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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

IPTV multimedia services and applications for IPTV –
IPTV terminal devices

Overview of IPTV terminal devices and end systems

Recommendation ITU-T H.720

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Recommendation ITU-T H.720

Overview of IPTV terminal devices and end systems

Summary

Recommendation ITU-T H.720 gives an overview of the architecture and functional components of an Internet Protocol television (IPTV) terminal device and provides a high-level description of the functionality necessary to support IPTV services. This Recommendation provides the definitions of terminal device and end system, the location of terminal devices and end systems within the overall architecture of IPTV, examples of IPTV services, an abstract description of the terminal device architecture, and descriptions of other Recommendations that discuss IPTV terminal devices.

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Overview of IPTV terminal devices and end systems

1   Scope

This Recommendation gives an overview of Internet Protocol television (IPTV) terminal devices and end systems. It also describes the general architecture and functional components of an IPTV terminal device, providing a high-level description of functionality of terminal devices for IPTV services. It provides the definitions of terminal device and end system, the location of terminal devices and end systems within the overall architecture of IPTV, examples of IPTV services, an abstract description of the terminal device architecture, and descriptions of other Recommendations that discuss IPTV terminal devices.

2   References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T F.703]	Recommendation ITU-T F.703 (2000), *Multimedia conversational services*. <http://www.itu.int/rec/T-REC-F.703>
[ITU-T F.790]	Recommendation ITU-T F.790 (2007), *Telecommunications accessibility guidelines for older persons and persons with disabilities*. <http://www.itu.int/rec/T-REC-F.790>
[ITU-T F.902]	Recommendation ITU-T F.902 (1995), *Interactive services design guidelines*. <http://www.itu.int/rec/T-REC-F.902>
[ITU-T G.1080]	Recommendation ITU-T G.1080 (2008), *Quality of experience requirements for IPTV services*. <http://www.itu.int/rec/T-REC-G.1080>
[ITU-T G.1081]	Recommendation ITU-T G.1081 (2008), *Performance monitoring points for IPTV*. <http://www.itu.int/rec/T-REC-G.1081>
[ITU-T H.622.1]	Recommendation ITU-T H.622.1 (2008), *Architecture and functional requirements for home networks supporting IPTV services*. <http://www.itu.int/rec/T-REC-H.622.1>
[ITU-T H.750]	Recommendation ITU-T H.750 (2008), *High-level specification of metadata for IPTV services*. <http://www.itu.int/rec/T-REC-H.750>
[ITU-T J.702]	Recommendation ITU-T J.702 (2008), *Enablement of current terminal devices for the support of IPTV services*. <http://www.itu.int/rec/T-REC-J.702>
[ITU-T M.1400]	Recommendation ITU-T M.1400 (2006), *Designations for interconnections among operators' networks*. <http://www.itu.int/rec/T-REC-M.1400>

[ITU-T Q.1290]	Recommendation ITU-T Q.1290 (1998), *Glossary of terms used in the definition of intelligent networks*. <http://www.itu.int/rec/T-REC-Q.1290>
[ITU-T Y.1910]	Recommendation ITU-T Y.1910 (2008), *IPTV functional architecture*. <http://www.itu.int/rec/T-REC-Y.1910>
[ITU-T Y.2014]	Recommendation ITU-T Y.2014 (2008), *Network attachment control functions in next generation networks*. <http://www.itu.int/rec/T-REC-Y.2014>
[ITU-R BT.2052]	Report ITU-R BT.2052 (2005), *Protection of end-users' privacy in interactive broadcasting systems*. <http://www.itu.int/publ/R-REP-BT.2052>
[ETSI TS 102 822-1]	ETSI TS 102 822-1 V1.3.1 (2006), *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 1: Benchmark Features*. <http://pda.etsi.org/pda/queryform.asp>
[ETSI TS 102 822-2]	ETSI TS 102 822-2 V1.4.1 (2007), *Broadcast and On-line Services: Search, select and rightful use of content on personal storage systems ("TV-Anytime"); Part 2: Phase 1 – System description*. <http://pda.etsi.org/pda/queryform.asp>
[ETSI TS 102 822-9]	ETSI TS 102 822-9 V1.2.1 (2007), *Broadcast and On-line Services: Search, select and rightful use of content on personal storage systems ("TV-Anytime"); Part 9: Phase 2 – Remote Programming*. <http://pda.etsi.org/pda/queryform.asp>
[ATIS-0800002]	ATIS standard ATIS-0800002 (2006), *IPTV Architecture Requirements*. <http://www.atis.org/docstore/product.aspx?id=21213>

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 application [b-ITU-T Y.101]: A structured set of capabilities, which provide value-added functionality supported by one or more services.

3.1.2 content provider [ITU-T Y.1910]: The entity that owns or is licensed to sell content or content assets.

3.1.3 content tracing [b-ITU-T Y.1901]: A process to enable the identification of the (arbitrary) origin of content, and/or the responsible party (e.g., the end-user), to facilitate subsequent investigation in the event of unauthorized content copying or distribution.

NOTE – Content tracing information may be attached to content either as metadata, or as a forensic watermark.

3.1.4 delivery [ITU-T Y.1910]: In context of IPTV architecture, "delivery" is defined as sending contents to the end-user.

3.1.5 delivery network gateway (DNG) [ATIS-0800002]: A device implementing the DNGF.

3.1.6 delivery network gateway functions (DNGF) [ITU-T H.622.1]: Set of functions that mediate between the network and service provider domains and the IPTV terminal function (ITF).

NOTE – A device implementing the DNGF is commonly referred to as the residential gateway (RG) or delivery network gateway (DNG).

3.1.7   distribution [ITU-T Y.1910]: In context of IPTV architecture, "distribution" is defined as sending the content to appropriate intermediate locations to enable subsequent delivery.

3.1.8   end-user [ITU-T Y.1910]: The actual user of the products or services.

NOTE – The end-user consumes the product or service. An end-user can optionally be a subscriber.

3.1.9   functional architecture [b-ITU-T Y.2012]: A set of functional entities and the reference points between them used to describe the structure of an NGN. These functional entities are separated by reference points, and thus, they define the distribution of functions.

NOTE 1 – The functional entities can be used to describe a set of reference configurations. These reference configurations identify which reference points are visible at the boundaries of equipment implementations and between administrative domains.

NOTE 2 – This definition is taken from [b-ITU-T Y.2012] and therefore relates to NGN. However, it is also valid for other networks, e.g., networks supporting IPTV terminal devices.

3.1.10   functional entity [b-ITU-T Y.2012]: An entity that comprises an indivisible set of specific functions. Functional entities are logical concepts, while groupings of functional entities are used to describe practical, physical implementations.

3.1.11   home network (HN) [ITU-T H.622]: Home network is the collection of elements that process, manage, transport, and store information, thus enabling the connection and integration of multiple computing, control, monitoring, communication and entertainment devices in the home.

3.1.12   hybrid terminal device [b-ITU-T Y.1901]: An IPTV terminal device that can also receive content from different types of transmission systems (e.g., terrestrial, satellite).

3.1.13   IPTV terminal device [b-ITU-T Y.1901]: A terminal device which has ITF functionality, e.g., STB.

3.1.14   IPTV terminal function (ITF) [b-ITU-T Y.1901]: The end-user function(s) associated with a) receiving and responding to network control channel messages regarding session set-up, maintenance, and tear-down, and b) receiving the content of an IP transport from the network and rendering.

3.1.15   linear TV [b-ITU-T Y.1901]: A television service in which a continuous stream flows in real time from the service provider to the terminal device and where the user cannot control the temporal order in which contents are viewed.

3.1.16   network personal video recorder (nPVR) [b-ITU-T Y.1901]: Same as PVR except that the recording device is located at the service provider premises.

3.1.17   personal video recorder (PVR) [b-ITU-T Y.1901]: An end-user controlled device that records, stores and plays back multimedia content. PVR is also known as personal digital recorder (PDR).

3.1.18   service provider [ITU-T M.1400]: A general reference to an operator that provides telecommunication services to customers and other users either on a tariff or contract basis. A service provider may or may not operate a network. A service provider may or may be a customer of another service provider.

NOTE – Typically, the service provider acquires or licenses content from content providers, and packages them into a service that is consumed by the end-user.

3.1.19   subscriber [b-ITU-T M.3050.1]: The subscriber is responsible for concluding contracts for the services subscribed to and for paying for these services.

3.1.20   terminal device (TD) [b-ITU-T Y.1901]: An end-user device which typically presents and/or processes the content, such as a personal computer, a computer peripheral, a mobile device, a TV set, a monitor, a VoIP terminal or an audiovisual media player.

3.1.21 video on demand [ITU-T Y.1910]: A service in which the end-user can, on demand, select and view a video content and where the end-user can control the temporal order in which the video content is viewed (e.g., the ability to start the viewing, pause, fast forward, rewind, etc.).

NOTE – The viewing may occur some time after the selection of the video content.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 client PVR (cPVR): An instance of PVR where the end-user terminal device contains the recording capability that can be solicited and operated by end-users to record and store video, audio and other associated data locally for subsequent playback.

3.2.2 distributed PVR (dPVR): Multiple instances of PVR, where a combination of cPVRs and nPVRs can be used to record and store video, audio and other associated data for subsequent playback. For example, this usually occurs within a home network containing multiple cPVRs in order to distribute storage of video, audio and other data.

3.2.3 home network capable IPTV TD: An IPTV TD which has HN capability. This is typically a server and/or a client to HN devices.

3.2.4 home network capable TD: A TD which has HN capability. This is typically a server and/or a client to HN devices.

3.2.5 IPTV end system (IES): A single or set of consumer devices that support IPTV services (i.e., everything from gateway to display).

3.2.6 IPTV network: An entity encompassing the full group of IPTV architecture functions expected to be within the network provider and service provider functional domains.

3.2.7 network provider: The organization that maintains and operates the network components required for IPTV functionality (this definition is based on the definition of network provider in [ITU-T Q.1290]).

NOTE 1 – A network provider can optionally also act as service provider.

NOTE 2 – Although considered as two separate entities, the service provider and the network provider can optionally be one organizational entity.

3.2.8 service navigation: A process of presenting information that allows the end-user to discover, select and consume services

3.2.9 watermark: Machine readable data in the form of a signal embedded in a digital media stream so as to be imperceptible to the consumer, but persistent through faithful transformations of the content. Note that this definition pertains to watermarks in the context of IPTV service and is not a universal definition of a watermark. In the IPTV context, watermarks are used to facilitate rights management and media piracy investigation.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API   Application Programming Interface

BC   BroadCast

DNG   Delivery Network Gateway

DNGF   Delivery Network Gateway Function

EAN   Emergency Alert Notification

EAS   Emergency Alert System

ECG	Electronic Content Guide
EPG	Electronic Programme Guide
ESG	Electronic Service Guide
FEC	Forward Error Correction
GUI	Graphical User Interface
HN	Home Network
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Secure Hypertext Transfer Protocol
HW	HardWare
IC	Integrated Circuit
IGMP	Internet Group Management Protocol
IMS	Internet Protocol Multimedia Subsystem
IPG	Interactive Programme Guide
IPTV	Internet Protocol Television
MLD	Multicast Listener Discovery
NACF	Network Attachment Control Function
NGN	Next Generation Network
NW	NetWork
OD	Output Device
PC	Personal Computer
PD	Peripheral Device
PDA	Personal Digital Assistant
PPV	Pay-Per View
PVR	Personal Video Recorder
QoE	Quality of Experience
QoS	Quality of Service
RAL	Resource Abstraction Layer
RAM	Random Access Memory
SADS	Service and Application Discovery and Selection
SCP	Service and Content Protection
SNA	Service Navigation Application
SW	Software
TD	Terminal Device
TV	Television
UI	User Interface
USB	Universal Serial Bus

VOD   Video On Demand

5   Introduction

5.1   IPTV domains

Figure 5-1 shows the main domains that are involved in the provision of an IPTV service. These domains do not define a business model. This decomposition does not preclude that one provider be involved in the support of any given IPTV service across more than one domain.
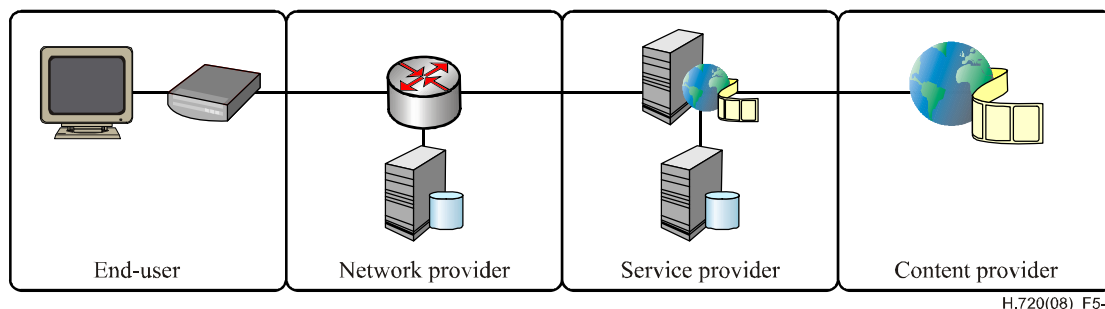

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Figure 5-1 – IPTV domains

The IPTV terminal device and end system is that part of the IPTV architecture included in the end-user domain. An IPTV end system is a single consumer device or a set of consumer devices that support IPTV services. It encompasses everything from the delivery network gateway to the display. Details of the home network are out of the scope of this Recommendation.

5.2   IPTV architectural overview

Figure 5-2 provides an overview of the IPTV functional architecture. Functions and functional blocks described in this clause are common to all architectural approaches as detailed in [ITU-T Y.1910] except where stated differently.

Key to figures:

–   The rectangular blocks represent functional blocks in the IPTV architecture, as indicated in clause 5 of [ITU-T Y.1910].

–   The rounded rectangular areas represent the particular grouping of functions, as indicated in clause 5 of [ITU-T Y.1910].

–   The solid lines represent direct relationships between either functions or functional blocks.

–   The dotted lines represent logical associations between end-user functions and either functions or functional blocks located outside the end-user functions.

–   Cross lines do not imply connections unless explicitly stated.

The end-user functions are comprised of IPTV terminal functions and the home network functions. The IPTV terminal device and end system are part of the end-user functions. The home network functions are out of the scope of this Recommendation. Refer to [ITU-T H.622.1] for details of home network issues including the relation between home networks and IPTV terminal devices.

An overview of the IPTV terminal functions is given in clause 8.

5.3   IPTV terminal device and its functional components

Figure 5-3 shows the relation between an IPTV terminal device and other functional components of the overall IPTV architecture.

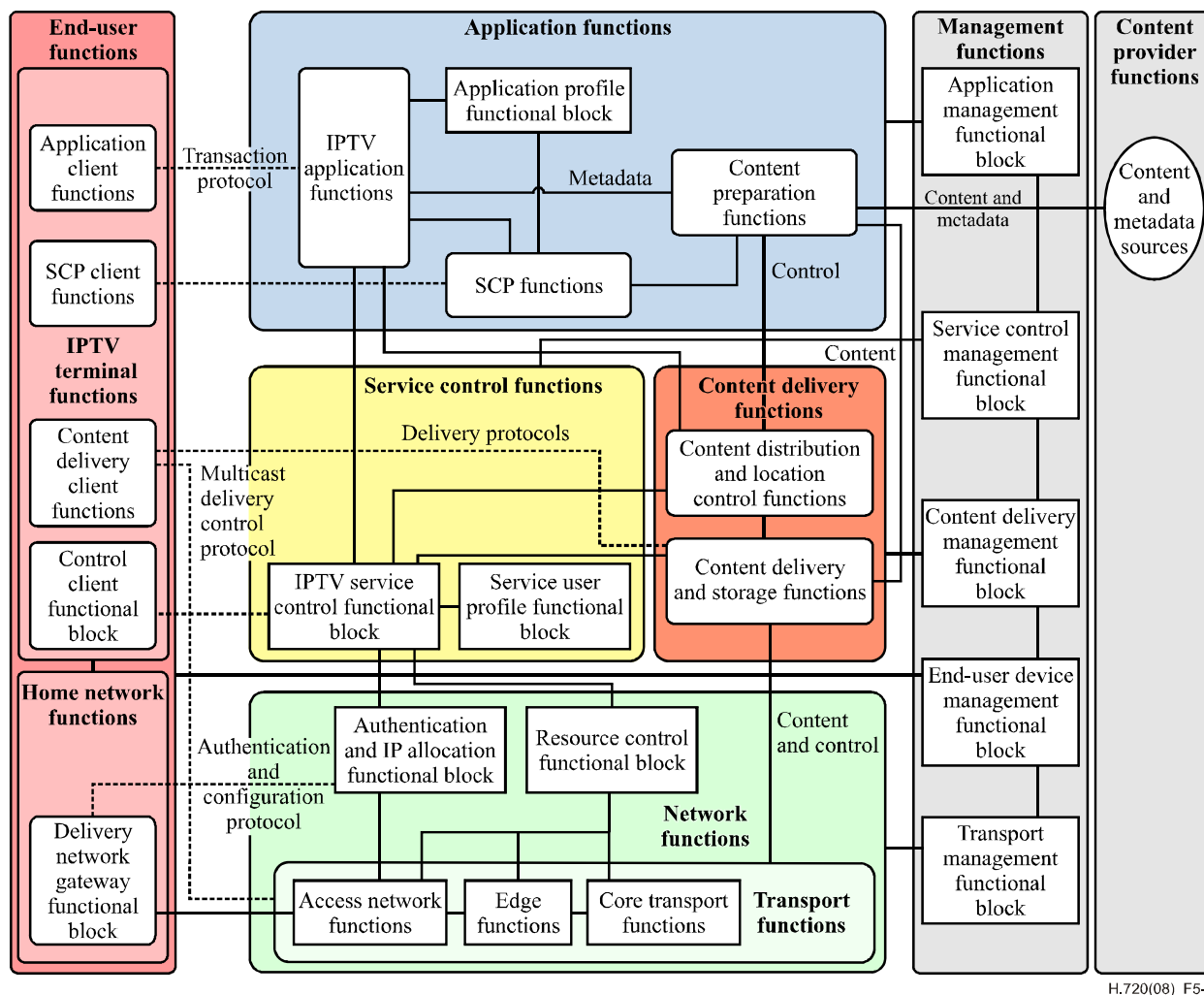A more detailed description of the IPTV terminal functions is provided in clause 7.
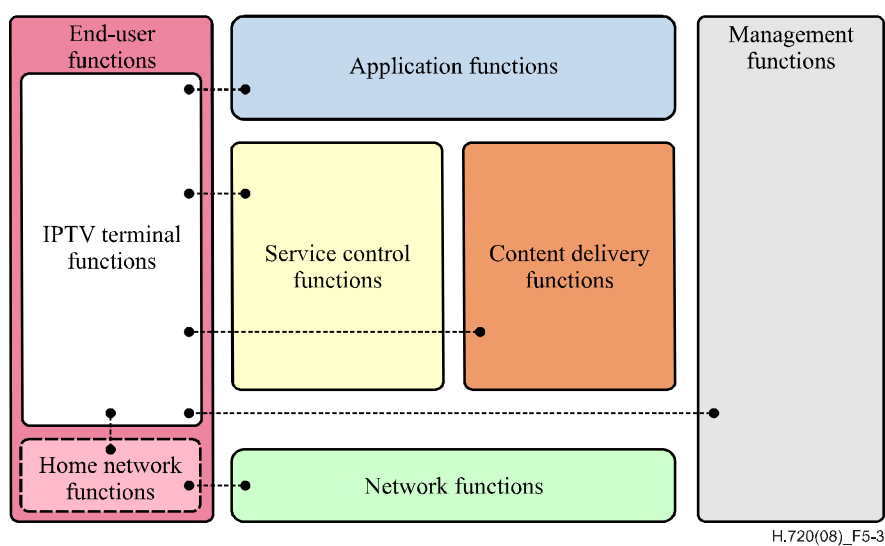

Figure 5-2 – IPTV architectural overview

Figure 5-3 – IPTV terminal device architectural overview

6 Services and key features of IPTV terminal device and end system

6.1 Examples of services

[b-ITU-T Y-Sup.5] provides a list of IPTV use cases that are informative illustrations of how IPTV services can be designed, deployed and operated. The following list is the summary:

a) Distributed content services:
   1) Broadcast services.
   2) On-demand services.
   3) Advertising services.
   4) Time-shifting and place-shifting services.
   5) Supplementary content.
b) Interactive services:
   1) Information services.
   2) Commerce services.
   3) Entertainment services.
   4) Learning services.
   5) Medical services.
   6) Monitoring services.
   7) Portal services.
   8) Interactive advertising.
c) Communication services.
d) Others:
   1) Public interest services.
   2) Hosting services.
   3) Presence services.
   4) Session mobility services.

6.1.1 Basic IPTV services

Of the services described in the informational list of [b-ITU-T Y-Sup.5], the following are considered to be the basic services for IPTV: broadcast services, on-demand services, and portal services. In addition to these, the public interest services are considered necessary because of their nature.

In this Recommendation, a broadcast service is called a linear TV service, and an on-demand service is called a content on-demand service.

6.1.1.1 Distributed content service

6.1.1.1.1 Service navigation

The service navigation is a process of presenting information that allows the end-user to discover, select and consume services.

Service navigation is an integral part of IPTV because it is expected that there are many services possible on IPTV and, without service navigation, it is very difficult, if not impossible, to obtain services. A typical means of service navigation is by way of a service navigation application, a user interface application that is intended to provide information on available services, including content that may be accessed by end-users for service navigation. Examples of service navigation

applications include EPG, IPG, ECG and ESG. The function provided by a service navigation application can also be called a service navigation function.

6.1.1.1.2 Linear TV

Linear TV is a broadcast TV service that is the same as the classic form of television services that are provided by terrestrial, cable and direct-to-the-home satellite broadcasting operators, where the programme content is transmitted according to a defined schedule and is intended for real-time consumption by the end-user. The service therefore provides an essentially continuous stream flowing from the content provider to the terminal device located in the end-user network.

Linear TV includes (but is not necessarily limited to) the following approaches:

–   **Audio and video**: Audio and video (audiovisual) signals are broadcast and distributed to the downlink without end-user control of the content flow (e.g., without trick mode (see clause 6.1.2.1 for a description of trick mode)).

–   **Audio only**: Audio signals are broadcast and distributed to the downlink without end-user control of the content flow (e.g., without trick mode (see clause 6.1.2.1 for a description of trick mode)).

–   **Linear TV with audio, video and data**: These audiovisual services are combined with interactive data for related or supplementary information of audiovisual programs using bidirectional links. The end-user can watch the downlink audiovisual stream and can simultaneously access more detailed or value-added information via the uplink.

6.1.1.1.3 Content on-demand

Content on-demand enables an end-user to select, acquire and consume from a library of content stored on a remote or local server.

6.1.1.2   Interactive services

The IPTV terminal device is recommended to have the ability to communicate with a remote interactive content server via means such as HTTP or HTTPS. Client-side interactive services may also be provided by a resident application. Interactive services may also include service-provider specific customer services, such as subscription, PPV, EPG, etc. It should be noted that using a browser does not necessarily indicate direct access to the Internet. Examples of interactive services are information services, learning services and entertainment services.

6.1.1.2.1 Information services

Information services support various types of content, such as news, weather and traffic forecasts, transportation, local community, etc.

6.1.1.2.2 Learning services

Learning services are instructional services for delivering educational content to students who are physically located in different geographic areas in a real-time and/or non-real-time manner.

6.1.1.2.3 Entertainment services

Entertainment services are designed to provide content such as games, karaoke, lottery, blogs and photo albums for the end-user's amusement.

6.1.1.3   Public interest services

Some examples of community and accessibility services that may be required by the local customer-base or regulations include the following.

6.1.1.3.1 Emergency alert system (EAS)

An IPTV terminal device is required to be compliant with regulatory requirements for emergency alerts. The terminal notifies the user of an incoming emergency alert notification (EAN) message both visually and audibly, or according to the user's preferences and capabilities, if specified. People have different preferences, perhaps based on need, for the delivery of notifications. Refer to [b-FSTP-TACL] and [ITU-T F.790] for a detailed description of accessibility issues.

6.1.1.3.2 Closed captions, subtitles, audio description and sign language interpretation

These features may be provided along with the above-mentioned basic services.

– **Closed captions and subtitles**: These services provide a real-time on-screen transcript of dialogue. Subtitles may be in different languages for the purposes of language translation. Captions for hearing-impaired people are in the same language.

– **Audio description**: Primarily intended to assist end-users who are unable to see the video content clearly. This service provides a commentary describing the visual events pertinent to the content.

– **Sign language interpretation**: This service provides supplementary video, usually smaller in image size to that of the main video content, showing an interpreter who uses hand gestures and facial expressions to convey the main audio content to sign language and lip readers. Refer to [b-ITU-T H-Sup.1] for the successful transmission of the components of visual language and certain quality requirements.

6.1.2 Advanced services

More advanced features of a full-fledged IPTV terminal device will allow some or all of the following services:

1) Linear TV with trick mode.

2) Personal video recorder (PVR) services.

    a) Client PVR (cPVR).

    b) Network PVR (nPVR).

    c) Distributed PVR (dPVR).

3) Advertising services.

4) Audience measurement information.

5) Interactive services requiring high security.

6) Personal IPTV broadcast.

Full-fledged services of IPTV will include, but will not be limited to, those listed above.

6.1.2.1 Linear TV with trick mode

Linear TV with trick mode enables the end-user to pause linear TV. For the ability to skip content and for other capabilities (e.g., instant replay), the use of a PVR is required. A PVR provides the capability of an end-user-controlled electronic device that records linear TV and stores it in a digital storage facility, either in standalone set-top boxes or in the network. This capability can support "time-shifting", "trick modes". IPTV terminal devices should have the following capabilities:

– provide an interface for the user to access the contents without time limitations, including pause, rewind, fast forward, etc.;

– provide an interface for the user to enable or disable the service of TV with trick mode;

– provide an interface to set the expiration time.

6.1.2.2   Personal video recorder (PVR) services

IPTV terminal devices are recommended to be capable of supporting PVR so that end-users can retrieve and playback content later. PVR services can include the following abilities:

–   schedule recordings;

–   display a list of stored programmes/content and a list of upcoming recordings;

–   rank recordings according to priority;

–   playback/erase stored programmes/content;

–   copy stored programmes/content to removable or external local storage devices.

Such services are required to ensure that copyright enforcement mechanisms are preserved. Relevant security issues should be consulted in [b-ITU-T X.1191] and [ITU-T H.622.1].

Advanced PVR will be able to support personal channel services at the PVR. In such services, the PVR generates the end-user's own preview schedule customized according to his/her preferences or lifestyle.

In addition, details of complementary convenience functions, such as programming and remote control by PDA, networked PC or web browser should be consulted in [ETSI TS 102 822-9].

6.1.2.2.1   Client PVR (cPVR)

In the case of client PVR, the IPTV terminal device contains (or is directly connected to) some sort of storage buffer or memory, such as a hard disk drive, removable media, or solid state memory (e.g., flash RAM). The end-user can interact with the GUI in order to schedule, modify, playback, erase and locate recordings.

6.1.2.2.2   Network PVR (nPVR)

There might be some cases in which it is not appropriate to save the content locally. For example, if the IPTV terminal is a PDA with limited size of hard drive, in which case a network PVR is more appropriate.

The end-user should not be able to recognize any difference between using cPVR or nPVR. The PVR service should function identically, the only difference being the location of the storage device.

6.1.2.2.3   Distributed PVR (dPVR)

In the distributed PVR case, all content is stored within the home network on multiple cPVRs or on a combination of multiple nPVRs and cPVRs, with interaction being done in order to schedule, modify, playback, erase and recordings. For examples, an IPTV terminal device could store end-user's content on a nPVR when the cPVR's disk, which is mainly used, is full. The end-user should not be able to recognize the difference between the cPVR, nPVR or dPVR. The PVR service should function identically, with the only difference being the location or distribution of the storage device(s). Refer to [ETSI TS 102 822-1] and [ETSI TS 102 822-2] for the variety of the PVR services.
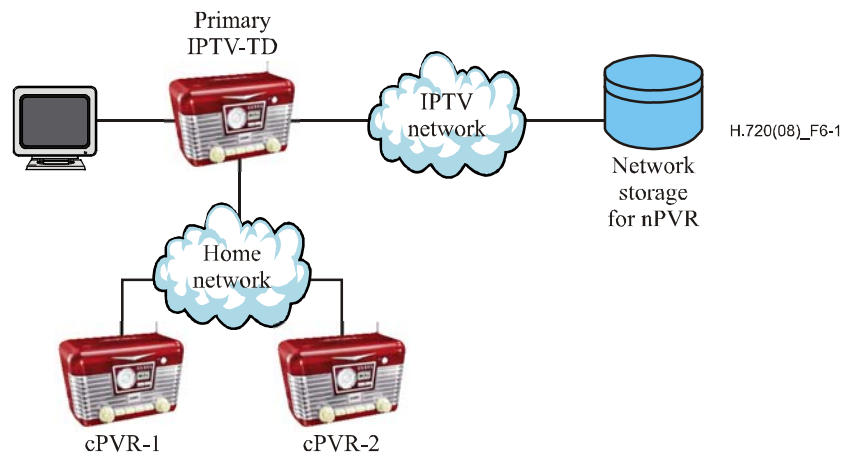
Figure 6-1 – Distributed PVR

In Figure 6-1, the "primary IPTV-TD" implements the PVR service. The content may be stored in the primary IPTV-TD in combination with one or more cPVRs (connected to the home network) or nPVRs (network storage in the IPTV network), or may be stored in one or more cPVRs or nPVRs entirely, without storing anything in the primary IPTV-TD.

6.1.2.3   Advertising services

Traditional advertising consists of broadcasting commercial advertising or public promotion of goods, services and companies. End-users located in a certain region will receive the same advertisements, which are usually inserted in audiovisual programmes.

The IPTV terminal device should be capable of supporting the following additional advertising services.

6.1.2.3.1 Targeted advertising

Targeted advertising can be defined as automatically matching and delivering relevant content to the end-users according to certain campaign objectives. Targeted advertising usually takes advantage of the end-user's profile, including user preferences, residence, usage history, personal characteristics (e.g., accessibility) and usage environments (terminals, networks and natural environmental characteristics, etc.). Advanced PVR can have a capability for selective playback and recording of advertisement content according to the end-user's preferences and other attributes.

The details concerning the end-user's profile should be consulted in [ITU-T H.750].

6.1.2.3.2 On-demand advertising

On-demand advertising delivers directory information of business so that the end-user can select and navigate through additional information or get additional services and benefits such as coupons. This type of advertisement is also called an "interactive advertisement".

6.1.2.4   Audience measurement information

Audience measurement information is used for the end-user's convenience when watching IPTV content. For example, advertisement services can refer to this information to provide appropriate advertisement. The information consists of the channel numbers before and after a channel change, time of the change and user information (e.g., a unique identifier). With the end-user's permission, information can be collected by the IPTV terminal device, and the IPTV network can be used to upload the collected information to the relevant server-side applications.

Refer to [b-ITU-T X.1191] and [ITU-R BT.2052] for discussions of privacy issues relating to audience measurement information.

6.1.2.5 Interactive services requiring high security

Interactive services requiring high security enable end-users to send various types of requests and receive feedback with high security and reliability. Examples of interactive services requiring high security are commerce and medical services.

6.1.2.5.1 Commerce services

Commerce services enable the end-user to purchase goods and use financial services such as banking, stocks, shopping, ticketing, auctions, etc.

6.1.2.5.2 Medical services

Medical services provide connections between doctors and patients who are in different geographic areas. Doctors can perform health monitoring, remote diagnosis, remote consultation, remote medical examinations, medical education, etc.

6.1.2.5.3 Personal IPTV broadcast

Personal broadcast services provide the end-user with a way to advertise personal content (possibly including scheduling information) so that other end-users can access such content. This service makes the IPTV end-user a content provider.

For a personal IPTV broadcast scenario, the IPTV terminal device can play a role as the content source or the delivery function. Some portion of the following capabilities is needed within the IPTV terminal device in order to support a service such as:

– Audiovisual capturing/encoding.

– Supporting protocols for transmission of content (e.g., RTP/RTCP).

– Security aspects associated with broadcasting of customer-generated content.

6.2 Key features of IPTV terminal devices

This clause provides the key features of IPTV terminal devices.

6.2.1 Network attachment and service discovery

6.2.1.1 Terminal device attachment and initialization

The IPTV terminal device attachment and initialization process is the process by which the IPTV terminal device is configured to attach to the network to discover the service provider and services offered in an IPTV system.

6.2.1.2 Service provider description entry points

When the IPTV terminal device attaches to the network, it has to know where to get the description of the IPTV service providers available to it. Such information is accessed via entities called service provider description entry points.

6.2.1.3 Service provider discovery and service attachment

Service provider discovery is the process by which an IPTV terminal device becomes aware of the available IPTV service providers, learns the location of their service discovery (SD) servers and the means for attaching to each SD server. As a result, by contacting the discovered SD server(s), an IPTV terminal device can perform the subsequent service discovery and service attachment procedures.

Details of service provider discovery procedures and service attachment procedures are outside the scope of this Recommendation.

6.2.2 Service navigation

Service navigation is a process of presenting information that allows the end-user to discover, select and consume services.

6.2.3 Security

There are many security concerns and requirements that are addressed and supported by the IPTV terminal device. Functional requirements for security mechanisms of IPTV terminal devices are for further study.

Refer to [b-ITU-T Y.1901] and [b-ITU-T X.1191] for details of the security requirements and security-related issues, respectively.

6.2.4 Privacy

There are many privacy requirements that relate to the IPTV terminal devices. [b-ITU-T Y.1901] should be consulted for a detailed list of privacy requirements placed on the IPTV terminal device. Furthermore, [b-ITU-T X.1191] should be consulted for detailed privacy-related issues directly affecting an IPTV system.

An IPTV terminal device is a source of private information. The following is a list of private information that possibly needs relevant protection within an IPTV terminal device:

– Viewing history.

– Return/interaction channel usage and audience rating information.

– History of interactive operations.

– Personal profiles and preferences.

– Identification:

 • Identification is not limited to a number, but can be in other forms (for example, e-mail address, MAC address and host name).

– Details about security and privacy-related concerns that may affect an audience measurement information service.

6.2.5 Quality and performance monitoring

[ITU-T G.1081] defines the performance monitoring points for IPTV services. Based on the definition of point 4 in Figure 2 of [ITU-T G.1081], STBs and DNGs should be capable of monitoring IP performance parameters, which can be used to estimate the subjectively perceived quality of video and audio. Moreover, [ITU-T H.622.1] should be consulted for the issues of home network QoS.

NOTE 1 – The parameters that should be monitored at the terminal devices and the methodologies to estimate the subjectively perceived quality are still under study and will be reflected in other ITU-T Recommendations once the study is complete.

NOTE 2 – The protocols/methods used for reporting the monitored parameters to the management platform are currently not specified in ITU-T Recommendations.

7   IPTV terminal device functional architecture

Figure 7-1 gives the functional architecture block diagram of IPTV terminal devices.
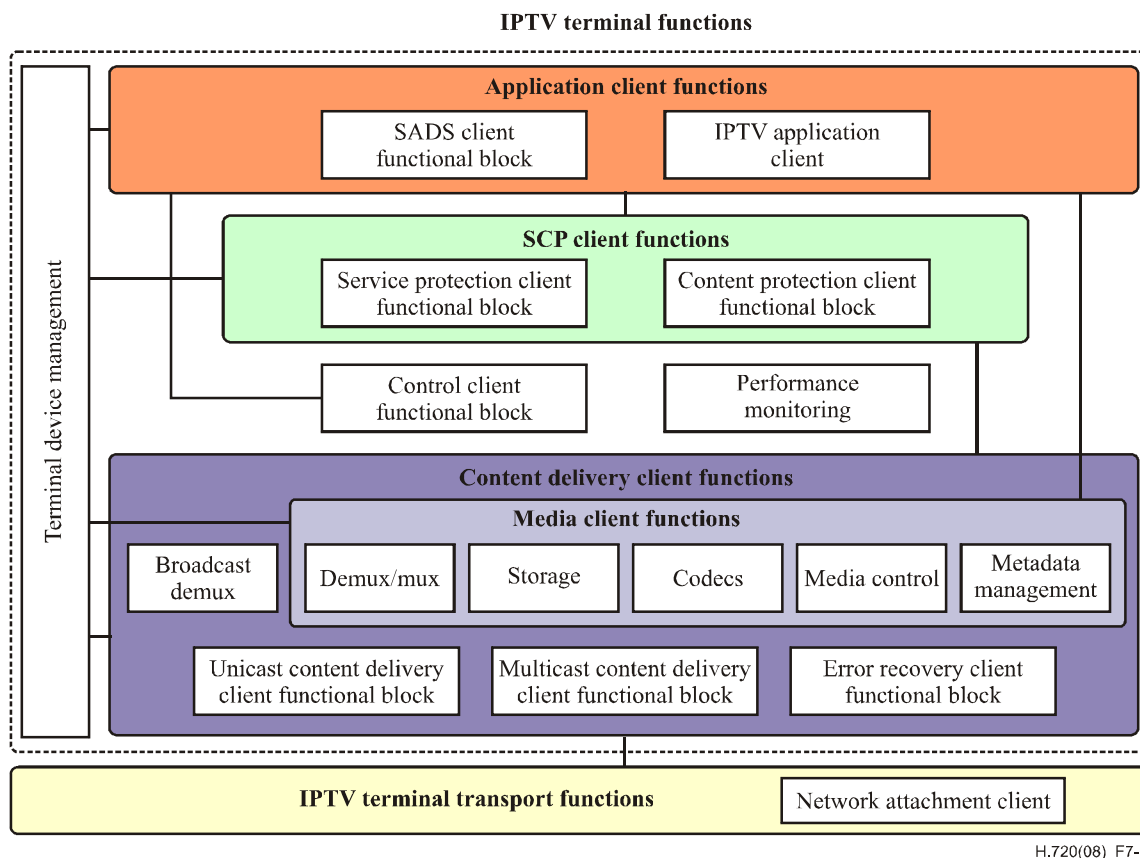
IPTV terminal functions

Figure 7-1 – Functional architecture block diagram of IPTV terminal device

A brief explanation of each component/functional entity in Figure 7-1 is presented below. The blocks including the words "functional block" in their names and some "functions" are defined in [ITU-T Y.1910].

7.1   IPTV terminal transport functions

The IPTV terminal transport functions are responsible for handling the IP-based connection between the DNG and the IPTV terminal device, or between the IPTV network and the IPTV terminal device.

7.1.1   Network attachment client

This functional entity manages IP connectivity and obtains IP addresses and configurations for the IPTV terminal device in the process of network attachment. The delivery network gateway functional block is out of the scope of this Recommendation; however, this functionality relates to this process. Refer to [ITU-T H.622.1] for details concerning this process issue. Moreover, in the case of NGN, the relevant issues concerning "network attachment control functions" (NACFs) are discussed in [ITU-T Y.2014].

7.2 Content delivery client functions

The content delivery client functions receive and control the delivery of the content from the content delivery and storage functions. After receiving the content, the content delivery client functions can optionally use the service and content protection (SCP) client functions to decrypt and decode the content, and can also optionally support playback control ([ITU-T Y.1910]).

7.2.1 Broadcast demux

The hybrid IPTV terminal device supports both IP content reception and non-IP content reception for terrestrial, cable or satellite broadcast services. The broadcast demux functional entity is responsible for de-multiplexing in non-IP content reception.

7.2.2 Multicast content delivery client functional block

The multicast content delivery client functional block receives the content from the multicast delivery functional block within the content delivery and storage functions. This functional block communicates with the multicast control point functional block for the selection of the multicast stream. Multicast protocols, such as IGMP for IPv4, or MLD for IPv6, are handled by this functional block.

7.2.3 Unicast content delivery client functional block

The unicast content delivery client functional block receives the content from the unicast delivery functional block within the content delivery and storage functions. This functional block communicates with the content delivery control functional block within the content delivery and storage functions for the control of the unicast stream. For example, RTP and HTTP for unicast content on-demand is supported in this functional block.

7.2.4 Error recovery client functional block

The error recovery client functional block is responsible for improving the QoS/QoE provided by the network. Retransmission, forward error correction (FEC), and hybrid combinations of both are known mechanisms for error recovery. [b-ITU-T H.701] should be referred to for details regarding error recovery.

7.3 Media client functions

The media client functions are implicitly described in clause 9.1.1 of [ITU-T Y.1910]. The content delivery client function has responsibility for the content reception, and its logically related function, the content delivery function, has content processing functionalities such as transcoding. Therefore, media client functions are located in content delivery client functions.

7.3.1 Media control

The media control functional entity controls video and audio components, and other components such as de-multiplexing, encoding, metadata handling, content storing and play/reproduction of content including streaming data. The PVR controller is involved in this functional entity.

7.3.1.1 Video

The IPTV terminal device is expected to support commonly used video formats.

7.3.1.2 Audio

The IPTV terminal device is expected to support commonly used audio formats.

7.3.1.3 Other data formats

The IPTV terminal device is expected to support other commonly used multimedia data formats such as text (i.e., closed caption) and graphics.

7.3.2 Demux/mux

The Demux/mux functional entity is responsible for the following functions:

1) De-multiplexing of video, audio and data streams.

2) Optional re-multiplexing functionality to combine video, audio and/or data streams, for potential distribution over the home network.

3) Embedding of content tracing information if required by the content provider and not done previously.

7.3.3 Codecs

The codecs functional entity is responsible for:

1) Decoding the compressed video and audio streams.

2) Decoding textual data, i.e., closed caption.

3) Decoding other multimedia content, e.g., graphics.

7.3.4 Storage

The storage functional entity is responsible for the caching and storage of content and other application data. The storage function may be implemented internally or externally (i.e., by means of the TD-PD interface).

7.3.5 Metadata management

The metadata management functional entity processes and manages the metadata provided within the IPTV terminal device. For example, the IPTV terminal device is expected to retrieve metadata from the service provider and temporarily store it as cache. Thus, the management of the cached metadata is an important aspect of metadata management. Another example is interaction with the service provider and/or with metadata locally cached in the IPTV terminal device to provide the search capability based on metadata. Still another example is the controlling of viewing based on metadata, e.g., parental guidance and control. Details of metadata are found in [ITU-T H.622.1].

7.4 Service and content protection (SCP) client functions

The SCP client functions include the following functions:

1) Handling of authentication mechanisms including key exchange and processing.

2) Creation of content tracing information to be bound to the content, if required by the content provider.

3) Embedding of content tracing information, or enforcing subsequent embedding of content tracing information, if required by the content provider.

4) Processing of SCP entitlement issues.

5) Descrambling of input stream.

7.4.1 Content protection client functional block

The IPTV terminal device is responsible for enforcing content usage rules ascribed to rights information (also known as content protection metadata). This functional block interprets content rights and keys obtained from the server-side right and key management function then acts on the interpretation to control how the content is processed and exposed to the end-user, either through integrated presentation devices (such as a display or audio rendering system) or through physical interconnects to external devices. Refer to clause 7.2 of [b-ITU-T X.1191] for details.

7.4.2 Service protection client functional block

For managed services involving protected content, it is typically the case that the end-user (who may be the subscriber) and IPTV terminal device must be authenticated and, subsequent to successful authentication, authorized to access service(s) and the content contained therein. Details are to be consulted in clause 7.3 of [b-ITU-T X.1191].

7.5 Application client functions

The application client functions in IPTV services are responsible for the following functions:

1) **Basic functions**: Applications include the software components capable of enabling functional and observable behaviour, such as the GUI, SNA, VoD controls, SCP applications and other service-related applications.

2) **Management functions**: Some applications are responsible for basic management of the IPTV terminal device, such as power management and event management.

3) **Service supporting functions**: Some applications are responsible for supporting services, including, but not limited to, plug-in applications, browser applications and media player applications.

In this Recommendation, the individual functional blocks of the application client functions defined in [ITU-T Y.1910] are divided roughly into the two groups below based on their nature.

7.5.1 IPTV application client

The IPTV application client functions consist of the following service-specific functional blocks.

1) **On-demand client functional block**: This functional block interacts with the server-side relevant one to perform session management, service authorization, presentation of the content metadata and execution of the service logic for the on-demand applications.

2) **Linear TV client functional block**: This functional block interacts with the server-side relevant one to perform session management, service authorization, presentation of the content metadata and execution of the service logic for the linear TV applications.

3) **Other client functional blocks**: These functional blocks interact with the server-side relevant one for the delivery and presentation of additional IPTV services and their content, e.g., games, distant learning, etc.

7.5.2 SADS client functional block

The SADS client functional block provides for the end-user's discovery and selection of IPTV services and applications. This functional block facilitates common services, cooperating with the IPTV application client. See clause 6.2.1 for the relevant key features of SADS clients.

7.6 Connection and session management

Connection and session management is responsible for the following functions. This functionality is not depicted in Figure 7-1; however, individual functions are satisfied by one or more functional blocks/entities depicted in Figure 7-1.

1) Authentication, communication and management of the connection to the IPTV server through the IPTV network (e.g., NGN)

The control client functional block allows the IPTV terminal device to initiate service requests to the IPTV service control functional block in order to prepare for the connection to the content delivery functions. Especially in the case of IMS NGN IPTV, control client functional block communicates with IPTV application functions via core IMS functions to prepare for the connection to the content delivery functions [ITU-T Y.1910].

2)   Managing the protocols necessary to stream and control the flow of media and other content arriving at the IPTV terminal device.

The unicast content delivery client functional block, multicast content delivery client functional block and IPTV application client functions could have responsibilities for content reception and control of real-time streaming, etc.

7.7   Terminal device management

The terminal device management functional entity basically provides the following functions:

1)   Configuration management of IPTV terminal devices.

2)   Monitoring and control of the IPTV terminal device functionality.

Remote management is closely related to this functional block. Details of remote management are outside the scope of this Recommendation.

7.8   Performance monitoring

The performance monitoring functional entity is charged with the role as described in clause 6.2.5. For example, the performance monitoring of the status of the "TD-OD" interface could provide various QoE information such as audiovisual quality and IPTV service attributes. Details of QoE issues are discussed in [ITU-T G.1080] and [ITU-T G.1081].

8   IPTV terminal device interfaces

This clause gives an abstract description of the IPTV terminal device interfaces. Since the realization of physical interfaces may be varied, the diagram of IPTV terminal device interfaces describes possible external terminal device interfaces and is not meant to indicate required interfaces.
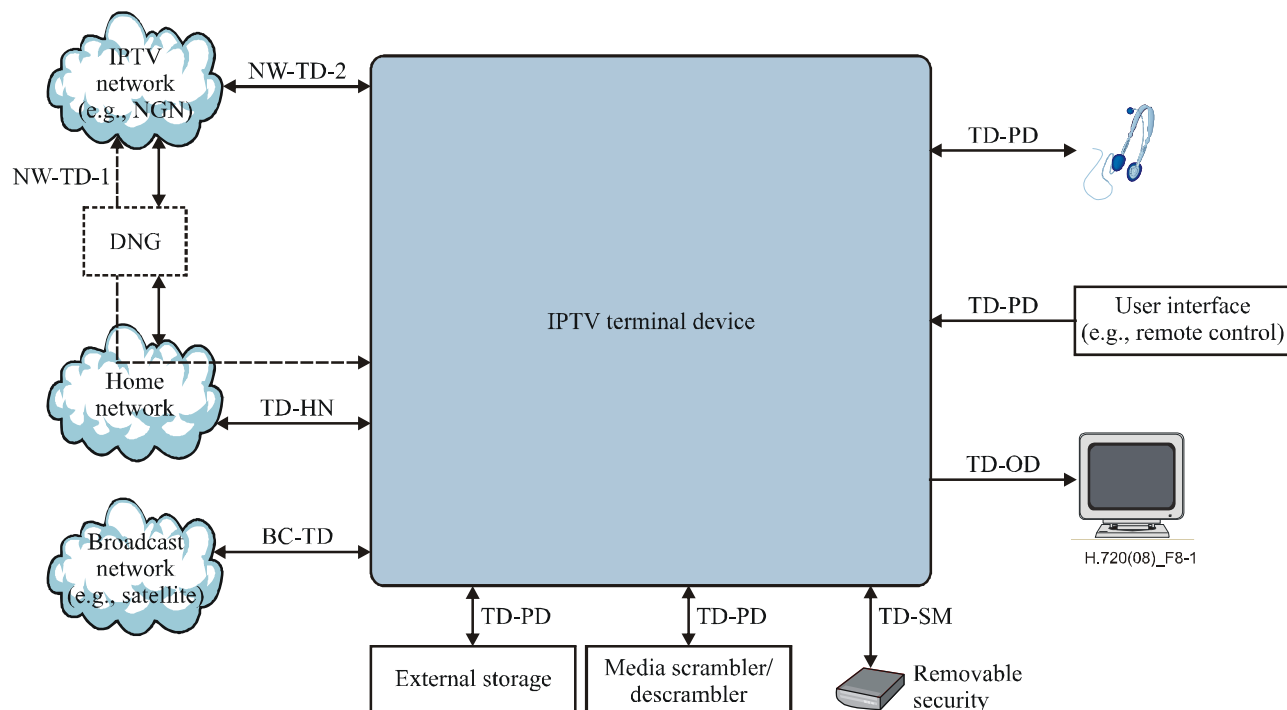

Figure 8-1 – Examples of IPTV terminal device interfaces

8.1 BC (Broadcast)-TD interface

This interface is between non-IPTV broadcasting network such as satellite and terrestrial network and the IPTV terminal device.

8.2 Network terminal device (NW-TD) interface

8.2.1 NW-TD-1

NW-TD-1 represents a connection by which the IPTV terminal device connects to the IPTV network via the DNG including TD-HN. [ITU-T H.622.1] should be consulted for details of NW-TD-1.

8.2.2 NW-TD-2

NW-TD-2 represents a direct connection between the IPTV network and the IPTV terminal device. This interface is between an IPTV terminal device or DNG and the IPTV network. This interface could facilitate content and metadata transfer via wireless network (e.g., 3G/WiFi/WiMax) by multicast or unicast operation.

8.3 TD-HN interface

TD-HN is an interface that provides a connection to the home network. TD-HN is used for the connection between the IPTV terminal device and other in-home devices such as an external PVR.

8.4 TD-OD and TD-PD interfaces

8.4.1 TD-PD interface

This interface is between a peripheral device (e.g., USB adapter or mobile telephone headset) and the IPTV terminal device. It allows transfer of information through a non-IP-based connection (e.g., Bluetooth and infrared communication)

8.4.1.1 User input interface

A user input interface is a combination of software and hardware components through which a user can interact with the user input functional entity [ITU-T F.902]. It can manifest itself in such forms as a remote control or a keyboard.

8.4.1.2 Input interface

The input interface is responsible for the interaction between user devices and the appropriate applications in the IPTV terminal device.

8.4.2 TD-OD interface

This interface is between an output device (e.g., display, home theatre system, external PVR, etc.) and IPTV terminal device, and facilitates the transfer of audio and video signals from the IPTV terminal device to the output device.

8.5 TD-SM interface

TD-SM is the terminal device-security module interface. It is the interface between the IPTV terminal device and an optional removable security function, such as an IC card. [b-ITU-T X.1191] should be consulted for details relating to the security issues of the IPTV system.

9 IPTV terminal software architecture

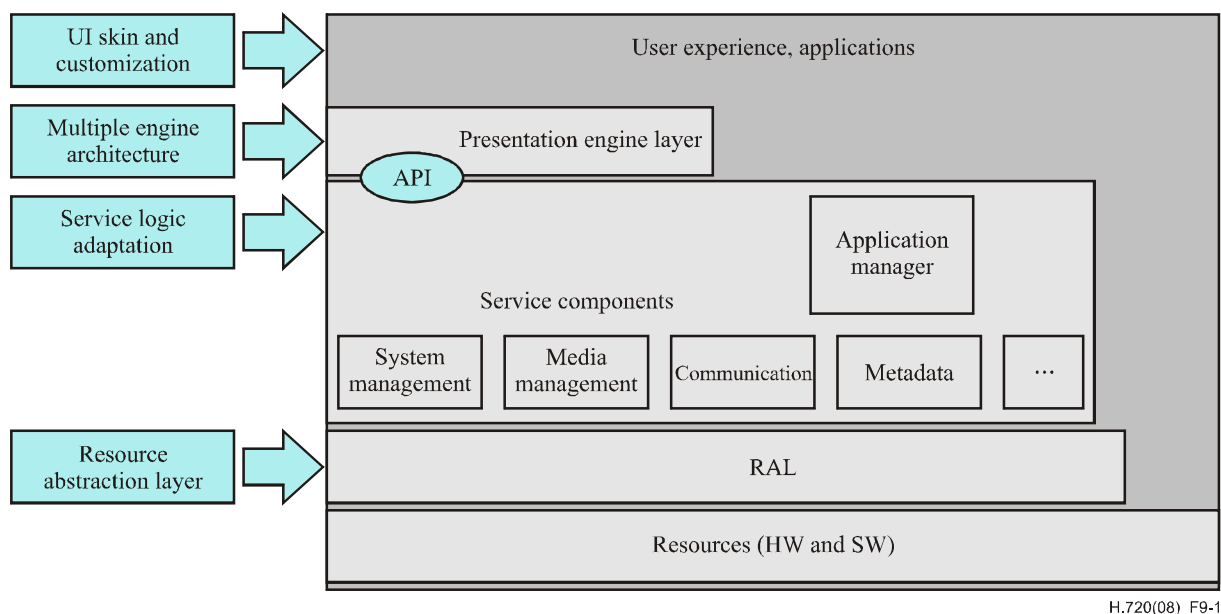Figure 9-1 shows the IPTV terminal software architecture.

Figure 9-1 – IPTV terminal software architecture – Overview

9.1 Resource abstraction layer (RAL)

The IPTV terminal middleware is hardware-agnostic. A specific resource abstraction layer (RAL) exists for each specific hardware and operating system – this provides the necessary interface to the lower layers (e.g., RAM, network access, hard drive, USB port, etc.). The RAL interface is designed so that device drivers can be written irrespective of the service logic adaptation layer.

9.2 Service logic adaptation layer

The service logic adaptation layer is made of service components. The service components are pure native components that offer functionalities common to all middleware implementations (e.g., service selection and presentation, service information management, PVR, security system). They are used and enriched by the application services in order to simplify the development of service components and applications above it.

The definition and the scope of services depend on the concrete functionalities deployed in the IPTV system.

Nevertheless, some service components can be defined that are generic in nature:

– System and resource management component.
– Media management component.
– Communication component.
– Security component.
– Metadata access component.
– User interaction component.

All these components can optionally use the functions available on the network.

9.3 Presentation engine layer

The presentation engine layer may include various engines along with a set of high-level services. This layer is built on top of the service logic adaptation layer.

9.4 User experience and application layer

The applications are either downloaded or resident. In particular, an application is powered by a presentation engine (e.g., HTML browser). An application can either have full or restricted access to the presentation engine layer features. Moreover, some applications may directly access the service logic adaptation layer without using a presentation engine.

Appendix I

Recommendations for IPTV terminal devices

(This appendix does not form an integral part of this Recommendation)

When considering implementation based on the service requirements, several instances of an IPTV terminal device can be derived from this Recommendation.

I.1   Enablement of current terminal devices for the support of IPTV services

[ITU-T J.702] outlines functional requirements of the terminal device capabilities expected to be supported by the migration model of the IPTV terminal devices and defines a profile for an IPTV terminal device that is intended to be migrated from conventional or currently available content delivery services, such as digital broadcasting, so that the immediate market demands on IPTV terminal devices may be met.

I.2   Draft Recommendation "IPTV terminal devices for basic services"

ITU-T is drafting a Recommendation "IPTV terminal devices for basic services" in order to discuss IPTV terminal devices targeted at IPTV services based on a narrowly defined IP network, which will give a lower-level, narrowly scoped description of the terminal functionalities of basic services, addressing detailed technical features.

I.3   Draft Recommendation "IPTV terminal device full-fledged model"

ITU-T is drafting a Recommendation "IPTV terminal device full-fledged model" which will describe IPTV terminal devices and end systems to be used for more advanced services, as described in clause 5.

I.4   Draft Recommendation "IPTV terminal device mobile model"

ITU-T is drafting a Recommendation "IPTV terminal device (mobile)" which will describe the functional requirements and capabilities expected to be supported by the mobile IPTV terminal device. That draft Recommendation will define a mobile profile for IPTV terminal devices that takes into account not only the characteristics, such as software and hardware constraints specific to mobile terminals, but also those service use cases relevant to mobile IPTV services.

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[b-ITU-T Y-Sup.5]   ITU-T Y.1900-series Recommendations (2008), *ITU-T Y.1900 series – Supplement on IPTV service use cases*. <http://www.itu.int/rec/T-REC-Y.Sup5>

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