Internet Protocol Television (IPTV)

Definition:

IPTV is 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.

Today, IPTV 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.

Overview

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 over a particular time period. It is therefore emerging as a perfect platform on which clients add personalized e-commerce options and a more targeted advertising. By now, IPTV has turned out to be a widespread denominator for systems where both television and video signals are circulated to subscribers or viewers.

IPTV uses a Internet Protocol over broadband connection and very often this service has been provided in parallel with the Internet connection of the subscriber, supplied by an operator dealing with broadband. This is done by using the same infrastructure but apparently over a dedicated bandwidth allocation. Hence, we can describe it as a system in which a digital television service is provided to subscribing consumers over a broadband connection using the Internet Protocol.

Moreover, one must also remember that IPTV is noticeably different from “Internet Video”. Internet Video provides services to watch videos, such as movie previews and web-cams. This service is a so-called “best effort” by providers of Internet, which has no back-to-back service management along with quality of service considerations.

In contrast, IPTV technology is more advanced, user friendly, and incorporated with the higher speed digital subscriber line (DSL) access technologies, such as asymmetric digital subscriber line (ADSL2), ADSL2+ and very-high-data-rate digital subscriber line (VDSL). This certainly offers eye-catching revenue-generating opportunities for the telecom service providers. Therefore, IPTV allows the service providers to participate and to compete efficiently in the so-called “triple play” market space. It is important to note here that the service is very prompt and effective with the delivery of voice, data, and video services to customers who can be both residential and business related.

Topics

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Short History of IPTV

IPTV is basically a fusion of voice, video, and data service. It is not a new idea or, rather, development, but it is a result of high bandwidth and high speed Internet access. In earlier days, the speed of the Internet did not suit the 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.

IPTV Architecture

Telephone companies will most likely be the first ones to offer IPTV service. Later on, this facility will be extended to other current television carriers. IPTV is not a costly affair, and it is even both operator and consumer friendly. Because it uses the Internet and sends less information compared to standard analog or digital television, IPTV promises both lower costs for operators and lower prices for consumers. The use of set-top boxes through broadband or DSL Internet is very helpful to transfer video signals. Therefore, video can be streamed to households more efficiently compared to signaling by coaxial cable. In addition to its higher speed, it can record multiple programs at once by use of digital video recorders (DVR). In ROI terms, the copper was already paid for by the phone service and the fibre/DSL by the broadband service. Therefore, IPTV only has incremental costs.

Let us have a look at the architecture of IPTV through *Figure 1*:

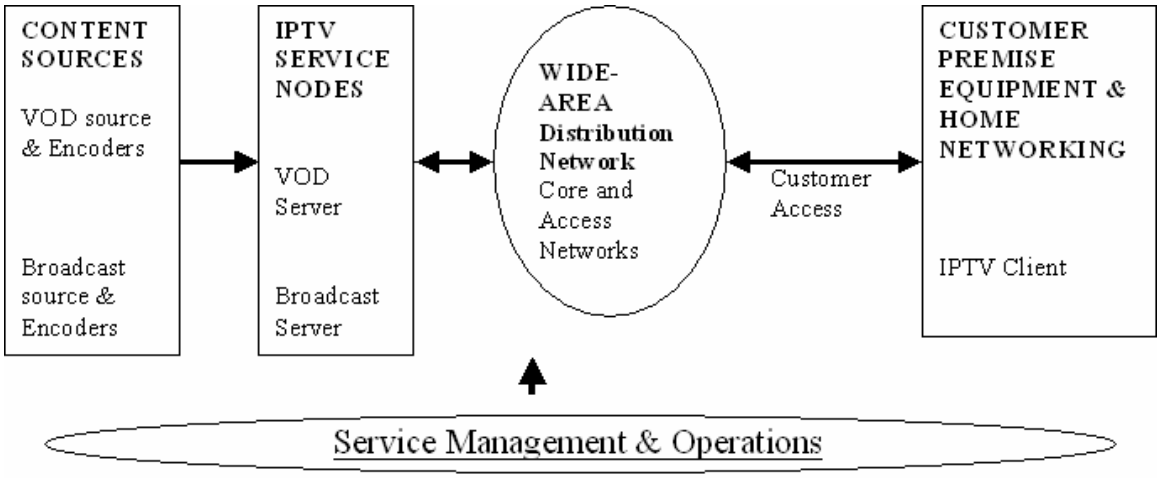

Figure 1: *Generic IPTV System Architecture*

The IPTV architecture consists of the following functional components:

Content Sources: The 'Content Source' is defined as a functionality which receives video content from producers and other sources. Afterwards, these contents are encoded and store in an acquisition database for video-on-demand (VoD)

Service Nodes: The 'Service Node' is defined as a functionality which receives video streams in different formats. These video streams in different formats then reformat and encapsulate it for transmission with appropriate quality of service (QoS) indications to the wide-area network. This makes it ready for delivery to customers. In regards to service management, the Service Nodes communicate with the customer premises equipment (CPE); for the subscriber, session and digital rights management, service nodes communicate with the IPTV service.

Wide Area Distribution Networks: The Wide Area Distribution Network is made up of distribution capability, capacity, and quality of service. It also consists of other capabilities, such as multicast, which is necessary for the reliable and timely distribution of IPTV data streams from the service nodes to the customer premises. Moreover, the core and access network cover the optical distribution backbone network and the various digital subscriber line access multiplexers (DSLAMs). This is located at the central office or remote distribution points.

Customer Access Links: In the customer access links, high-speed DSL technologies such as ADSL2+ and VDSL are required; with the help of such technology, customer delivery can be provided over the existing loop plant and through phone lines to homes. There are some other options available. Service providers may use a combination of fiber-to-the curb (FTTC) and DSL technologies for delivery to customers. They can also implement direct fiber-to-the-home (FTTH) access. However, good results depend on the richness of their IPTV service offerings.

Customer Premises Equipment (CPE): In context of IPTV, the CPE device is located at the customer premises. This provides the broadband network termination (B-NT) functionality. At a minimum, it may also include other integrated functions which can be routing gateway, set-top box, or home networking capabilities.

IPTV Client: The IPTV client is a functional unit which terminates the IPTV traffic at the customer premises. This is only a device, such as a set-top box, which performs the functional processing. The functional processing includes setting up the connection and QoS with the service node, decoding the video streams, channel change functionality, user display control and connections to user appliances such as a standard definition television (SDTV) or a high definition television (HDTV) monitor.

IPTV vs. Internet Television

Now, let us take a look at what makes IPTV and Internet Television different. To differentiate these two models is in general quite challenging. But studying and analyzing the said concepts in depth explains the differences.

IPTV is the representation of a profile of a closed, proprietary TV system. This is somewhat similar to the present day cable service providers. But, unlike IPTV, it is delivered via IP-based secure channels. As a result, it sharply increases the control of content distribution.

Internet Television is an open evolving framework where a huge number of small and medium-sized video producers contribute. Such a service provides highly innovative content, where the contributors are very much comfortable. This is due to the opening of different traditional channels which are either retail and for wide distribution.

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.

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 it 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.

Addressable Advertising

The well-knit communication of a particular message or media content between a specific device and the customer based on their address is called addressable advertising. Here, the said address of the customer may be obtained by scrutinizing the profile of the viewer. This is done in order to determine whether the advertising message is appropriate for the recipient or not. Therefore, addressable advertising allows for speedy and straight measurement of the efficiency of advertising campaigns.

The cooperation of the viewer is the key aspect of addressable advertising. As soon the IP television is turned on, the IP television systems may ask or prompt the viewer to pick their name from a list of registered users. As a reply, viewers will typically want to select their programming name. Here, the programming name has a profile (or, preferences) and the advertising messages can be selected, which are the best match to the concerned viewer profile. Because of the advanced features offered by IP television, such as incoming calls and e-mails and programming guides that remember favorite channels, the viewers can actually do so here.

The generated revenue for addressable advertising messages sent to viewers with specific profiles can be 10 to 100 times higher than the revenue for broadcasting an advertisement to a general audience. The ability to send commercial advertisements to a specific number of viewers allows the advertisers to fix a precise budget for addressable advertising. It also allows the advertiser to experiment a number of different commercial advertisements in the same geographic area at the same time.

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.

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 terestial, 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 labelled as IPTV services.

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 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.

IPTV can report detailed levels of usage and viewership which can allow the operator to report statistics of programs/channels/adverts watched as well as be able to bill using various methods of bundled or a-la-carte content….billed by the second, minute, month or par per view.

Conclusion

Among the diverse areas within an IPTV solution, which are to be addressed, it is obvious that the standardization process related to it is in its early stages. In the different parts of the whole system, many entities are working. However, so far, the observation is that there is little coordination among them. After issuing a standard offer, it can be observed that one component of a system is a good step forward, but too little. Now for IPTV the need of the hour is to gain mass acceptance and to reach to the optimum technical and commercial success as per everyone’s expectation. In order to achieve this, the IPTV market must make itself free from closed solutions, which may hamper the following three goals: innovation, development, and competition.

In regards to the future of IPTV, it can only follow one path, which is close to what the market has witnessed in the traditional broadcast world. Moreover, it is important to note that this market has built an open system, which is well defined and relies on open standards. To make IPTV successful and perfect as per expectations, it has to guarantee the interoperability between all the building blocks. But, the conformance program related to it is critical.