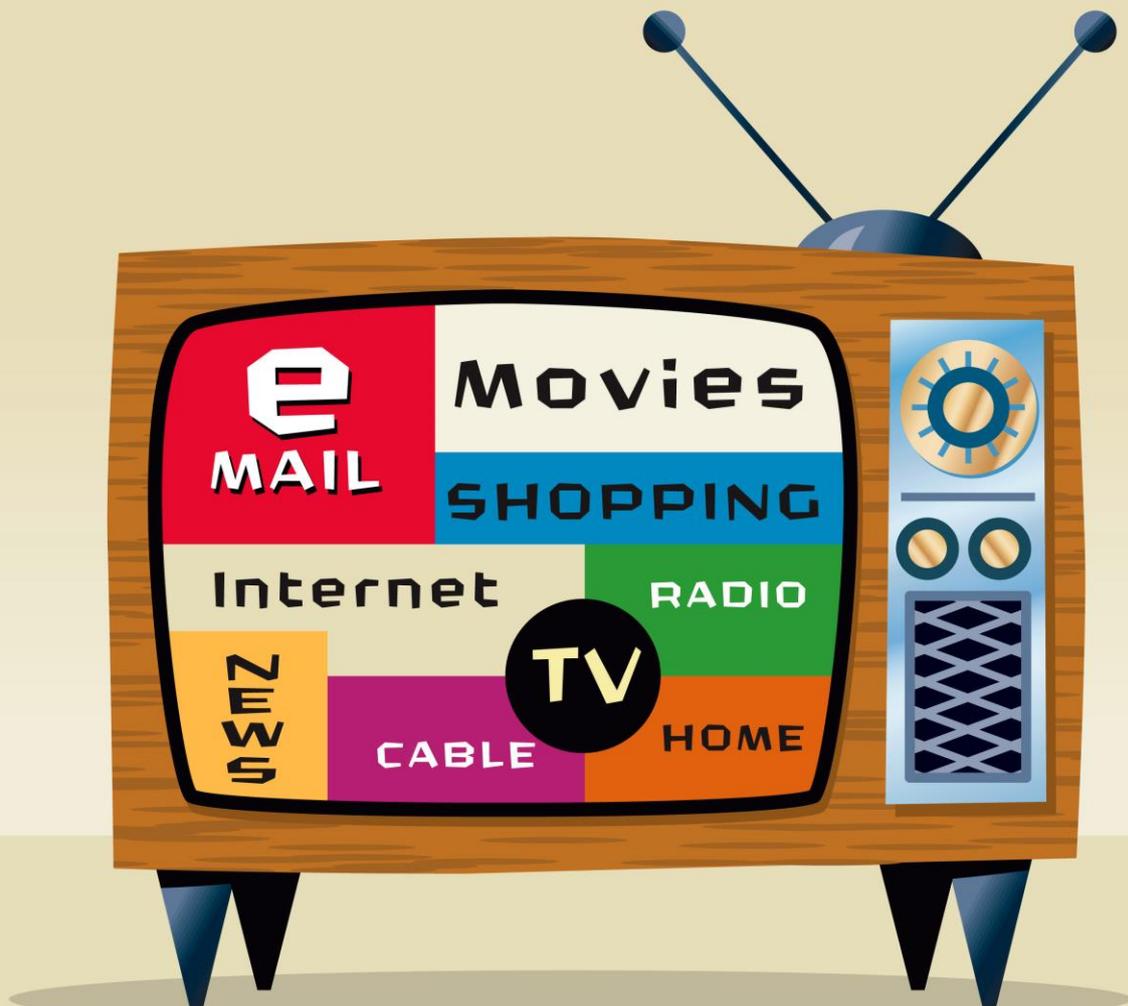


WHITE PAPER

IPTV

Internet Protocol Television



Introduction

IPTV stands for Internet Protocol Television; watching television over a broadband IP connection. This TV technology was developed at the end of last century and is in use by practically all major Dutch ISPs.

IPTV is suitable for network operators with a broadband IP network such as xDSL, coax, fibre but mobile data operators also offer IPTV services. To provide IPTV the operator needs a platform that digitizes TV programs (video content) and that distributes it to end consumers.

This white paper describes the delivery of video content and interactive TV. Interactive TV enables the consumer to interact with his video device (TV, smartphone, tablet or computer) so that he can watch TV in a personalized manner at the moment of his choosing.

A trend in the market is that content providers like HBO and Walt Disney and large internet players like Google, Microsoft and Netflix attempt to directly reach the consumers via their own Over the Top (OTT, i.e. via the internet) channels. This personalizes the offering of video content even more for consumers. This leads to new business models that provides both threats and opportunities for incumbents.

The media landscape is changing because a direct relationship is made between content owners and consumers. ISPs that deliver interactive TV service often package these as part of dual/triple/quadruple play offerings. An interactive TV service is increasingly seen as the unique selling point of the complete package.

An interactive TV service nowadays often contains the following features:

- ▼ Live (linear) TV including multiple themed channel packages.
- ▼ Pause TV and live recording
- ▼ Catch-up TV
- ▼ Video On Demand (VOD)
- ▼ Electronic Program Guide
- ▼ 2nd screen app

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Delivery via operator Network

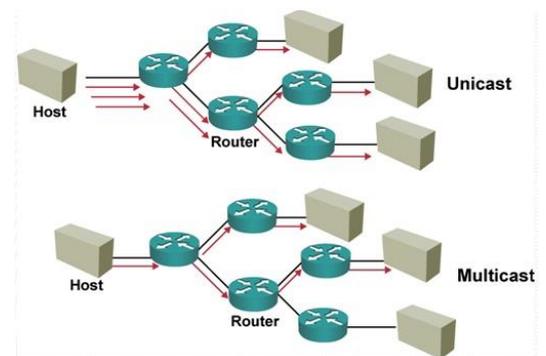


Figure 1: Unicast and Multicast content delivery

To be able to deliver high quality premium content, a reliable connection is needed that has sufficient bandwidth. TV requires a lot more network resources than internet or telephony. The continuous network load can vary from a couple to dozens of megabit per second per channel or program watched. To efficiently manage bandwidth, operators use “multicast” technology to have people that watch the same channel share the video traffic.

For Video on Demand services every viewer gets his own specific video IP stream via a “unicast” or using an HTTP based protocol like HLS. This increases the required bandwidth proportionally with the number of viewers.

Besides sufficient bandwidth, a minimal quality of service must be guaranteed; during network congestion only few IP packets can be afforded to be lost (packet loss) and delays and variation in the network bandwidth (jitter) must be minimized. These types of disturbances introduce disturbances

and artefacts in the video and sound and degrade consumer experience.

To counter these, special network and modem configurations (QoS) should be used to deliver IPTV. Per consumer specific modem settings are required with appropriate connect processes. These consumer specific configuration need to be centrally managed. This can be done with specialised systems for remote management and configuration of network and customer premises equipment (CPE).

For delivery of large volumes of video over large geographic areas Content Delivery Networks (CDNs) are used.

Delivery via Internet

For various reasons it can be necessary to deliver TV over the open internet, for instance when the operator is a pure 'Over the Top' (OTT) party. Over the internet multicast is not a viable option. A number of technologies make it possible to deliver video via the internet.

Adaptive HTTP Streaming

Http based protocols can be used like HLS, developed by Apple, or Microsoft Smooth Streaming (MSS). These protocols have the client request video segments of 2 to 10 seconds in length. They support Adaptive Streaming: the client continuously monitors the available bandwidth and if it detects decreased throughput it starts requesting segments of a lower bitrate, resulting in quicker download times. This allows the video to play on unhampered but with less resolution. This is based on research that indicated that consumers care more about the continuity of the video than about the picture quality.

Content Delivery Network

For delivery of large volumes of video over large geographic areas Content Delivery Networks (CDNs) are used. These are third party companies that own an extensive

network with proxies at multiple geographic locations. This allows the physical distance of the last mile of delivery to be as short, and therefore cheap, as possible. Combined with their bulk purchasing power of internet traffic this makes CDNs a cheaper alternative for delivering video than directly from the operator's own network.

Middleware

To meet the demands involved with an interactive TV proposition it is important to implement a suitable Middleware solution on the IPTV platform. Middleware connects the Set-top Box hardware, smart devices (Smartphone, Tablet, PC), the IPTV core network and the OSS of an ISP.

The most important **functions** are:

- ▼ Managing STB hardware
- ▼ Handling DRM
- ▼ Implementing IPTV product features
- ▼ Managing channel packages and content
- ▼ Electronic Program Guide
- ▼ GUI and APIs

Modern Set-Top Boxes have an increasingly simple middleware implementation focusing on hardware control and DRM, delegating GUI, EPG and other functions to an HTML5 implementation in a web browser. This has the advantage that the skills to produce a good looking AI are more readily available in the market (web development vs embedded). It is especially common for OTT delivery.

Set-top-Boxes and Smart Devices

To successfully implement IPTV a careful selection from the wide range of network and peripheral equipment is necessary. Thorough integration and end to end tests

User experience is the crucial factor in a product's success or failure. Two important user experience aspects are: Service Quality Management and the Graphical User interface.

are important conditions for success. The consumer directly experiences quality flaws in any link of the IPTV chain.

Consumers are gathering more smart devices in their homes on which content can be viewed. These devices well suited to make use of the features of a modern IPTV product. Good integration, a well-honed user experience and placing the right features on the appropriate screen are very important. Consumers do not associate TV screens with social features, but sending a message about what you are watching on your mobile device comes much more naturally.

aspects: Service Quality Management and the Graphical User interface.

Service Quality Management

The quality of the user experience can be deduced from performance indicators like image quality, zap delay, response time of the remote control and the boot time of the Set-Top Box. Modern STBs can measure such indicators and expose them to a Service Management System. This generates a large amount of service quality data per consumer.

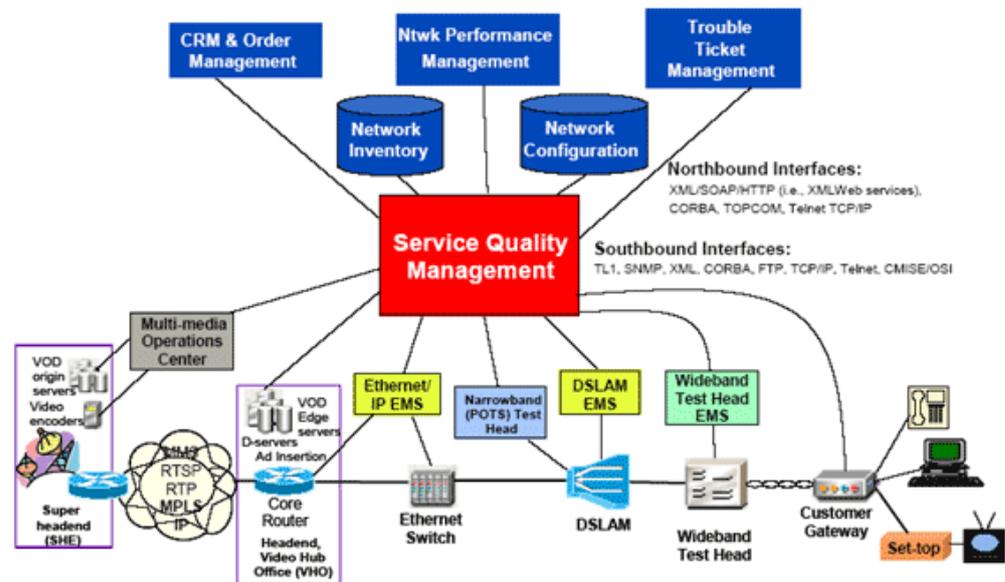


Figure 2: IPTV Network Management System (source: iec)

The role of the Set-top box (STB) as we know it will decrease over time. This is because the STBs keep getting smaller and TVs keep getting more powerful processors. Over time the function of the STBs will be integrated in the TV itself.

User experience

There is a lot to be said about user experience and increasingly it is the crucial factor in a product's success or failure. In this white paper we highlight on two important

An IPTV network management system enables an operator to produce service quality reports that can be used to find and solve potential problems. Upon receiving a consumer complaint it enables immediate quality measurements that help support personnel in further investigations.

Graphical User Interface

Interactive TV services keep getting new features. To give consumers an optimal experience and to make sure that all features of the product are discovered and used, a clean and user friendly GUI is of the utmost

importance. Furthermore a GUI can help to reduce the number of support request regarding the use of the product.

It is important to have the GUI be designed by a specialised designer or design agency. Usability testing is of great value.

Despite all fancy features of an interactive IPTV product, the prime differentiator will always be available content.

Content Rights

Despite all fancy features of an interactive IPTV product, the prime differentiator will always be available content. Therein linear TV will remain the most important for the foreseeable future. An average ISP typically has between 100 and 200 channels, divided over multiple channel packages. This means that an ISP has a business relation with 40 to 80 different rights holders.

Important items on which agreements need to be made are:

- ▼ Price
- ▼ Quality (SD / HD / 3D / 4K Ultra HD – i.e. 4x more pixels than HD)
- ▼ In which channel package will the content be offered
- ▼ Content protection
- ▼ Geographical area of delivery
- ▼ Further features (pausing / PVR / 2nd screen)

Because broadcasters often purchase third party content (e.g. films from Hollywood

studios) it is sometimes necessary to comply with security requirements and to differentiate which programs can and can't be recorded.

Business Models

Due to the complexity and the high investment cost of an interactive TV service, mainly large ISPs with their own networks are able to deliver this service. Often a consumer only has the opportunity to get the service from his own access or internet provider. Exceptions in the Netherlands are satellite TV and Digitenne. These offer only linear content and no interactive TV service.

Interactive TV services are often positioned as the unique selling point within dual/triple/quadruple play package deals. Usually it is even impossible to purchase only the TV service because it technically depends on the internet service for delivery.

Development and Standardisation

IPTV offers opportunities for development of new program material customized for niche target audiences. IPTV can also offer

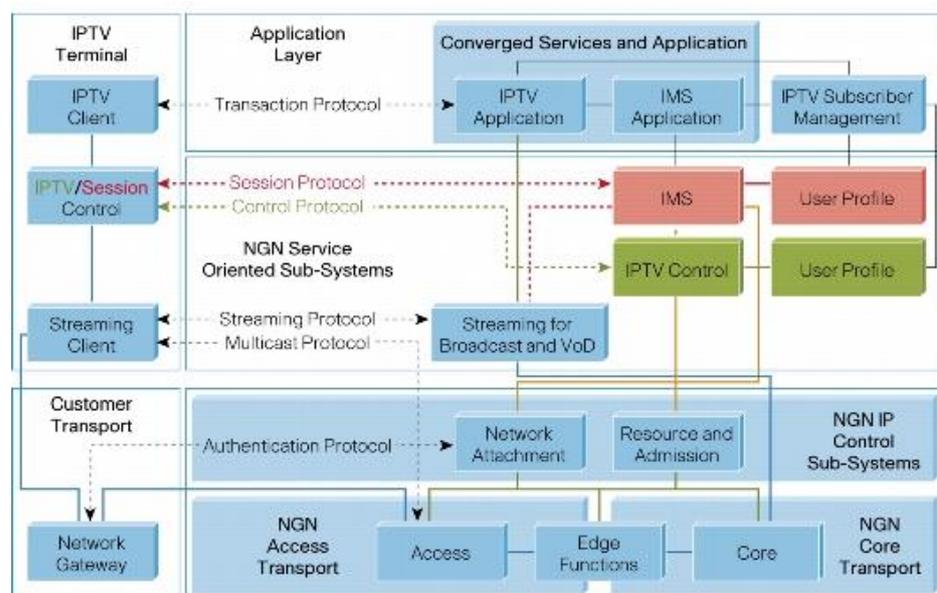


Figure 3: ITU-T IPTV architecture (source: Cisco)

By leveraging IMS, an operator can deliver TV and voice services from one central network core.

program makers detailed statistics on viewer numbers and service usage. This information is useful for billing consumers but even more important, it can be very valuable to determine when to show which commercial message. It is feasible to show different commercials to specific target audiences.

For IPTV various standards are under development. ITU-T has recently described an architecture in which network and user functions are specified. The architecture describes IPTV in functional blocks necessary for delivery, maintenance and charging of services.

Service Control Function

An important functional block is the Service Control Function. This function manages access and security of services. Encryption ensures control over storage and copying of content. Furthermore it enables the operator to control per consumer whether and how often he/she can use each service. IPTV and IMS Standards organisation 3GPP has developed an architecture that supports IPTV as part of the IP Multimedia Subsystem (IMS); the so-called 'IMS-based IPTV'. Both ITU-T and ETSI are involved in this standard (ETSI TS 182 027). By leveraging IMS, an operator can deliver TV and voice services from one central network core.

Benefits

- ▼ IPTV is a new technology for ISPs and broadband parties to offer value added multimedia services apart from internet access and voice services.
- ▼ Interactive TV services are differentiators while Internet access and voice have become commodities. No bespoke hardware like an antenna or coaxial

cables are necessary in a household, TC can be delivered via an existing IP network.

- ▼ Services are innovative, interactive and make optimal use of broadband technology.
- ▼ A lot of consumer usage feedback data is generated, allowing for optimisation of consumer interaction.

Drawbacks

- ▼ New entrants have to make many choices in services portfolio, activation and installation processes, security management, charging and data storage management.
- ▼ There is great variety in Set-Top Boxes, software and network systems from which a selection needs to be made and integrated. There are high demands on the quality and security of the operator's network but also on the network at consumer premises. This requires an end to end quality approach.
- ▼ Technology is still developing and therefore there are no readymade off the shelf solutions.
- ▼ The content market is diversifying and therefore the operator faces competition from many OTT parties that are trying to reach the consumer directly.

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