuning in to a sporting event).

**Video Server**
Video servers are computer-based devices connected to large storage systems. Video content, previously encoded, is stored either on disk or in large banks of RAM. Video servers stream video and audio content via unicast or multicast to STBs. Typical storage systems range from 5 terabit (Tb) to 20 Tb. Video servers are mostly used for VoD; however, they are also used for NPVR, which allows subscribers to record shows remotely on a device at the operator site. The key technical attributes of video servers are scalability in terms of storage and number of streams, management software, and variety of interfaces.
**The Service Provider Core/Edge Network**
The grouping of encoded video streams, representing the channel line up, is transported over the service provider’s IP network. Each of these networks is unique to the service provider and usually includes equipment from multiple vendors. These networks can be a mix of well-engineered existing IP networks and purpose-built IP networks for video transport. At the network edge, the IP network connects to the access network.

**The Access Network**
The access network is the link from the service provider to the individual household. Sometimes referred to as the “last mile,” the broadband connection between the service provider and the household can be accomplished using a variety of technologies. Telecom service providers are using DSL (digital subscriber line) technology to serve individual households. They also are beginning to use fiber technology like PON (passive optical networking) to reach homes. IPTV networks will use variants of asymmetrical DSL (ADSL) and very-high-speed DSL (VDSL) to provide the required bandwidth to run an IPTV service to the household. The service provider will place a device (like a DSL modem) at the customer premises to deliver an Ethernet connection to the home network.

**The Home Network**
The home network distributes the IPTV service throughout the home. There are many different types of home networks, but IPTV requires a very robust high bandwidth home network that can only be accomplished today using wireline technology.

**Middleware: The IPTV enabler**
Middleware is the software and hardware infrastructure that connects the components of an IPTV solution. It is a distributed operating system that runs both on servers at the Telco location and on the STBs. Among other things, it performs end-to-end configuration, provisions the video servers, links the electronic program guide (EPG) with the content, acts as a boot server for the STB and ensures that all STBs run compatible software. The key technical attributes of a middleware are reliability, scalability, and ability to interface with other systems.

**Set Top Box (STB)/Terminal**
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 for live TV and VoD, the STB supports an EPG that allows the users to navigate through the programming. The STB transforms a scrambled digital compressed signal into a signal that is sent to the TV. The STB hosts the middleware and is poised to become the center of the communications infrastructure within the home.

**Content Security**

**Conditional Access System (CSA)/Digital Rights Management (DRM)**

A conditional access system (CAS) allows for the protection of content. Historically, a switched digital video network did not require CAS, since the network would perform content entitlement. In theory, it could still be the case if the device that performs the multicasting function could also determine whether the user is entitled to view the content. In several early IPTV trials, the content was not protected; however, this content was not very “fresh.” As IPTV becomes more mainstream, content providers are mandating CAS and digital rights management (DRM), which not only controls the real-time viewing, but also what happens to the content after it has been viewed once. Generically, most CAS/DRMs are a combination of scrambling and encryption. The video feed is scrambled using a control word. The control word is sent over an encrypted message to the decoding device. The CAS/DRM module on the decoding device decrypts the control word that is fed to the descrambler. The key technical attributes of CAS/DRM are: smart card versus soft client; security; server scalability; and integration with encoder, video server, and STB.
IPTV Protocols

As already discussed, IPTV covers both Live TV, i.e., multicasting, as well as stored video or VoD. The requirements for playback of IPTV are either a personal computer or a “set-top box” connected to a TV. Typically, the video content is a moving pictures expert group (MPEG) 2-transport stream (TS) delivered via IP multicast. This is a method in which information can be sent to multiple computers at the same time, with the newly released H.264 format predesigned to replace the older MPEG-2. In standard-based IPTV systems, the primary underlying protocols used for IPTV are Internet group management protocol (IGMP) and real time streaming protocol (RTSP). Here, IGMP is the version 2 for channel change signaling for Live TV and RTSP for VoD. Currently, only one alternative exists to IPTV which is the traditional TV distribution technology covering terrestrial, satellite and cable TV. However, when there is a possibility for the cable TV, it can be upgraded to two-way capability system and thus also carry IPTV. Another alternative available is VoD which is usually delivered in the US over cable TV through the digital video broadcasting (DVB) protocol, but it is not labeled as IPTV services.
Viewing IP Television

IP television channels can be viewed on a multimedia computer, standard television using an adapter, on a dedicated IP television, or on a mobile device.

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 IP television through the addition or use of media player software. The media player must be able to find and connect to IP television media servers, process compressed media signals, maintain a connection, and process television control features. Control of the IP television on a multimedia computer may be per-formed by the keyboard, mouse, or external telephone accessory device (such as a remote control) that may 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 hand-set), and manages the call connection. IP television signals may be able to be displayed on a multimedia device provided it has enough processing power (processing speed) and the necessary media player protocols and signal decompression coders. IP television 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 IP television signals. This may become more apparent when IP television 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. The burden of processing video signals may be decreased by using a video accelerator card that has MPEG decoding capability.

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.

**Analog Television Adapters (ATVA)**

Analog television adapters are devices designed to convert digital broadband signals into analog television formats (e.g. NTSC or PAL). Using ATVAs, it is possible to use standard televisions for viewing television channels that are sent over data network such as the Internet. Analog television adapters are commonly called "IP Set top boxes."

An ATVA is basically a dedicated mini computer which contains the necessary software and hardware to convert and control IP television signals. Analog television adapters (ATVA) 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 ATVA and media gateways.

**IP Television (IPTV)**

IP televisions are television display devices that are specifically designed to receive and decode television channels through the Internet without the need for adapter boxes or media gateways. IP televisions contain embedded software that allows them to initiate and receive television through the Internet 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 IP television signals into a format that can be displayed on the IP television (e.g. picture tube or plasma display).

**Mobile Telephone Television**

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 may use compression and protocols that are more efficient than those used by standard IP television 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 control over IP Television Services
IP television network systems usually provide you with more direct control over television services. IP television service is typically activated and changed directly through a screen display or Internet web page. Instead of using a customer service representative (CSR) from the television company, the user may be able to setup IP television services directly. These changes such as service activation and feature addition/deletions can have immediate results.

IPTV-Quality of Service (QOS)

Television networks provide a fairly high level of quality of service (QoS) to television viewers and to be successful, IP television service should have similar quality as standard television systems.

Audio Quality
Audio Quality is the ability of the system to recreate the key characteristics of an original audio signal. Audio Quality can be affected by many factors such as the type of audio codecs (audio compression), transmission system and bandwidth limits.
Generally, the more you compress the audio, the lower the audio quality. Recently, innovations in audio compression technology provide similar quality audio signals using a much lower data communication (connection) speed.
The symptoms of a poor transmission system include audio distortion which is caused by packet loss and/or packet corruption. Packet loss is the inability of the network to deliver a packet to its destination within a specified period of time. Packet loss can result from a variety of events such as network congestion or equipment failures. The effect of packet loss on audio distortion is to temporarily mute or distort the audio signal. Packet losses are rare as systems normally resend a data packet if it gets a reply from the destination that the original data packet failed to reach within a specified time.
Packet corruption is the modification of packet data during its transmission. Packet corruption can occur due to various reasons such as poor
communication line quality or momentary line loss from electrical spikes. As IPTV systems use audio compression, the packet data represents a sound that will be recreated rather than a specific portion of the actual audio signal. As a result, if corrupted data is used, this can create a very different audio sound (Warble) than expected.

**Video Quality**
Video quality is the ability of a display or video transfer system to recreate the key characteristics of an original video signal. Similar to Audio quality, some of these factors that affect video quality include the video codecs, transmission type and bandwidth limitations. The types of distortion on analog video systems include blurriness and edge noise. Digital video and transmission system impairments include tiling, error blocks, smearing, jerkiness, edge busyness and object retention. Tiling is the changing of a digital video image into square tiles that are located in positions other than their original positions on the screen. Error blocks are groups of a block of pixels that do not represent error signals rather than the original image bits that were supposed to be in that image block. Jerkiness is stalling or skipping of video image frames or fields. Object retention is the retention of a portion of a frame when the image has changed.
IPTV vs. Conventional TV transmission Techniques

More than simply a new distribution and playback method, IPTV is poised to create an entirely new mindset about the television experience. Whereas current terrestrial broadcast television is the same content sent continuously to all consumers’ homes, IPTV removes the fixed television schedule. Similar to how information on the Internet can be downloaded and viewed at any time, IPTV enables television programming to be available whenever each individual consumer demands it. In this way, each household can create their own custom content and viewing schedule.

Comparison of IPTV and cable television network architectures
Image below illustrates the structures of IPTV’s DSL implementation and the cable television transmission architecture, which are similar in principle. Within the architecture, the transmission centre (and reception) can be the same for IPTV and cable television based on equipment that converts the cable television signal to an IP transmission. Cable television operators can therefore utilize their existing transmission infrastructures in the implementation of the IPTV service.
Cable television networks are nowadays constructed as Hybrid Fiber Coaxial Networks. These are divided into partial networks with a headend, from which separate fibers depart to each network cell’s fiber node point, and thence all the way to homes via coaxial Cables. Similarly, the IPTV signal is typically transmitted in regional networks to Centralizers via fiber, and from there to homes via copper. In the future, fiber cables will be moved closer and closer to homes to increase connection capacity. The closer to Homes fiber cables are, the closer cable television network and xDSL-based IPTV Network structures will move to one another. In completely fiberbased networks the Topologies are the same.

**IPTV in comparison to the traditional digital TV distribution channels**

Table below compares IPTV to other digital television distribution channels. The table is based on the television services currently available in most of the places. The situation may change in the future, but this table illustrates the main differences between channels.
There are no significant differences between the transmission methods with regard to Basic television channels. Although it is true that several hundred foreign TV channels are available through satellite transmission, the reception of these channels requires Special reflectors. IPTV does provide a significant number of additional pay television channels to homes covered by the terrestrial network. The range of available channels is approximately the same as for satellite and cable transmission homes. IPTV enables immediate interactivity through a broadband connection, and it is possible to browse the Internet on a basic level using the television set. The interactive services currently available in the other transmission channels comprise television channel Subscriptions by SMS message or telephone call, and a group of simple MHP services (E.g. super teletext, games, and chats). IPTV has the best future potential of all the Transmission channels regarding interactive services since, to reach the level of IPTV, Other transmission channels require consumers to acquire separate return channels (e.g. cable modem or DSL connection) and a so-called hybrid STB (DVB-C/T/S digital STB With an Ethernet connection).

Comparing the different distribution methods’ costs for the customer is not straightforward, since service providers offer different service ranges, pricing and discounts. At present, basic STBs cost substantially more in the case of IPTV. Due to this, it is advisable for consumers to rent an IP STB at first. In addition to the purchase price, IP STBs are developing rapidly, so

**Table 2. Digital television transmission channels compared from the consumer’s perspective**

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<td>Other</td>
<td>Tuple Pay package, cost savings (Cost, broadband, IPTV)</td>
<td>Possible external network removal and maintenance</td>
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consumers will soon have to replace their STBs, which is easy to do in the case of rental devices.

Advantages of IPTV

Now, let us have a look at the various advantages of IPTV. It has already been established that IPTV system conserves bandwidth. But there are many more advantages beyond this. In IPTV, a new level of interactivity among Internet, voice, and video can be established. This enables new types of services which were previously unavailable over stacked networks. For example, in traditional cable TV networks, video transmission is beamed over MPEG streams on an explicit portion of the bandwidth. On the other hand, high-speed data products, such as cable- and modem-based Internet service, are delivered over an IP based network. It is separate from the broadcast TV network that uses MPEG
transmission. In this case, both services were delivered via an IP network then, in such a situation, overlapping products are possible. Interactive TV is a good example which often relies on data-centric applications. Today, the delivery of such applications is quite complex due to the separation of IP packets from MPEG streams. These would be missing if such IP packets delivered all video and data.

Another very distinctive advantage of IPTV is that numerous channels can be beamed to the viewer. The operator has a very meager choice in regards to the traditional network. Due to the scarcity of choices and space available, the operator chooses the networks which are later beamed. This doesn't allow for market segmentation, and ultimately the highest levels of satisfaction are missing. In contrast, in the case of IPTV, the "switching" is carried out in the network which is just the right fit for services such as RNSIT, Department Of Electronics and Communication 40 VoD. Another distinctive feature is that IPTV delivery consists of a return path, which ensures the facilitation of advanced products.

IPTV can be very helpful in providing web-based training to courses. If we take a case of large size courses, they contain many sections and instructors that can easily share video materials. Therefore, if you own an instructional video which needs to cover ten sections of a course, IPTV can greatly extend its service. The video can be put on IPTV and then all the ten sections could be viewed at one time, or each instructor will have the freedom to schedule a broadcast time for their concerned section. As a result, this removes the scheduling conflicts, if any. Moreover, appearances of any valuable guest lecturers can be recorded and kept for future use. The recording can be used for multiple courses and can be viewed semester after semester. In addition, different orientations, which are given to a large group of people on a regular basis, can be recorded and stored. The recording can be viewed through IPTV, which is possible as long as you have rights from the publishing company to do so.

The point to remember is that video broadcasts made through IPTV is automatically archived in Real Media format, which is stored on a real server. This facility allows the students, who could not view the broadcast or watch the same video, to view it later, either on or off campus. However, Real Media is not a multicast system and therefore has a limited bandwidth capacity.

**Hurdles for IPTV**

There exist several barriers for IPTV before it truly can be embraced by the mass Consumer audience and new content providers. First, there is the question of **broadband availability**. IPTV services depend on customers having access to high-speed Internet services. Concurrently, content providers must be able to reach their intended audiences. If a
government agency wants to create an IPTV program about certain programs or benefits, but the intended audience does not have access to broadband, then there is no utility. Continued growth in the broadband market will be necessary in order for IPTV to take root as a viable programming option.

Industry experts believe many of the technical hurdles to IPTV deployment have been overcome. —Transport is frictionless” according to one IPTV provider and the technology for consumers receiving and viewing video over IP is readily available. Even though the technology has arrived for IPTV to flourish, some industry analysts believe standards will be required for the many different types of equipment and services. Without standards, experts believe, it will be difficult for IPTV systems and their many component parts to interact seamlessly.

In the regulatory arena, there are several issues that affect IPTV deployment and Commercial success. For IPTV products offered by telecommunications companies, local franchising rules govern how and when video services can be deployed and marketed. IPTV providers who offer video content directly online face fewer regulatory barriers. One issue that will be important to these types of IPTV providers is piracy and digital rights management. Copyrighted content will be available over IPTV networks, and Analysts believe providers will have to be vigilant to protect both their content providers and customers.

**IPTV-Applications and Services**

The applications for IPTV deployment are to provide the delivery of digital broadcast television and also the selected VoD. Such application enables service providers to offer the so-called “triple play,” which is video, voice and data. The IPTV infrastructure also provides additional video applications mostly after the installation of IPTV infrastructure is in place. Now, let us take a look at the major applications and services enabled by IPTV.
**Digital Broadcast TV**

Customers get a conventional digital television through IPTV. This digital broadcast TV is delivered to subscribers via an upgraded cable TV plant or through satellite systems. The initiation of higher-speed DSL technology such as ADSL2, ADSL2+ and VDSL has brought a revolution to this field. This higher-speed technology enables IPTV to be a convincing and highly competitive substitute for customers. Today, a number of telecom Service providers are testing, planning, and building collaborations around IPTV throughout North America, Europe, and Asia.

IPTV has the full potential to offer various high-quality services and much more than what traditional broadcast, cable, and satellite TV providers have offered subscribers in the past. Another utility with IPTV is that it has more content variety with a larger number of channels to choose depending on the customers’ preferences. This makes a promising start especially as customers can choose from its diversified content. It will reach its target group no matter whether the subscribers are in the mass markets, in specialized groups, or spread out in demographic communities.

The function of conventional broadcast, cable, and satellite TV is to provide all channels simultaneously (i.e., broadcast) to the subscriber home. However, IPTV is unique and different from all conventional groups. IPTV only delivers those channels which are being viewed by the subscriber and has the potential to offer practically an ‘unlimited’ number of channels. The IPTV consumers will get the freedom to control what they want to watch and also when they want to watch. This is possible because it has a combination of two-way interactive capability. This is inherent in IPTV because of its association with IP. This association is built-in and tied to a robust internal network. Therefore, subscribers are enjoying the facility to broaden the unique experience at home or in their business.

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**Video on Demand (VoD)**

VoD is a service which provides television programs per the demands of the subscribers. The users interactively request and can receive television channels. These television services are beamed from previously stored media
consisting of entertainment movies or education videos. It has a live access through live connection, such as news events in real time. The VoD application provides freedom to the individual subscribers to select a video content and view it at their convenience.

When the initial IPTV infrastructure is in its place, IPTV applications and potential revenue-generating services, such as video telephony and video conferencing, remote education, and home security/monitoring cameras, will be available.

There are also some additional features and services available, which are much more advanced in comparison to traditional broadcast television systems. In addition to providing the basic television services and features, IP Television can provide the following advanced features and services:

• Anywhere Television Service
• Global Television Channels
• Personal Media Channels
• Addressable Advertising

We think of these as VOD, timeshift TV and Network PVR...all based on the Media Server approach.

**Anywhere Television Service**

Anywhere Television Service uses television extensions, which are the viewing devices that can be connected to the system of a television distribution. There are two options in this regard: (1) these connections may be shared, for example, by several televisions on the same line or (2) they may be controlled independently, such as the case of a private television system. Conventionally, television extensions have a fixed wire or a connection line. This is because: (1) it allows a television viewing device to either share (i.e., directly connect to) another communication line or (2) it allows an independent connection to a switching point (such as a private company television system).

In IPTV, when an IP television viewer is connected to a data connection for the first time, it sends the request to an assignment of a temporary Internet address from the data network. After its connection to the Internet, it uses the said Internet address to get registered with the Internet Television Service Provider (ITVSP). The reason is that the ITVSP is always aware of the current Internet address, which is assigned to the IP television each time it has been connected to the Internet. This also allows IP televisions to operate at any connection point that is willing to provide it broadband access to the Internet.

In real meaning, this allows an IP television to operate like a television extension, which can be plugged in anywhere in the world.
Global Television Channels
As the name indicates, global television channels are TV channels which can be viewed globally. IP television channels are beamed through the Internet and, as it offers broadband data access, it can thus be typically viewed in any part of the globe. The IP television system is capable of providing video service outside the purview of their local, often regulated, areas. This ability makes IP television a very competitive tool around the world. The typical cost for viewing global television channels is the content media access costs, for example, the cost or fee for watching a movie. Moreover, the cost includes the broadband data access cost, which is a monthly charge for broadband access.

Personal Media Channels (PMC)
PMC is a communication service which is user friendly to subscribers. It allows a media user, for example, to select and view media from different media sources such as video or music. Here is an example how a PMC may be used for IP television. The control and distribution of mixed media, such as digital pictures and digital videos, can be done through a personal television channel for the service of friends and family members. In this regard, an IP television customer can be assigned a personal television channel. Then, the user can upload media to their personal media channels and can thus allow friends and family to access their pictures and videos. This is done via their IP televisions.

Multicast
By using the IP multicast feature in providing an IPTV service, a service provider can conserve bandwidth in their core and access networks. When more than one user is viewing the same channel in a home network, the service provider may only deliver a single video stream. But, at the same time, the home network technology must be competent to distribute this towards multiple users on the home network. Imagine the core requirements for bandwidth if all customers are watching a different time-shifted channel to when they wanted to watch. Both Multicast and Unicast are needed in the IPTV world, but the former is quicker and easier to deploy in terms of core network capacity than the latter which mostly requires a dedicated one-to-one relationship from customer to server.
Privacy and Security
Let us look at the important aspect of privacy and security of the subscribers.
In this regard, the home network must be a closed one. Where is the user’s security in this regard? It should be a secure network where access is limited only to users and concerned devices within the home. This is an important factor for the home networks as it uses wireless technologies or shared media technologies such as power line networking. Further, the user data on the home network is protected and no outsiders or intruders have the power to intercept. Unauthorized users do not have the capacity to view it.

CONCLUSION

IPTV, once a dream wandering amidst streams of choppy online video, is now seen by many experts as a potentially multi-billion dollar industry in the very near term. IPTV, according to industry watchers, can change the way people receive video programming and revolutionize content creation. With the expansion of broadband access and the Growth of computing and video production equipment, industry analysts believe IPTV is realizing its potential as a viable programming platform that can compete with cable, satellite and other traditional video mediums.
Consumers can benefit greatly from IPTV services by enjoying greater flexibility in their video —experience” by obtaining the content of their choosing. With on-demand IPTV services, the content comes to the consumer. Interactive applications will empower the viewer to use online video not only as an entertainment option but as a learning tool. IP video can be harnessed and used in many different forms that would aid society. It can provide road maps on screens installed in ambulances, fire trucks, and police cars enabling them to —read” a situation before arriving on the scene. It can aid doctors by sending images across the nation or world and enabling them to discuss the data face to face in real time through a video link.
IPTV is also seen by providers and industry watchers as a gateway for new content providers. IPTV is not simply offering traditional television programming through another device or connection. The low costs of creating content allows just about anyone to produce a —television show. “IPTV providers are already offering content from sports leagues to home cooking shows and more. The video content is making the web experience more robust for consumers, presenting information in compelling formats that greatly interests existing and new audiences. This new programming vehicle,
allowing organizations and individuals to transmit their messages to an audience of their choice, could be the —killer application” that expert agrees is needed to catapult IPTV to equal footing with traditional television. Although IPTV is still in the early stages, the growth in the number of providers and Users has demonstrated too many experts that the technology is now an important factor in the video marketplace. In the near term, it will be important to watch how IPTV Providers offer new services and attract customers. The continued realization of online video’s potential will be of great interest to the people even though it might now be on a computer.

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