IPTV Explained

Part 1 in a BSF Series

TECHNOLOGY ▷ SERVICE ▷ CONTENT ▷ LIFE

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INTRODUCTION

As a result of broadband service providers moving from offering connectivity to services, the discussion surrounding broadband entertainment has increased significantly. The Broadband Services Forum (BSF) membership has identified a number of services that require significant focus in this decade; one of these is Internet Protocol Television (IPTV). This paper provides a high level, vendor-agnostic overview of what IPTV is and how it works.

THE DEFINITION

IPTV, essentially, has two components:

> Part 1: Internet Protocol (IP): specifies the format of packets and the addressing scheme. 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.

Note: It is important to point out that IPTV services usually operate over a private IP network and not the public Internet. In a private IP network specifically designed for IPTV, a service provider can ensure quality of service (QoS) for consumers. QoS refers to giving certain IP traffic a higher priority than other IP traffic. In an IPTV network, TV signals are given the highest priority. As a result, the TV service is instantaneous; there is no downloading involved for the linear or on-demand content.

An IPTV service model offers a complete broadcaster and "cable programmer" channel line-up, including live programming delivered in real time. Additionally, it can offer a video on demand (VOD) service and enables the broadband service provider to develop new and unique services to differentiate their offering from competitors.

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 single 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.

Since IPTV is enabled by the availability of network technology, the network architecture used to deploy IPTV is important. Content delivery requires bandwidth and performance, not only in the last mile (the access network), but also in the edge and core of the network and in the customer premises.

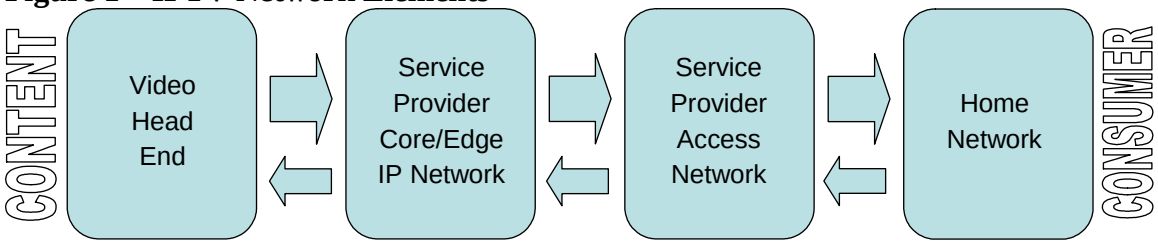
The IPTV service model, and its market advantages, is not a new concept. However, recent developments have enabled the delivery of IPTV service in an increasingly secure, scalable and cost-effective manner. These recent developments include:

- 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

THE IPTV NETWORK ELEMENTS

An IPTV system is made up of four major elements; all are generic are common to any vendor's (or combination of vendors') infrastructure.

Figure 1 – IPTV Network Elements



This is a high-level overview and, in reality, many IPTV subsystems and vendor-specific architectures are required to make each incarnation of IPTV unique and of varying complexity.

Figure 1 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).

The 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, as it has some advantages over MPEG-2, such as lower bit-rate requirements for encoding both SD and HD television signals.

After encoding, each channel is encapsulated into IP and sent out over the network. These channels are typically IP multicast streams, however, certain vendors make use of 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).

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 are unique to the service provider and usually include 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. The end point in the home network, to which the television set is connected, is the set-top box (STB).

Middleware: The IPTV Enabler

The term IPTV middleware is used to describe the software packages associated with delivering an IPTV service. There are a variety of vendors in this space, each with their own unique approach to IPTV. The middleware selection by a service provider can impact the IPTV network architecture. The middleware is typically a client/server architecture where the client resides on the STB. The middleware controls the user experience and, because of this, it defines how the consumer interacts with the service. For example, the user interface and services available to a consumer (such as the electronic program guide (EPG), VOD or pay per view service), are all made available and controlled through the middleware.

The ease of managing multiple services is a function of the two-way IP network. This IP architecture provides a standard for applications and services to be integrated into the

network, and IPTV becomes just one of these applications. The differentiating factor in an IP service model is convergence.

Because of the common structure for applications and services, convergence can be realized for network elements, applications and operations/business support systems (OSS/BSS). Therefore, managing multiple services becomes a matter of managing the same services through the network and distributing them to multiple end-user environments.

IPTV Video on Demand (VoD)

Video on demand(VoD) services operate in a different manner than linear television service as the IPTV system provides the subscriber with a unicast stream of programming with VCR-like controls including pause, fast forward and rewind. The IPTV middleware controls the user interface and commercial experience/details of VOD and can also be extended to include services like subscription VOD and network based personal video recorder (PVR).

CONTENT SECURITY

When discussing online content the insecurity of PC-based content, and the piracy issues which have plagued the entertainment industry, often come to mind. Although not the primary focus of this paper, content security is a very important topic when discussing IPTV. Each IPTV solution vendor has a slightly different approach to the content security requirement. Usually vendors will partner with experts in this space to provide a complete solution to the service provider and one which will be acceptable to the content community.

A high level discussion on Content Security will be detailed in a separate document from the BSF.

SUMMARY

An IPTV service model offers a complete multi-channel video line-up as well as on-demand programming. IPTV technology promises to make more content available because of the limitless nature of the switched digital video architecture theoretically giving access to niche content that has not previously been available on TV.

Middleware vendors are focused on making more content available, making programming easier to access and making the solution portable (while maintaining security).

The extensible user environment of IPTV increases the interactive nature of the consumer product and will allow single applications to be run over multiple end-user devices, all over a single service delivery network. IPTV also capitalizes on the two-way

nature of the IP network, enabling unprecedented interaction among subscribers, content providers and service providers.

With a single standardized service delivery network, the integration and management of new services becomes simpler, reducing time to market and the cost of launching that new service. This provides marketing opportunities to use new applications to gain or keep market share and generate added revenue.

About the BSF:

The Broadband Services Forum is an international industry resource that provides a forum for dialogue and development, along with the tools and information to address the fundamental business and technology issues vital to the growth and health of the broadband industry. The Broadband Services Forum fosters collaboration across the broadband value chain including content, service and technology providers.

The business and technical issues the organization addresses include:

- Innovative profitable services
- Reduced time to deployment
- Unified services and applications experience
- Network and device agnostic service delivery
- Simplified multi-service architecture
- Business tools and rationale
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