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Internet protocol aspects – IPTV over NGN

Requirements for the support of IPTV services

Recommendation ITU-T Y.1901

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Summary

Recommendation ITU-T Y.1901 specifies the high level requirements to support IPTV services. These include IPTV requirements for service offering, network aspects, QoS and QoE, service and content protection, end system, middleware and content.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

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NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

CONTENTS

Recommendation ITU-T Y.1901

Requirements for the support of IPTV services

1 Scope

This Recommendation specifies the high level requirements to support IPTV services. These include IPTV requirements for service offering, network aspects, QoS and QoE, service and content protection, end system, middleware and content.

1.1 Organization

The taxonomy that articulates this Recommendation is therefore twofold:

• A functional taxonomy, which aims at reflecting the fact that IPTV services are deployed and operated according to the combined activation of a set of elementary capabilities – IPTV traffic forwarding and routing, IPTV quality of service and quality of experience, IPTV security, IPTV middleware, etc.

• Within each of the aforementioned functional areas, a further classification organizes the requirements into mandatory requirements, recommended requirements and optional requirements.

1.2 IPTV domains

Figure 1-1 shows the main domains that are involved in the provision of IPTV services [ITU-T Y.1910]. It is provided in this Recommendation to help the understanding of requirements which in some way relate to these domains. These domains do not define a business model. Also, one provider may play in multiple domains in the provision of an actual service.
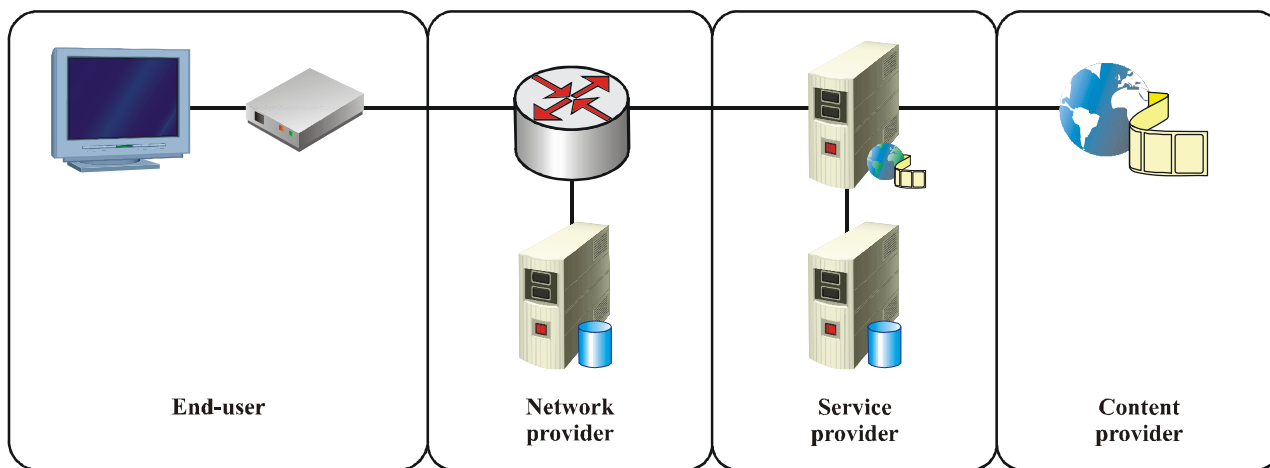
Figure 1-1 – IPTV domains

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 Y.1541]   Recommendation ITU-T Y.1541 (2006), *Network performance objectives for IP-based services*.

[ITU-T Y.1910]   Recommendation ITU-T Y.1910 (2008), *IPTV functional architecture*.

3   Definitions

3.1   Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1   aspect ratio [b-ITU-T T.101]: The ratio of the width to the height of a rectangular area, such as the defined display area.

3.1.2   broadcast [b-ITU-T M.60]: One-way transmission from one point to two or more other points.

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

3.1.4   elementary stream [b-ITU-T H.222.0]: Generic term for either the coded video, the coded audio, or other coded bit stream in the PES packet.

NOTE – PES stands for packetized elementary stream.

3.1.5   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.

3.1.6   home network [b-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.

3.1.7   mobility [b-ITU-T Q.1706]: The ability for the user or other mobile entities to communicate and access services irrespective of changes of the location or technical environment.

3.1.8   network provider [ITU-T Y.1910]: The organization that maintains and operates the network components required for IPTV functionality.

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.

3.1.9   service information [b-ITU-T J.200]: Data which describes programs and services.

3.1.10   service provider [b-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 not be a customer of another service provider.

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

3.1.11   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.

3.1.12   subscription [b-ITU-T Q.1741.3]: A subscription describes the commercial relationship between the subscriber and the service provider.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 accessibility feature: An additional content component that is intended to assist people hindered in their ability to perceive an aspect of the main content. Examples: captions for the hard of hearing, subtitles in various languages, sign-language interpretation video and descriptive audio.

3.2.2 acquisition: The process of obtaining content by the end-user.

NOTE – For content with accessibility features, this means that the content will be available in a form that can be used by the end-user.

3.2.3 audio description: This service provides a commentary describing the visual events pertinent to the content and augments the dialog in the content.

NOTE – Audio description is primarily intended to assist users who are unable to see the video content clearly. The narrative passages fit between the dialogue and other significant audio content so as not to interfere with it. Ideally, the user can control the volume and spatial positioning of the audio or derive it from a separate output.

3.2.4 captions: Captions provide a real-time on-screen transcript of the dialogue as well as any sound effects.

NOTE – This service can be provided by means of either textual or graphical supplementary content. The captions and the dialogue are usually in the same language. The service is primarily to assist users having difficulty hearing the sound. Ideally, users may have some control over the position and size of the presentation. Different speakers are distinguished, usually by different colours.

3.2.5 channel: Content formatted as a selectable set of data and transported as part of a data stream.

3.2.6 channel changing: The act of changing from one channel to another.

3.2.7 client personal video recorder (cPVR): Same as PVR except that the recording device is located at the end-user's premises.

3.2.8 content protection: Ensuring that an end-user can only use the content they have already acquired in accordance with the rights that they have been granted by the rights holder.

3.2.9 content segment: A continuous portion of a piece of content, for example, a single topic in a news programme.

3.2.10 content tracing: 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.

3.2.11 delivery network gateway functions (DNGF): 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).

3.2.12 delivery network gateway (DNG): A device implementing the DNGF.

NOTE – DNG also is commonly referred to as the residential gateway (RG).

3.2.13 electronic program guide (EPG): A structured set of data, intended to provide information on available content that may be accessed by end-users.

3.2.14 end system: A single or set of consumer devices that support IPTV services (e.g., delivery network gateway, display).

3.2.15 Internet Protocol Television (IPTV): Multimedia services such as television/video/audio/text/graphics/data delivered over IP-based networks managed to support the required level of QoS/QoE, security, interactivity and reliability.

3.2.16 IPTV terminal function (ITF): 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.

3.2.17 IPTV terminal device: A terminal device which has ITF functionality, e.g., a STB.

3.2.18 linear TV: 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.

3.2.19 metadata: Structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment, and management of the described entities.

NOTE – EPG metadata has many applications and may vary in depth from merely identifying the content package title or information to populate an EPG to providing a complete index of different scenes in a movie or providing business rules detailing how the content package may be displayed, copied, or sold.

3.2.20 middleware: A layer of software between applications and resources, which consists of a set of service enablers that allow multiple functionalities running on one or more devices in an IPTV system to interact across a network.

3.2.21 multi-channel audio: Audio signal with more than two channels.

3.2.22 network personal video recorder (nPVR): Same as PVR except that the recording device is located at the service provider premises.

3.2.23 package: A collection of content components that in some combination (either all or a subset) together provide an end-user experience and are intended to be used together.

NOTE – A package can be instantiated with or without audiovisual content depending on scenarios, in which audiovisual content and package can be tightly associated or can be loosely coupled enough to be handled (generation, delivery, consumption) independently.

3.2.24 pay per view (PPV): A TV service where a particular program event (e.g., a hockey match) can be bought separately from any package or subscription. The transmission of the program event is made at the same time to everyone who has ordered it.

3.2.25 personal video recorder (PVR): An end-user controlled device that records, stores and plays back multimedia content. PVR is also known as personal digital recorder (PDR).

3.2.26 picture-in-picture: One program is displayed on the full-seized IPTV TD screen, one or more other programs are simultaneously displayed in inset windows.

3.2.27 place shifting: A function which allows subscribers to see the content without placing limitations.

3.2.28 push VoD: A TV service where multimedia content is packaged and delivered at the discretion of the service provider to the end-user's storage system.

3.2.29 random access point: A point in the content from which playback can begin.

NOTE – For example, in MPEG encoding, this would be an I-frame, as opposed to a P-frame or B-frame.

3.2.30 rights: One or more legal or business entitlements to use or employ content, e.g., to view, record, redistribute content.

3.2.31 re-transmission broadcast service: A service in which content is provided from various broadcasting environments including, but not limited to, terrestrial, satellite and cable, and re-transmitted into IP network simultaneously or otherwise.

3.2.32 SCP: A combination of service protection and content protection.

3.2.33 service: A set of functionalities enabled by a provider for end-users.

NOTE – Example provisioned functionalities include IP connectivity with managed quality of service, video-on-demand.

3.2.34 service protection: Ensuring that an end-user can only acquire a service, and, by extension, the content contained therein, that he or she is entitled to receive.

3.2.35 sign language interpretation: A video service showing an interpreter who uses hand gestures and facial expression to convey the main audio content and dialogue to sign language and lip readers.

NOTE – This service comes in the form of supplementary video content, usually smaller in image size to that of the main video content. Ideally, the user can control the position, size and background properties (solid or transparent and the colour, if solid). It is of sufficient temporal and spatial quality to enable sign reading and lip reading.

3.2.36 skin: A customized graphical appearance (the visual aspect of a graphical user interface (GUI)) applied to certain software and websites for aesthetic reasons or ease of use.

3.2.37 subtitles: Subtitles provide a real-time on-screen transcript of dialogue for the purpose of language translation or to clarify speech that is unclear.

NOTE – This service can be provided by means of either textual or graphical supplementary content. The subtitles and the dialogue are usually in different languages. The assumed audience for subtitling is hearing people who do not understand the language of the dialogue.

3.2.38 supplementary content: Video, audio, textual, graphical or other forms of content that can be optionally accessed by the end-user and rendered by the terminal. It has the following features:

–   It only works in conjunction with the main content.

–   It is synchronous with the main content.

3.2.39 terminal device (TD): 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.

3.2.40 terminal device protection: Ensuring that a terminal device employed by an end-user in the reception of a service can reliably and securely use content while enforcing the rights of use granted for that content, and while physically and electronically protecting the integrity of the terminal device, and the confidentiality of the content and critical security parameters not otherwise protected by encryption or watermarking.

3.2.41 third party metadata: Metadata provided by an entity (which may be a person) not directly tied to the primary service provider by whom the end-user is being served.

3.2.42 time shifting: A function which allows playback of content after its initial transmission.

3.2.43 trick mode functionality: The ability to pause, rewind or forward stored content.

3.2.44 TV with trick mode: TV service with trick mode functionality.

3.2.45 universal design: It is the design of the products and environments to be useable by all people, to the greatest extent possible by including accessibility features in the original design to prevent the need for adaptation after deployment.

NOTE – The intent of universal design is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Universal design benefits people of all ages and abilities.

3.2.46 usage environment description: The usage environment description includes the description of end-user characteristics, terminal capabilities, network characteristics and natural environment characteristics.

NOTE – These various dimensions of the usage environment description, which originate from end-users, can be used for accommodating, for example, the adaptation of contents for transmission, storage and consumption.

3.2.47 user privacy protection: Ensuring that information considered to be private (or confidential) by an end-user be maintained in confidence, while remaining subject to mandatory disclosure due to legal processes.

3.2.48 video-on-demand (VoD): 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.

3.2.49 wireless network characteristics: The characteristics of a wireless network expressed in terms of the current available bandwidth, packet loss and possibly other wireless network information parameters for a specific wireless link type, e.g., WLAN, cellular, WPAN or WMAN.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AES	Advanced Encryption Standard
API	Application Programming Interface
CBC	Cipher Block Chaining
cPVR	Client PVR
DNG	Delivery Network Gateway
DNGF	Delivery Network Gateway Function
DoS	Denial of Service
DRM	Digital Rights Management
DTS	Digital Theatre System
DVD	Digital Versatile Disc
EAN	Emergency Alert Notification
ECB	Electronic CodeBook
ECM	Entitlement Control Message
EMM	Entitlement Management Message
EPG	Electronic Program Guide
FCAPS	Fault, Configuration, Accounting, Performance, and Security
FTA	Free To Air
GUI	Graphical User Interface
HD	High Definition
HE-AAC	High-Efficiency Advanced Audio Coding
HTML	HyperText Markup Language
ID	Identifier
IP	Internet Protocol
IPTV	Internet Protocol Television

IPTV TD	Internet Protocol Television Terminal Device
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISDN	Integrated Services Digital Network
ITF	IPTV Terminal Function
LAN	Local Area Network
MIKEY	Multimedia Internet KEYing
MPEG	Moving Picture Experts Group
n/cPVR	Network and Client PVR
NAPT	Network Address Port Translation
NAT	Network Address Translation
NGN	Next Generation Network
nPVR	Network PVR
OAMP	Operate, Administer, Maintain, and Provision
OFB	Output FeedBack
OS	Operating System
PDA	Personal Digital Assistant
PDR	Personal Digital Recorder
PES	Packetized Elementary Stream
PPV	Pay Per View
PSTN	Public Switched Telephone Network
PVR	Personal Video Recorder
QoE	Quality of Experience
QoS	Quality of Service
QoSM	Quality of Service Measurement
RACF	Resource and Admission Control Function
RG	Residential Gateway
SCP	Service and Content Protection
SD	Standard Definition
SI	Service Information
SIM	Subscriber Identification Module
STB	Set Top Box
TD	Terminal Device
TS	Transport Stream
TV	Television
UCC	User Created Content
UI	User Interface

UMF	Uniform Media Formats
URL	Uniform Resource Locator
USB	Universal Serial Bus
VBI	Vertical Blank Interval
VoD	Video-on-Demand
WAN	Wide Area Network
WLAN	Wireless Local Area Network
WMAN	Wireless Metropolitan Area Network
WPAN	Wireless Personal Area Network
xDSL	Any of the various types of Digital Subscriber Lines (DSL)
XML	eXtensible Mark-up Language

5　Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.

The keywords "is prohibited from" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

The keywords "is not recommended" indicate a requirement which is not recommended but which is not specifically prohibited. Thus, conformance with this Recommendation can still be claimed even if this requirement is present.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option, and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with this Recommendation.

Requirements are identified using the following conventions:

– Requirement number xx in subclause n.m is of the form R n.m-xx;

– Recommended requirement number yy in subclause n.m is of the form RR n.m-yy;

– Optional requirement number zz in subclause n.m is of the form OR n.m-zz.

NOTE – Future issues of this Recommendation should never reuse previously assigned numbers.

6　Requirements

6.1　General aspects

General requirements

• R 6.1-01: The IPTV architecture is required to support multiple content resolutions and multiple content aspects ratios.

• R 6.1-02: The IPTV architecture is required to allow for a two-way communication between the end-user and the service provider.

- R 6.1-03: The IPTV architecture is required to support mechanisms to support on demand services.

  NOTE 1 – Further information regarding "on Demand service" can be found in [b-ITU-T Y-Sup.5].

- R 6.1-04: The IPTV architecture is required to support navigation capability for IPTV content.

- R 6.1-05: The IPTV architecture is required to support the ability of the ITF to display and allow user selection of program, content, and service descriptions.

- R 6.1-06: The IPTV architecture is required to support service selection mechanisms.

NOTE 2 – Further information regarding service selection can be found in clauses 6.6.5 and 6.6.6.

General recommendations

- RR 6.1-01: The IPTV architecture is recommended to support content segmentation.

- RR 6.1-02: The IPTV architecture is recommended to ensure content and segment data integrity.

- RR 6.1-03: The IPTV architecture is recommended to support a mechanism for obtaining information pertaining to terminal device capabilities.

- RR 6.1-04: The IPTV architecture is recommended to present an open interface for 3rd party applications to use the capabilities and resources of the service and network functional components.

- RR 6.1-05: The IPTV architecture is recommended to support 3rd parties metadata (e.g., content recommendations) in addition to metadata from service/content providers.

- RR 6.1-06: The IPTV architecture is recommended to support the display of multiple supplementary video streams and layouts.

- RR 6.1-07: The IPTV architecture is recommended to support various encapsulation types including MPEG-2 TS.

- RR 6.1-08: The IPTV architecture is recommended to allow the delivery of IPTV services to any type of IPTV terminal device, e.g., mobile phone, PDA, set top box.

- RR 6.1-09: The IPTV architecture is recommended to support functions in order to adapt dynamically to changes in wireless networks characteristics when the service is delivered over a mobile network, e.g., bandwidth, packet loss rate.

- RR 6.1-10: The IPTV architecture is recommended to support viewership data tracking while protecting the user's privacy as required in clause 6.3.6.

  NOTE 3 – For example, this tracking may allow content provider and service provider to provide audience rating service, track popular programs, craft and target specific advertisements to particular groups of users demonstrating certain surfing patterns.

- RR 6.1-11: The IPTV architecture is recommended, if viewership data tracking is supported, to have the ability to configure it on a per user basis, a per content basis and a combination of both.

- RR 6.1-12: The IPTV architecture is recommended to support (remote) software upgrade and (e.g., configuration data) download.

- RR 6.1-13: The IPTV architecture is recommended to support XML encoding for application signalling.

- RR 6.1-14: The IPTV architecture is recommended to have a means to allow content to be seen only by the appropriate audience. This means it may be triggered by the service provider and/or the user.

- RR 6.1-15: The IPTV architecture is recommended to support mechanisms for allowing the integration of other telecommunication services (e.g., instant messaging, telephony) into IPTV services.

General options

- OR 6.1-01: The IPTV architecture can optionally support separate content and segment metadata storage and distribution.

- OR 6.1-02: The IPTV architecture can optionally support the replacement of the content caching and distribution algorithm.

- OR 6.1-03: The IPTV architecture can optionally support advertisement insertion.

- OR 6.1-04: The IPTV architecture can optionally support the time-shift TV functionality.

- OR 6.1-05: The IPTV architecture can optionally support usage environment description.

- OR 6.1-06: The IPTV architecture can optionally support content presentation adaptation to the usage environment.

6.1.1 Service offering

Architecture requirements

- R 6.1.1-01: The IPTV architecture is required to support the ability for the service provider to prevent the sending of bulk unsolicited content to end-users.

- R 6.1.1-02: The IPTV architecture is required to support interactive services such as educational applications, entertainment applications (such as games), communications services (such as mail, chat, and messaging), and information services (such as stock and weather services).

- R 6.1.1-03: The IPTV architecture is required to support mechanisms for the delivery of interactive and downloadable contents including games.

- R 6.1.1-04: The IPTV architecture is required to support mechanisms to block transmission of content to specified geographical areas whenever blackout requirements are applicable.

- R 6.1.1-05: The IPTV architecture is required to support the service provider to be able to push content onto the terminal device (content requested or not by the end-user).

- R 6.1.1-06: The IPTV architecture, if cPVR is supported, is required to support the service provider to be able to insert additional contents in content played from the cPVR.

Architecture recommendations

- RR 6.1.1-01: The IPTV architecture is recommended to allow seamless IPTV service provision and operation across different networks supporting IPTV services.

- RR 6.1.1-02: The IPTV architecture, if retransmission broadcast service is supported, is recommended to support geographical regionalization of content.

- RR 6.1.1-03: The IPTV architecture is recommended to support mechanisms for the receipt of content from different sources, e.g., satellite, dedicated IP connections.

- RR 6.1.1-04: The IPTV architecture is recommended to support mechanisms for the content provider to perform content management such as uploading content or deleting content or modifying the relevant attributes of content.

- RR 6.1.1-05: The IPTV architecture, if retransmission broadcast service is supported, is recommended to provide comparable quality of experience to the end-user as the direct reception.

- RR 6.1.1-06: The IPTV architecture is recommended to support real-time encoded and pre-encoded stored programs.

Architecture options

-     OR 6.1.1-01: The IPTV architecture can optionally support a cPVR function.

-     OR 6.1.1-02: The IPTV architecture can optionally support a nPVR function.

  NOTE – The nPVR function may be subject to national regulation as far as service and content protection aspects are concerned.

-     OR 6.1.1-03: The IPTV architecture can optionally support means for the content provider to define a set of language options for its content.

-     OR 6.1.1-04: The IPTV architecture can optionally support mechanisms to capture and utilize user profiles and preferences to target/restrict content items.

-     OR 6.1.1-05: The IPTV architecture can optionally convert video content from its stored format into one that is compatible with that required to be displayed on the devices implementing the ITF.

-     OR 6.1.1-06: The IPTV architecture can optionally support mechanisms that allow private entities, e.g., residential users, to act as content providers for the purpose of sharing their own content.

-     OR 6.1.1-07: The IPTV architecture can optionally support the ability to trace the source of incoming content, e.g., messages that have been a cause for complaint by an end-user.

-     OR 6.1.1-08: The IPTV architecture can optionally support for the insertion of content into VoD content.

-     OR 6.1.1-09: The IPTV architecture can optionally have the capability to support insertion of appropriately scoped advertisements (e.g., geographically or demographically).

-     OR 6.1.1-10: The IPTV architecture can optionally support mechanisms for targeted advertising (e.g., based on user profile preferences).

6.1.2 Accounting and charging

Architecture requirements

-     R 6.1.2-01: The IPTV architecture is required to support IPTV services accounting and charging. This includes charging through various charging methods (such as prepay, post pay, advice of charge, and third-party charging).

-     R 6.1.2-02: The IPTV architecture is required to not preclude the use of NGN charging architectures for all IPTV services accounting and charging functions.

-     R 6.1.2-03: The IPTV architecture is required to support mechanisms for the collection of data for accounting and reporting purposes, partner settlements, and reconciliation of end-user usage, such as service subscriptions, purchases, and transactions.

-     R 6.1.2-04: The IPTV architecture is required to include capabilities for transferring settlement information between service providers.

-     R 6.1.2-05: The IPTV architecture is required to support the acquisition of appropriate VoD accounting data, to fulfil licensing agreements.

-     R 6.1.2-06: The IPTV architecture is required to support the service provider to be able to authenticate, authorize and charge the subscriber.

Architecture recommendations

-     RR 6.1.2-01: The IPTV architecture is recommended to allow service providers to integrate IPTV services accounting and charging functions with accounting and charging components that can be used across multiple NGN services and applications.

6.1.3 Service consumption

<u>Architecture requirements</u>

• <u>R 6.1.3-01:</u> The IPTV architecture is required to support a means for the service provider to provide an integrated presentation of content received at the ITF via out-of-band (to IP) delivery methods and via IP networks, i.e., hybrid methods.

• <u>R 6.1.3-02:</u> The IPTV architecture is required to support mechanisms so that the end-user can filter unwanted contents.

• <u>R 6.1.3-03:</u> The IPTV architecture is required to support the end-user with the ability to move between a free-to-air (FTA) and a pay per view (PPV) environment.

• <u>R 6.1.3-04:</u> The IPTV architecture is required to support the end-user with the ability to choose a preferred language option (audio, subtitles, captioning, supplementary video and supplementary descriptive audio) from various languages that the content provider pre-defined and the service provider delivered.

• <u>R 6.1.3-05:</u> The IPTV architecture is required to support the ability for the end-user to turn on and off the audio, the subtitles, captioning, supplementary video, and supplementary descriptive audio at anytime without altering any of the default setting options.

• <u>R 6.1.3-06:</u> The IPTV architecture is required to support the capability to store and retrieve multiple profiles containing sets of user interface preference settings and language settings so that it will be easy to switch to different personal preferences for different viewers.

<u>Architecture recommendations</u>

• <u>RR 6.1.3-01:</u> The IPTV architecture is recommended to support the capability for the subscriber to query his or her usage detail record lists.

• <u>RR 6.1.3-02:</u> The IPTV architecture is recommended to support the ability for the end-user to independently select a default language for each of the following: audio, subtitle, captioning, supplementary video and supplementary descriptive audio.

• <u>RR 6.1.3-03:</u> The IPTV architecture is recommended to support the capability for the end-user to switch audio, subtitles, captioning, supplementary video, and supplementary descriptive audio back and forth when the user is watching the program without having to change his or her preferred language settings.

• <u>RR 6.1.3-04:</u> The IPTV architecture is recommended to allow the end-user, according to his or her rights, to replace an IPTV terminal device without inherently affecting his or her rights to consume content.

<u>Architecture options</u>

• <u>OR 6.1.3-01:</u> If the end-user's language option cannot match the predefined content languages, the IPTV architecture is recommended to support the capability for the IPTV terminal device to present the content with default audio, default subtitles, default captioning, default supplementary video and default supplementary descriptive audio.

6.1.4 Miscellaneous

<u>Architecture requirements</u>

• <u>R 6.1.4-01:</u> The IPTV architecture is required to support a means to present the ITF with the time of day reference.

• <u>R 6.1.4-02:</u> The IPTV architecture is required to support mechanisms for the service provider to operate, administer, maintain, and provision (OAMP) IPTV devices.

• <u>R 6.1.4-03:</u> The IPTV architecture is required to facilitate the ability of the service provider to manage the IPTV services with regard to fault, configuration, accounting, performance, and security (FCAPS).

- R 6.1.4-04: The IPTV architecture is required to support mechanisms that allow IPTV services delivery from a 3rd party provider as defined in clause 3.
- R 6.1.4-05: The IPTV architecture is required to support an extensible method for the service provider to query for the ITF's capabilities and status.
- R 6.1.4-06: The IPTV architecture is required to support maintaining accurate time-based control for synchronization, e.g., lip-sync with video as judged by the general viewer at all times, pause and resume, random access.

Architecture recommendations

- RR 6.1.4-01: The IPTV architecture is recommended to allow content usage statistics to be collected.
- RR 6.1.4-02: The IPTV architecture is recommended to support mechanisms for the service provider to provide the functions for service usage and the prevention of the service abuse.
- RR 6.1.4-03: The IPTV architecture is recommended to support capabilities for the end-user mobility allowing access to IPTV services by the end-user either in motion or not.
- RR 6.1.4-04: The IPTV architecture is recommended to support capabilities for exchange of IPTV services related information between different IPTV service providers. The IPTV service related information can optionally include the source information, channel information, service start/end time, and QoS information.
- RR 6.1.4-05: The IPTV architecture is recommended not to put any constraint on latency sensitive services.

Architecture options

- OR 6.1.4-01: The IPTV architecture can optionally support a time reference that is traceable to national time standards.

6.2   QoS and performance aspects

Architecture requirements

- R 6.2-01: The IPTV architecture is required to support a framework that identifies the components and measurement points for quality of service measurement (QoSM).
- R 6.2-02: The IPTV architecture is required to support capabilities for management of capacity on service and network elements.
- R 6.2-03: The IPTV architecture is required to support a mechanism that allows for service-based transport QoS to be managed across multiple network provider domains.
- R 6.2-04: The network that supports IPTV is required to support IP QoS classes and to satisfy associated performance requirements specified in [ITU-T Y.1541].

    NOTE 1 – [ITU-T Y.1541] recommends the selection of relevant QoS classes based on application requirements.

Architecture recommendations

- RR 6.2-01: The IPTV architecture is recommended to support consistent QoS for the whole period of the IPTV service operation.
- RR 6.2-02: The IPTV architecture is recommended to support mechanisms by which network operators can integrate IPTV QoS management functions into a common QoS management framework with other services and applications.
- RR 6.2-03: The IPTV architecture is recommended to rely upon any relevant QoS capabilities (e.g., RACF [b-ITU-T Y.2111] and DiffServ [b-IETF RFC 2475]) when integrating IPTV services into NGN-based environments.

- RR 6.2-04: The IPTV architecture is recommended to support transmission of video or data with sufficient quality for perception of sign language interpretation, including lip reading. This requires the transmission of a sufficient number of frames per second and sufficient spatial resolution to reproduce details of the signing person's hands, face, lips, eyes and body [b-ITU-T H-Sup.1].

  NOTE 2 – Perception of sign language interpretation depends on actual terminal device capabilities.

Architecture options

- OR 6.2-01: The IPTV architecture can optionally support the delivery of multiple services over the common IP transport with manageable IP quality of service (QoS).

  NOTE 3 – Services can be delivered by multiple service providers or by a single provider.

- OR 6.2-02: The IPTV architecture can optionally support mechanisms for QoE/QoS parameters adjustment due to changes of content characteristics in a channel.

- OR 6.2-03: The IPTV architecture can optionally support a content delivery error recovery mechanism to achieve required level of QoE/QoS for unicast/multicast content delivery.

6.2.1 Quality of experience

Architecture requirements

- R 6.2.1-01: The IPTV architecture is required to support mechanisms for supporting appropriate resiliency in the service provider infrastructure to maintain high QoE.

- R 6.2.1-02: The IPTV architecture is required to allow the delivery of IPTV services with defined quality of experience (QoE) for the IPTV end-user.

Architecture recommendations

- RR 6.2.1-01: The IPTV architecture is recommended to support appropriate QoE for end-users eligible for uploading content to the service provider's network.

- RR 6.2.1-02: The IPTV architecture is recommended to support means to provide channel changing times with sufficient QoE.

- RR 6.2.1-03: The IPTV architecture is recommended to support capabilities to monitor audio and video quality.

  NOTE – Further information regarding IPTV monitoring points can be found in [b-ITU-T G.1081].

- RR 6.2.1-04: The IPTV architecture is recommended to support navigation of EPG menu items with sufficient QoE.

6.2.2 Traffic management

Architecture requirements

- R 6.2.2-01: The IPTV architecture is required to support traffic management mechanisms for the differential treatment of IPTV traffic.

- R 6.2.2-02: The IPTV architecture is required to support the ability to configure QoS rules at the DNGF that govern traffic mapping (upstream or downstream) for the different IPTV services.

- R 6.2.2-03: The IPTV architecture is required to support a mechanism for assigning IPTV traffic priorities.

- R 6.2.2-04: The IPTV architecture is required to support the relevant mechanisms for IPTV traffic identification, classification and marking, policing and conditioning, scheduling and discarding.

Architecture recommendations

- RR 6.2.2-01: The IPTV architecture is recommended to support mechanisms for dynamic IPTV traffic load balancing so as to dynamically accommodate with the network load and congestion conditions at any given time, enabling delivery of IPTV services to end-users with the required level of quality.

- RR 6.2.2-02: The IPTV architecture is recommended to offer admission control mechanisms for IPTV traffic, including those generated by end-users, over the access and core network.

6.3 Security aspects including service and content protection

6.3.1 General IPTV security

Architecture requirements

- R 6.3.1-01: The IPTV architecture is required to support content protection as defined in clause 3.

- R 6.3.1-02: The IPTV architecture is prohibited from precluding support for service and content protection interoperability where only authorized user(s) or device(s) are allowed to use the IPTV content, even after content is transferred to another security system.

Architecture options

- OR 6.3.1-01: The IPTV architecture can optionally support service and content protection (SCP) of end-user shared content.

6.3.2 Service and content protection

Architecture requirements

- R 6.3.2-01: The IPTV architecture is required to support associating content with protection and content management metadata to permit the expression of its rights of usage.

- R 6.3.2-02: The IPTV architecture is required to support content usage rights metadata that distinguish among different rights of use including rendering (viewing), storage, (re)distribution, and combinations thereof.

- R 6.3.2-03: The IPTV architecture is required to support protection of content that is distributed simultaneously to a very high number of subscribers (scalability).

- R 6.3.2-04: The IPTV architecture is required to support protection of content that is transferred over multicast and/or over unicast streams.

- R 6.3.2-05: The IPTV architecture is required to support the securing of stored content according to granted usage.

- R 6.3.2-06: The IPTV architecture is prohibited from precluding support for service and content protection interoperability so as to keep identification information to identify IPTV content consistently, no matter which identification schemes are used and no matter which security system the content is transferred to.

- R 6.3.2-07: The IPTV architecture is prohibited from precluding support for service and content protection interoperability whereby only trusted devices have granted rights.

- R 6.3.2-08: The IPTV architecture is prohibited from precluding support for service and content protection interoperability so as to provide a secure environment for exchanging service and content protection interoperability data, e.g., authentication information, metadata, key information.

- R 6.3.2-09: The IPTV architecture is prohibited from precluding support for service and content protection interoperability such that interoperability is not dependent on specific software or hardware.

- R 6.3.2-10: The IPTV architecture is prohibited from requiring service and content protection mechanisms of either side of two interoperating SCP schemes to be openly specified to achieve interoperability.

- R 6.3.2-11: The IPTV architecture is prohibited from precluding support for service and content protection interoperability which is flexible and extensible to support various business models.

- R 6.3.2-12: The IPTV architecture is prohibited from precluding support for service and content protection interoperability so as to maintain transparency to users.

- R 6.3.2-13: The IPTV architecture is prohibited from precluding support for multiple content and service protection mechanisms regardless of specific hardware or software requirements.

Architecture recommendations

- RR 6.3.2-01: If IPTV content employs a content tracing technology, then it is recommended that the tracing technology be imperceptible.

- RR 6.3.2-02: The IPTV architecture is recommended to support service and content protection interoperability so as to not reduce the level of security when content is transferred to another security system.

- RR 6.3.2-03: The IPTV architecture is recommended to support service and content protection interoperability among multiple security systems which use different security mechanisms, where the purpose is, respectively, to support seamless time shifting (subscribers can store the content and retrieve it later) and place shifting (subscribers can see the content anywhere).

- RR 6.3.2-04: If IPTV employs a content tracing technology based on metadata for watermarking facilitation, it is recommended to embed relevant metadata in the content elementary stream using such provisions for "user data" as are provided in the specific codec.

NOTE 1 – See [b-ITU-T H.262] for information on "user data".

Architecture options

- OR 6.3.2-01: The IPTV architecture can optionally support the inclusion of content tracing information.

    NOTE 2 – This content tracing information may contain the operator ID, content owner ID, IPTV terminal device ID, and other information.

- OR 6.3.2-02: The IPTV architecture can optionally support robust content tracing for offline (non real-time) content (e.g., VoD content).

- OR 6.3.2-03: The IPTV architecture can optionally support robust content tracing for real-time content (e.g., broadcast content).

- OR 6.3.2-04: The IPTV architecture can optionally support a means for conveyance of content tracing information (e.g., watermark facilitation metadata).

    NOTE 3 – Such provision may be made by the selection of appropriate standard profiles or by extensions to the existing standards.

- OR 6.3.2-05: The IPTV architecture can optionally support the application of content tracing technology within the output of an IPTV terminal device for the purpose of uniquely identifying a session (e.g., channel, time/date), IPTV terminal device and/or network operator.

    NOTE 4 – Content tracing information optionally includes visible and invisible information.

- OR 6.3.2-06: The IPTV architecture can optionally allow the retrieval of all the content tracing information from the content.

6.3.2.1 IPTV scrambling algorithms

Scrambling algorithm requirements

- R 6.3.2.1-01: Scrambling algorithms for broadcast stream are required to support the periodic update of necessary cryptographic keys.

- R 6.3.2.1-02: Scrambling algorithms for IPTV are required to be built using publicly available and standardized cryptographic algorithms.

Scrambling algorithm recommendations

- RR 6.3.2.1-01: Scrambling algorithms for IPTV are recommended to have sufficiently large key entropy to protect the content from crypto-analysis (e.g., at least 128 bits for the AES symmetric algorithms).

- RR 6.3.2.1-02: IPTV architecture is recommended to not preclude support of more than one scrambling scheme.

- RR 6.3.2.1-03: Scrambling algorithms for IPTV are recommended to support updatable cryptographic parameters (e.g., key length, crypto periods, etc.) or cryptographic mode (e.g., CBC, OFB, ECB, etc.).

Scrambling algorithm options

- OR 6.3.2.1-01: Scrambling algorithms for IPTV can optionally apply cryptographic algorithms of different security strengths depending on the content value.

6.3.3 Service security

Architecture requirements

- R 6.3.3-01: The IPTV architecture is required to support service protection, as defined in clause 3.

- R 6.3.3-02: The IPTV architecture is required to support authorization and authentication of end-user.

  NOTE – End-user may be subscriber.

- R 6.3.3-03: The IPTV architecture is required to have the ability to use standard key management systems (e.g., MIKEY, EMM/ECM), to the extent that this is required for interoperability.

- R 6.3.3-04: The IPTV architecture is required to support the capability to update and query the SCP system concerning scrambling algorithms for IPTV and any other operator-selected scrambling algorithms.

- R 6.3.3-05: The IPTV architecture is required to support rights management that is independent of specific content formats or specifications.

- R 6.3.3-06: The IPTV architecture is required to support a mechanism for the secure delivery of rights and content access control information to the IPTV terminal devices.

- R 6.3.3-07: The IPTV architecture is required to support content usage control (e.g., re-play rights and content access control information).

- R 6.3.3-08: The IPTV architecture is required to support different modes of re-play rights and content access control information, e.g., limit on number of plays, time-limit on plays, restriction of fast forward or rewind.

- R 6.3.3-09: The IPTV architecture is required to support a mechanism for transmitting signalling messages securely between the SCP server-side functions and the SCP client-side functions.

- R 6.3.3-10: The IPTV architecture is required to support a mechanism to allow for the confidentiality of signalling messages between the SCP server-side functions and the IPTV terminal device SCP client-side functions.

- R 6.3.3-11: The IPTV architecture is required to support a mechanism to allow for the authenticity of signalling messages between the SCP server-side functions and the IPTV terminal device SCP client-side functions.

- R 6.3.3-12: The IPTV architecture is required to support a mechanism to allow for the integrity of signalling messages between the SCP server-side functions and the IPTV terminal device SCP client-side functions.

- R 6.3.3-13: The IPTV architecture is required to support a mechanism to securely retrieve the SCP parameters (e.g., configuration, status) from IPTV terminal device.

- R 6.3.3-14: The IPTV architecture is required to support a mechanism to securely update the SCP parameters (e.g., configuration) of the IPTV terminal device.

- R 6.3.3-15: If the IPTV architecture employs a key management system, then the latter is required to be designed for scalability, reliability, and interoperability.

- R 6.3.3-16: The IPTV architecture is prohibited from precluding support for the installation and operation of multiple service protection solutions without any hardware replacement except removable devices (such as USB dongle and SIM cards).

- R 6.3.3-17: The IPTV architecture is prohibited from precluding support for an identification mechanism for available service protection solutions capable of satisfying related content protection requirements.

- R 6.3.3-18: The IPTV architecture is prohibited from precluding support for a SCP system discovery mechanism, such that whenever specific content requires a specific SCP system, the IPTV architecture may support a discovery mechanism and adapt to it.

- R 6.3.3-19: The IPTV architecture is prohibited from precluding support for a mechanism for the selection of a SCP system from the available SCP systems without any hardware replacement except removable devices.

- R 6.3.3-20: The IPTV architecture is prohibited from precluding support for secure downloading of a SCP system. The specific downloading can optionally depend on specific service protection requirements.

- R 6.3.3-21: The IPTV architecture is prohibited from precluding support for verification and authentication of the downloaded SCP system mechanisms.

Architecture recommendations

- RR 6.3.3-01: The IPTV architecture is recommended to support the capability for authenticating and authorizing end-users for content sharing services (e.g., content export and content redistribution), if content sharing is supported.

- RR 6.3.3-02: If the IPTV architecture employs a key management system, then a hierarchical key management scheme is recommended to be considered to support scalability.

- RR 6.3.3-03: If the IPTV architecture employs a key management system that uses a group key management protocol, then a hierarchical key management scheme and a key management algorithm alternative are recommended to be considered to support scalability.

- RR 6.3.3-04: If the IPTV architecture employs a key management system that uses short term keys, then it is recommended that the media path is provisioned in such a way that NAT traversal and bandwidth constraints do not limit the key exchange.

- RR 6.3.3-05: The IPTV architecture is recommended to support the joint transmission of content and content tracing information such that the content and its respective content tracing information remain synchronized during transport.

- RR 6.3.3-06: The IPTV architecture is recommended to support at least the same degree of protection (for purposes of controlling unauthorized access) to content tracing information as it is applied to the corresponding traced content.

- RR 6.3.3-07: The IPTV architecture is recommended to enable content confidentiality.

- RR 6.3.3-08: The IPTV architecture is recommended to support a "blackout mechanism", that is a mechanism for limiting viewing-rights of certain programs to certain groups of subscribers (e.g., to block viewing by residents of a specific area (for example, this may be useful for sporting events)).

Architecture options

- OR 6.3.3-01: The IPTV architecture can optionally support the capability to turn on and off content tracing function with flexibility (e.g., based on time, event, content, channel).

6.3.4   Network security

Architecture requirements

- R 6.3.4-01: The IPTV architecture is required to support capabilities of mitigating DoS attacks.

- R 6.3.4-02: The IPTV architecture is required to support the provision of security measures to block illegal or unwanted traffic.

- R 6.3.4-03: The IPTV architecture is required to support the network operators' capability to prevent that the network topology and resources are visible to unauthorized entities.

- R 6.3.4-04: The IPTV architecture is required to be hardened against attacks on multicast capabilities.

Architecture recommendations

- RR 6.3.4-01: The multicast architecture is recommended to support the capability to authenticate a peer in the general or overlay (peer to peer) multicast environment.

- RR 6.3.4-02: To protect the home network from malicious or unauthorized access, the IPTV architecture is recommended to support the ability for the DNGF to establish a firewall, with multiple levels of security and appropriate application level gateways.

- RR 6.3.4-03: The IPTV architecture is recommended to support capabilities to use content label information to control content delivery.

6.3.5   IPTV terminal device security

Architecture requirements

- R 6.3.5-01: The IPTV architecture is required to support IPTV terminal device protection, as defined in clause 3.

- R 6.3.5-02: The IPTV architecture is required to support a means to authenticate IPTV terminal devices.

- R 6.3.5-03: The IPTV architecture is required to support physical tampering resistance for IPTV terminal devices.

- R 6.3.5-04: The IPTV architecture is required to support a means to detect when physical tampering has occurred for IPTV terminal devices.

- R 6.3.5-05: The IPTV architecture is required to support secure installation of the SCP operating code to IPTV terminal devices.

- R 6.3.5-06: The IPTV architecture is required to support secure means for performing critical security enabling processes in IPTV terminal device, such as key management, content tracing, abortion of content playback in the event of a security related malfunction, detection of tampering, or other indication of misuse.

- R 6.3.5-07: The IPTV architecture is prohibited from precluding support of the interchange of content between an IPTV terminal device and other (physical or logical) devices provided that the usage granted for this content includes such an interchange.

Architecture options

- OR 6.3.5-01: The IPTV architecture can optionally provide physical protection (against probing or tampering of SCP function on the TD) of sensitive security enabling processes, as well as of critical data supporting those processes, and components involved in the processing, transmission and storage of any valued content in IPTV terminal device in case no logical protection (such as encryption or content tracing watermarks) is present. These processes include descrambling and content tracing.

6.3.6 Subscriber security

Architecture requirements

- R 6.3.6-01: The IPTV architecture is required to support user privacy protection, as defined in clause 3.

- R 6.3.6-02: The IPTV architecture is required to support a mechanism to allow the IPTV terminal device SCP client-side functions to authenticate the SCP server-side functions.

- R 6.3.6-03: The IPTV architecture is required to allow a subscriber to set an access control mechanism (e.g., a password) in order to restrict access to content and/or services.

- R 6.3.6-04: The IPTV architecture is required to be capable of indicating why access to content and/or services has been denied to the end-user.

- R 6.3.6-05: The IPTV architecture is required to allow for a mechanism for a subscriber to request extensions (e.g., more plays, more play-time) to digital rights associated with specific content instances.

- R 6.3.6-06: The IPTV architecture is required to support the ability to ask for the end-user's permission when a non-anonymous use of the end-user privacy related information is involved.

Architecture recommendations

- RR 6.3.6-01: The IPTV architecture is recommended to support a mechanism for parental rating, i.e., facilities for rating programs according to content.

- RR 6.3.6-02: The IPTV architecture is recommended to support mechanisms to support the enforcement of parental controls in a manner consistent with ratings defined by each country.

- RR 6.3.6-03: The IPTV architecture is recommended to support mechanisms for the service provider to support the enforcement of parental controls on a user profile basis or a policy basis, e.g., time-limit.

6.4 Network related aspects

Architecture recommendations

- RR 6.4-01: The IPTV architecture is recommended to support the ability of both multicasting and unicasting transmission schemes.

- RR 6.4-02: The IPTV architecture is recommended to support content delivery in several yet optional versions to be selected according to the capabilities of the IPTV terminal device receiving the content (e.g., access rate, resolution, supported formats).
- RR 6.4-03: The IPTV architecture is recommended to support the ability to identify wireless network characteristics information sent by the IPTV terminal device.

Architecture options

- OR 6.4-01: The IPTV architecture can optionally support signalling capabilities for transmitting bandwidth related information.
- OR 6.4-02: The IPTV architecture can optionally use the bandwidth related information to determine the appropriate content coding means to deliver the content.

6.4.1 Network

Architecture requirements

- R 6.4.1-01: The IPTV architecture is required to support the management and enforcement of the service providers' transport policies by the network provider.
- R 6.4.1-02: The IPTV architecture is required to support a mechanism to appropriately distinguish different forms of traffic, e.g., data and voice.
- R 6.4.1-03: The IPTV architecture is required to support a mechanism for NAT traversal.
- R 6.4.1-04: The IPTV architecture is required to support a mechanism for assigning IP addresses and IP subnet masks to an attaching DNG.

Architecture recommendations

- RR 6.4.1-01: The IPTV architecture is recommended to support mechanisms for accessing and obtaining end-user location information.
- RR 6.4.1-02: The IPTV architecture is recommended to allow the delivery of IPTV services over different access networks (e.g., cable, optical, xDSL, wireless).
- RR 6.4.1-03: The IPTV architecture is recommended to support IPv4 and IPv6.
- RR 6.4.1-04: The IPTV architecture is recommended to support both static and dynamic address allocation, numbering and naming schemes.

6.4.2 Multicast distribution

Architecture requirements

- R 6.4.2-01: The IPTV architecture is required to support multicast means of communication to all end-users.
- R 6.4.2-02: The IPTV architecture is required to allow the service provider to utilize the network providers' multicast delivery capabilities.

Architecture recommendations

- RR 6.4.2-01: The IPTV architecture is recommended to support mechanisms that allow IPTV services to be distributed to specific groups of end-users.
- RR 6.4.2-02: The IPTV architecture is recommended to support mechanisms for transmitting identification information related to end-users who want to receive or are selected to receive IPTV services.

6.4.3 Mobility aspects

<u>Architecture requirements</u>

- <u>R 6.4.3-01:</u> The IPTV architecture is required to support mechanisms for exchanging subscriber-related information between the visited network (where the end-user accesses the IPTV services) and the home IPTV service provider (where the end-user has its subscription to the IPTV services) in case mobility is supported.

- <u>R 6.4.3-02:</u> The IPTV architecture is required to support mechanisms for discovering and selecting end-user's service profile from the IPTV terminal device or the home IPTV service provider that will be used by the end-user whenever it accesses such IPTV services from a visited network in case mobility is supported.

- <u>R 6.4.3-03:</u> The IPTV architecture is required to support mechanisms for discovering and selecting IPTV services provided by the home IPTV service provider for roaming users in case mobility is supported.

- <u>R 6.4.3-04:</u> The IPTV architecture is required to support capturing relevant control context information from the originating terminal device, and transferring them to the target terminal device in case mobility is supported.

- <u>R 6.4.3-05:</u> The IPTV architecture is required to support nomadism for both personal mobility and terminal mobility.

   NOTE – Further information concerning nomadism, personal mobility and terminal mobility can be found in [b-ITU-T Y.2201].

<u>Architecture recommendations</u>

- <u>RR 6.4.3-01:</u> Where support for terminal mobility with service continuity exists, such support is also recommended for IPTV.

6.4.4 Interworking between IPTV and PSTN/ISDN

<u>Architecture recommendations</u>

- <u>RR 6.4.4-01:</u> The IPTV architecture is recommended to support the relevant network facilities for processing PSTN/ISDN incoming/outgoing calls.

- <u>RR 6.4.4-02:</u> The IPTV architecture is recommended to support voice encoding/decoding capabilities, as per PSTN/ISDN incoming/outgoing calls.

- <u>RR 6.4.4-03:</u> The IPTV architecture is recommended to be scalable as far as the processing of incoming/outgoing PSTN/ISDN calls per unit of time is concerned.

- <u>RR 6.4.4-04:</u> The IPTV architecture is recommended to support real-time audio related to PSTN/ISDN incoming/outgoing calls, with a voice quality similar to that of PSTN/ISDN environments.

- <u>RR 6.4.4-05:</u> The IPTV architecture is recommended to support call control service capabilities for the processing of incoming/outgoing PSTN/ISDN calls.

6.5 End systems and interoperability aspects

6.5.1 End-user aspects on IPTV services

<u>Architecture requirements</u>

- <u>R 6.5.1-01:</u> The IPTV architecture is required to support the end-user ability to choose and select one subtitle or closed caption flow from several that might be delivered with the IPTV content.

Architecture recommendations

- RR 6.5.1-01: The IPTV architecture is recommended to support a mechanism through which end-users can make the content they produced/created available to other end-users.
- RR 6.5.1-02: The IPTV architecture is recommended to support mechanisms for end-users to control who is able to view end-user originated content (e.g., every end-user versus a specific subset of end-users).

6.5.1.1 End-user aspects on linear TV

Architecture requirements

- R 6.5.1.1-01: The IPTV architecture is required to support the end-user ability to access different IPTV contents on different IPTV terminal devices if the network allows the simultaneous delivery of several contents (e.g., different IPTV contents).
- R 6.5.1.1-02: The IPTV architecture is required to support the end-user ability to select an additional audio associated with the main content, e.g., audio description.

Architecture recommendations

- RR 6.5.1.1-01: The IPTV architecture is recommended to support the end-user with the ability to select an audio alternative to receiving textual information (e.g., scrollbars).

6.5.1.2 End-user aspects on linear TV with trick mode

Architecture requirements

- R 6.5.1.2-01: The IPTV architecture is required to support the availability of accessibility features (captions, subtitles, descriptive audio and multiple video streams such as for sign-language) and their synchronization with the main content when viewing in normal playback.
- R 6.5.1.2-02: The IPTV architecture is required to support the IPTV terminal device ability to record all available accessibility features (captions, subtitles, descriptive audio and multiple video streams such as for sign-language) with the main content, whilst retaining the synchronization of the original information.
- R 6.5.1.2-03: The IPTV architecture is required to support the IPTV terminal device ability to synchronize multiple video streams, captions, and subtitles when the video stream is paused.
- R 6.5.1.2-04: The IPTV architecture is required to support the IPTV terminal device ability to restart the previously selected associated accessibility features after a pause.

Architecture recommendations

- RR 6.5.1.2-01: The IPTV architecture is recommended to support the end-user ability to replay what has just been watched on a TV channel.
- RR 6.5.1.2-02: The IPTV architecture is recommended to support the end-user ability to pause and later play in fast forward mode.
- RR 6.5.1.2-03: The IPTV architecture is recommended to support the IPTV terminal device ability to allow the end-user to select any of the recorded accessibility features.

Architecture options

- OR 6.5.1.2-01: The IPTV architecture can optionally support the IPTV terminal device ability to render available accessibility features with the main content when viewing in playback.

6.5.1.3 End-user aspects on time-shift TV

<u>Architecture requirements</u>

- <u>R 6.5.1.3-01:</u> The IPTV architecture, if time-shift TV is supported, is required to support the end-user ability to easily identify the TV channels delivering the selected content and the relative progress position in the delivery of this content.

- <u>R 6.5.1.3-02:</u> The IPTV architecture, if time-shift TV is supported, is required to support the end-user ability to switch easily between the TV channels which are delivering or about to deliver the same content but at different delivery time using the remote control keys (e.g., channel up, channel down).

6.5.1.4 End-user aspects on VoD

<u>Architecture requirements</u>

- <u>R 6.5.1.4-01:</u> The IPTV architecture, if VoD is supported, is required to support the end-user ability to discover and browse content catalogue(s).

- <u>R 6.5.1.4-02:</u> The IPTV architecture, if VoD is supported, is required to support the end-user ability to select contents using a single criterion or a combination of criteria such as title, reference, genre, keyword, director, actor, etc.

- <u>R 6.5.1.4-03:</u> The IPTV architecture, if VoD is supported, is required to support the end-user ability to get the selected content streamed after authorization.

- <u>R 6.5.1.4-04:</u> The IPTV architecture, if VoD is supported, is required to support the end-user ability to pause and then resume watching the selected content.

- <u>R 6.5.1.4-05:</u> The IPTV architecture, if VoD is supported, is required to support the end-user ability to rewind or fast forward, with or without watching capability, the VoD content.

6.5.1.5 End-user aspects on push VoD

<u>Architecture requirements</u>

- <u>R 6.5.1.5-01:</u> The IPTV architecture, if push VoD is supported, is required to support the end-user option to receive content without being disturbed (e.g., when watching a TV channel, recording a content on a PVR, downloading from the Internet, having a videoconference) and without disturbing activities of the devices engaged in providing a service (e.g., recording a content on a PVR).

- <u>R 6.5.1.5-02:</u> The IPTV architecture, if push VoD is supported, is required to support the end-user ability to receive content with no impact on the storage allocated to the end-user.

<u>Architecture recommendations</u>

- <u>RR 6.5.1.5-01:</u> The IPTV architecture, if push VoD is supported, is recommended to support the end-user option to be informed after push VoD content reception is completed, if not otherwise stated.

6.5.1.6 End-user aspects on PVR service

<u>Architecture requirements</u>

- <u>R 6.5.1.6-01:</u> The IPTV architecture, if n/cPVR is supported, is required to support the end-user ability to choose whether recording of a new version of content replaces the old version or will coexist with it.

- <u>R 6.5.1.6-02:</u> The IPTV architecture, if n/cPVR is supported, is required to support the end-user ability to check if the end-user IPTV terminal devices are suitable for playing back the recorded content.

- <u>R 6.5.1.6-03:</u> The IPTV architecture, if n/cPVR is supported, is required to support the end-user ability to set a preference to see or block a specific content or range of contents.

Architecture recommendations

- RR 6.5.1.6-01: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to record the content according to the metadata received from a broadcaster and then discard unwanted elements when the broadcaster updates the metadata between scheduling and recording.

- RR 6.5.1.6-02: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to record the content, even if there is a schedule change recoverable by the PVR (delayed broadcast, no overlap with other scheduled recording, etc.) without any specific end-user action.

- RR 6.5.1.6-03: The IPTV architecture, if n/cPVR is supported, is recommended to support both the user profile and service profile management on the IPTV terminal device.

- RR 6.5.1.6-04: The IPTV architecture, if nPVR is supported, is recommended to support the end-user ability to manage the items stored for them or give an appropriate provider(s) permission to do so, e.g., items to be deleted next, permanently stored, etc.

- RR 6.5.1.6-05: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to allow the PVR to automatically capture content based on the end-user viewing behaviour.

- RR 6.5.1.6-06: The IPTV architecture, if cPVR is supported, is recommended to support the end-user ability to allow a service provider to remotely control the functionality of the PVR (e.g., to capture settings, profiles).

- RR 6.5.1.6-07: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to select programmes for recording based on information provided by the service or content provider.

- RR 6.5.1.6-08: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to move personal profiles to different PVRs in the same or other physical locations, e.g., when upgrading the devices or while viewing in a hotel when on holiday.

- RR 6.5.1.6-09: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to automatically update time sensitive content (such as news and advertising) recorded on the PVR.

- RR 6.5.1.6-10: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to make a selection after seeing promotional or advertising features which are part of the PVR content.

- RR 6.5.1.6-11: The IPTV architecture, if n/cPVR is supported, is recommended to support an update of the PVR recordings.

- RR 6.5.1.6-12: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to set preferences on the PVR that allow it to capture captions or subtitles and audio description in the native language of the end-user when programmes are transmitted in a foreign language.

- RR 6.5.1.6-13: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to select content to be recorded depending on its characteristics such as broadcast quality, aspect ratio, etc.

- RR 6.5.1.6-14: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to see relevant, timely interstitials (commercials and promotional) when time-shifted viewing of content.

- RR 6.5.1.6-15: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to receive replacement of advertising interstitials in certain events (such as live sport) with relevant programme content.

- RR 6.5.1.6-16: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to display text, images and other associated content that broadcasters make available as enhancements to their programmes.

- RR 6.5.1.6-17: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to pause live incoming content on a n/cPVR so that it can be "resumed" later and allow the continued watching of the content in time-shift mode.

- RR 6.5.1.6-18: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to amend the list of items scheduled to be recorded.

- RR 6.5.1.6-19: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to set up and manage multiple personal profiles on their PVR associated with one or more service providers.

- RR 6.5.1.6-20: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to navigate and explore content segments using indexes.

- RR 6.5.1.6-21: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to capture a multi-stream offering in such a way that, when playing the content at a later date, the different streams remain synchronous.

- RR 6.5.1.6-22: The IPTV architecture, if n/cPVR is supported, is recommended to support the end-user ability to select either audio, captions, subtitles or all to be recorded along with the video, and to store this selection as "preference".

- RR 6.5.1.6-23: The IPTV architecture, if nPVR is supported, is recommended to support the end-user's rightful ability to check if any content searched for is playable on the IPTV terminal device.

Architecture options

- OR 6.5.1.6-01: The IPTV architecture, if n/cPVR is supported, can optionally allow retrieval of content in a segmented manner.

- OR 6.5.1.6-02: The IPTV architecture, if n/cPVR is supported, can optionally support the end-user ability to insert captured advertisements or promotions along with the content being played back.

- OR 6.5.1.6-03: The IPTV architecture, if n/cPVR is supported, can optionally support the end-user ability to edit the recorded content.

- OR 6.5.1.6-04: The IPTV architecture, if both of nPVR and cPVR are used together, can optionally support the end-user ability to utilize the capacity of nPVR as expanded capacity of cPVR for personal content.

- OR 6.5.1.6-05: The IPTV architecture, if n/cPVR is supported, can optionally support the end-user ability to pause what is being watched, view any other material, and then resume the original material from where it was paused.

- OR 6.5.1.6-06: The IPTV architecture, if n/cPVR is supported, can optionally support the end-user ability to capture content onto the portable device, if the portable device has recording capability, over a network and transfer that content with associated metadata to his or her home devices and other mobile devices with the permission of the service or content provider.

- OR 6.5.1.6-07: The IPTV architecture, if n/cPVR is supported, can optionally support the end-user ability to decide whether to capture single or multiple episodes of a series or other programmed groupings.

- OR 6.5.1.6-08: The IPTV architecture, if n/cPVR is supported, can optionally support the end-user ability to play games that include pre-recorded content.

6.5.1.7 End-user aspects on service information

Architecture requirements

•   R 6.5.1.7-01: The IPTV architecture is required to support the end-user ability to see the associated information (e.g., by pressing a specific remote control key) and to act upon it (e.g., to follow the link, to make a choice, to bet, to return).

Architecture recommendations

•   RR 6.5.1.7-01: The IPTV architecture is recommended to support the end-user ability to tune to a TV channel from the displayed list of authorized TV channels.

•   RR 6.5.1.7-02: The IPTV architecture is recommended to support the end-user ability to configure or watch a short list of the TV channels among those authorized to watch (free or subscribed channels).

•   RR 6.5.1.7-03: The IPTV architecture is recommended to support the end-user ability to get information about the available TV channels (name, logos, owner, website).

6.5.2 IPTV terminal device

Terminal device requirements

•   R 6.5.2-01: The IPTV terminal device is required to support the decoding of at least one video and one audio format.

•   R 6.5.2-02: The IPTV terminal device is required to support system start-up and initialization function.

•   R 6.5.2-03: The IPTV terminal device is required to have the ability to select and receive multiple audio sources (e.g., one with audio description).

•   R 6.5.2-04: The IPTV terminal user interface is required to not rely on colour alone to convey information.

•   R 6.5.2-05: For multichannel audio transmissions, the IPTV terminal device is required to have an IEC 958 type II interface.

•   R 6.5.2-06: The IPTV terminal device without multichannel audio capabilities is required to implement multichannel audio decoders and downmix from multichannel to stereo.

Architecture recommendations

•   RR 6.5.2-01: The IPTV architecture is recommended to allow multiple services with different contents to be displayed on a single IPTV terminal device.

Terminal device recommendations

•   RR 6.5.2-02: The IPTV terminal device is recommended to support the rendering of multiple IPTV contents and layouts.

•   RR 6.5.2-03: The IPTV terminal device is recommended to support decoding of a variety set of video formats such as, but necessarily limited, to SD and HD.

•   RR 6.5.2-04: The IPTV terminal device is recommended to support audio services.

•   RR 6.5.2-05: The IPTV terminal device is recommended to support mono, stereo and multi-channel audio decoding capabilities.

•   RR 6.5.2-06: For multichannel audio transmissions, the IPTV terminal device is recommended to implement transcoding, e.g., from HE-AAC to DTS Surround or Dolby Digital Plus to Dolby Digital, if it is a multichannel audio capable terminal.

•   RR 6.5.2-07: The IPTV architecture is recommended to support IPTV terminal devices with the capability to choose the desired format of the content if there are multiple formats available.

- RR 6.5.2-08: The IPTV terminal device is recommended to offer to the end-user a service navigation capability based on the metadata for the services available through each network.

- RR 6.5.2-09: The GUI API module is recommended to include the following functions:
    - Graphic design and display functions;
    - UI control interface design and display functions;
    - Image and video attribute set functions.

- RR 6.5.2-10: The IPTV terminal device is recommended to provide a user setting enabling selection of an opaque background for any on-screen display, i.e., text that is overlaid onto video, thereby making it easier to read.

- RR 6.5.2-11: The IPTV terminal device is recommended to provide a user setting to change the default colours of text and background for on-screen displays, i.e., as a minimum, a combination of white text on a black background is recommended to be offered.

- RR 6.5.2-12: The IPTV terminal device is recommended to provide a user setting to change the default size of text for on-screen displays.

- RR 6.5.2-13: The IPTV terminal device is recommended to inform the user of the timing when an action (for example, downloading content) is complete.

- RR 6.5.2-14: The IPTV terminal device is recommended to display Arabic numerals (1, 2, 3, 4) rather than Roman numerals (I, II, III, IV) where applicable to the language used.

- RR 6.5.2-15: The IPTV terminal device is recommended to support the ability to display subtitles and captions in any character set of the content provider's choice.

- RR 6.5.2-16: The IPTV terminal device is recommended to maintain the end-user's selected subtitle and caption styles/options/modes/formats, supplementary audio content and supplementary video content as far as possible when switching between services.

- RR 6.5.2-17: Any on-screen displays are recommended to be available via external interfaces.

- RR 6.5.2-18: The IPTV terminal device is recommended to support diagnostic for IPTV terminal.

- RR 6.5.2-19: The IPTV terminal device is recommended to support subtitle and caption decoding and display.

- RR 6.5.2-20: The IPTV terminal device, when permitted, is recommended to be able to acquire and save the audience rating information and send it to the service provider.

- RR 6.5.2-21: The IPTV terminal device is required to support the ability to ask for the end-user's permission when a non-anonymous use of the end-user privacy related information is involved.

- RR 6.5.2-22: The IPTV terminal device with multichannel audio capabilities is recommended to utilize audio control features, e.g., dynamic range control, programme reference level (or dialogue) normalization and downmix in the audio decoder.

- RR 6.5.2-23: The IPTV terminal device is recommended to support pause.

- RR 6.5.2-24: The IPTV terminal device is recommended to support an IP-based 2-way communication channel.

- RR 6.5.2-25: The IPTV terminal device, if n/cPVR is supported, is recommended to support distributed personal video recorder functionality.

- RR 6.5.2-26: The IPTV terminal device is recommended to communicate with the service provider in order to be aware of service availability.

- RR 6.5.2-27: The IPTV terminal device is recommended to have the capability to decode and display captions in a separate window or overlaid with different colours, colours for different speakers as signalled by the content provider.

- RR 6.5.2-28: The IPTV terminal device is recommended to be able to declare to media-providing entities its usage environment description, e.g., type of service, type of terminal, type of transmission medium, user preferences, available QoS level.

- RR 6.5.2-29: The IPTV terminal device is recommended to be able to display the service logo.

- RR 6.5.2-30: The IPTV terminal device is recommended to support skip forward and skip backward (e.g., by time period, interval, location in content) in linear TV with trick mode.

- RR 6.5.2-31: The IPTV terminal device is recommended to support skip forward and skip backward (e.g., by time period, interval, location in content) in VoD service.

- RR 6.5.2-32: The IPTV terminal device is recommended to support skip forward and skip backward (e.g., by time period, interval, location in content) in client PVR service.

- RR 6.5.2-33: The IPTV terminal device is recommended to support skip forward and skip backward (e.g., by time period, interval, location in content) in network PVR service.

- RR 6.5.2-34: The IPTV terminal device is recommended to allow the end-user the selection of subtitles or captions being displayed with a solid background or a transparent one.

- RR 6.5.2-35: The IPTV terminal device is recommended to be able to declare its usage environment description to the service provider.

- RR 6.5.2-36: The IPTV terminal device is recommended to select the preferred subtitle or closed caption flow when several such flows are available with the IPTV content.

- RR 6.5.2-37: The IPTV terminal device is recommended to have the ability to select the preferred main and supplementary content associated with the main content.

- RR 6.5.2-38: The IPTV terminal device is recommended to have the ability to discover and display any additional information (such as subtitles and captions) delivered with the TV channel.

- RR 6.5.2-39: The IPTV terminal device is recommended to support the end-user ability to set up and manage multiple user profiles.

- RR 6.5.2-40: The IPTV terminal device is recommended to output video in accordance with accepted international standards.

- RR 6.5.2-41: The IPTV terminal device is recommended to support video scaling.

- RR 6.5.2-42: The IPTV terminal device is recommended to provide native mode video output support, if it supports high definition outputs.

- RR 6.5.2-43: The IPTV terminal device is recommended to support a combination of video scaling and de-interlacing.

- RR 6.5.2-44: The IPTV terminal device is recommended to be capable of outputting SD and HD video signals according to one or more of the existing interface standards for video signals, if it is HD-capable.

- RR 6.5.2-45: The IPTV terminal device with multichannel audio capabilities is recommended to support downmix from multichannel to stereo.

Architecture options

- OR 6.5.2-01: The IPTV architecture can optionally support the ability to store, cache, update, and run applications on devices that implement the ITF.

- OR 6.5.2-02: The IPTV architecture can optionally support the ability for applications to be delivered to ITF implementing devices with a video service (i.e., streamed with the video), by user request over the two-way network connection, and by the service provider at the service provider's direction.

- OR 6.5.2-03: The IPTV architecture can optionally support the ability of ITF implementing devices to serve as a master monitor or switcher application that can be updated by the service provider and that can manage the execution of other applications.

- OR 6.5.2-04: The IPTV architecture can optionally support the ability for service provider-managed applications to be stored and executed in the devices implementing the ITF.

- OR 6.5.2-05: The IPTV architecture can optionally support the ability for video service-associated applications to be stored and executed in the devices implementing the ITF.

- OR 6.5.2-06: The IPTV architecture can optionally support user-requested applications to be stored and executed in the devices implementing the ITF.

- OR 6.5.2-07: The IPTV architecture can optionally have the ability to arrange displays of multiple video sources in different layouts.

Terminal device options

- OR 6.5.2-08: When no relevant national regulations apply, the IPTV terminal device can optionally support the ability of presenting emergency messages in text, alert video and audio over normal program media streams, and also the ability of interrupting any audio stream, including the supplementary audio.

    NOTE – When relevant national regulations apply, the IPTV architecture is required to support national regulations.

- OR 6.5.2-09: The IPTV terminal device can optionally support VBI capabilities.

- OR 6.5.2-10: The IPTV terminal device can optionally support the modification of display duration.

- OR 6.5.2-11: The IPTV terminal device can optionally enable the skin to contain properties of the graphical entities of the EPG interface such as fonts, icons, pointer, background pictures, and sound effect.

- OR 6.5.2-12: The IPTV terminal device can optionally enable the specified skin style to be further customized according to graphical entities such as fonts, icons, pointer, background pictures, sound effect, etc.

- OR 6.5.2-13: The IPTV terminal device can optionally download the skin on boot process.

- OR 6.5.2-14: The IPTV terminal device can optionally enable the end-user to access the remote control functions via GUI.

- OR 6.5.2-15: The IPTV terminal device can optionally render the UI with the end-user preferred skin.

- OR 6.5.2-16: The IPTV terminal device can optionally support the capability to provide information regarding its bandwidth availability.

- OR 6.5.2-17: The IPTV terminal device can optionally support the capability to allow the end-user to adjust the size of the subtitles or captions displayed.

- OR 6.5.2-18: The IPTV terminal device can optionally have the ability to select from a range of languages, speed and verbosity for subtitles and captions.

- OR 6.5.2-19: The IPTV terminal device can optionally be capable of responding to user preferences for adjusting audio dynamic range compression and control based on audio metadata.

- OR 6.5.2-20: The IPTV terminal device can optionally be capable of supporting user or network selection among a minimum of three levels of audio dynamic range compression: uncompressed, intermediate and heavy.

6.5.2.1 Interfaces

Terminal device recommendations

- RR 6.5.2.1-01: The IPTV terminal device is recommended to provide a human control interface (for example an infrared remote-control).
- RR 6.5.2.1-02: The IPTV terminal device is recommended to provide means for feedback of control actions to the end-user by visual and/or audio indications selected by the end-user.
- RR 6.5.2.1-03: The IPTV terminal device is recommended to provide end-user interface(s) for control and feedback of control actions by external devices or additional software, e.g., Braille interpretive device.

6.5.2.2 Provisioning

Terminal device recommendations

- RR 6.5.2.2-01: The IPTV terminal device is recommended to be easy to install and configure for operation.
- RR 6.5.2.2-02: The IPTV terminal device is recommended to support self- and remote provisioning of services, including network configuration and device-specific service enabling tasks.

6.5.2.3 PVR control

Terminal device recommendations

- RR 6.5.2.3-01: The IPTV terminal device is recommended to support both internal and/or external control of PVR functionality.

6.5.2.4 Security and authentication functions

Terminal device requirements

- R 6.5.2.4-01: The IPTV terminal device is required to support subscriber authentication and identification information management.

Terminal device recommendations

- RR 6.5.2.4-01: The IPTV terminal device is recommended to support IPTV service authorization.
- RR 6.5.2.4-02: The IPTV terminal device is recommended to support software upgrade and download authentication.
- RR 6.5.2.4-03: The IPTV terminal device is recommended to support network security policy management.
- RR 6.5.2.4-04: The IPTV terminal device is recommended to support parental control related information management.
- RR 6.5.2.4-05: The IPTV terminal device is recommended to support content purchasing information management.
- RR 6.5.2.4-06: The IPTV terminal device is recommended to support API for service provider functions such as locking screen (which disables the displayed image to change for a certain amount of time until, e.g., all the resources needed to be shown are ready and can be synchronized).

6.5.2.5 SCP functions

Terminal device recommendations

- RR 6.5.2.5-01: The IPTV terminal device is recommended to support the SCP functions in line with the recommendations made in [ITU-T Y.1910].
- RR 6.5.2.5-02: The IPTV terminal device is recommended to support rights management.
- RR 6.5.2.5-03: The IPTV terminal device is recommended to support decryption of media streams and data streams.
- RR 6.5.2.5-04: The IPTV terminal device is recommended to support access to security information.

6.5.2.6 End-user interaction functions

Terminal device recommendations

- RR 6.5.2.6-01: The IPTV terminal device is recommended to support event reception and dispatching from end-user to service provider.

6.5.2.7 Terminal management

Terminal device recommendations

- RR 6.5.2.7-01: The IPTV terminal device is recommended to support remote management.
- RR 6.5.2.7-02: The IPTV terminal device is recommended to support log management.
- RR 6.5.2.7-03: The IPTV terminal device is recommended to support software version management.
- RR 6.5.2.7-04: The IPTV terminal device is recommended to support media device parameter configuration, such as decoder parameter configuration.
- RR 6.5.2.7-05: The IPTV terminal device is recommended to support subscriber configuration, such as access account, service account.

6.5.2.8 System resource management functions

Terminal device recommendations

- RR 6.5.2.8-01: The IPTV terminal device is recommended to support monitoring and management of its own resources.
- RR 6.5.2.8-02: The IPTV terminal device is recommended to support allocation and scheduling of its own resources to IPTV services.

6.5.2.9 Internet access functions

Terminal device options

- OR 6.5.2.9-01: The IPTV terminal device can optionally support Internet client management, such as web browser, e-mail and news client management.

6.5.2.10 Aspects related to ITF

Architecture requirements

- R 6.5.2.10-01: The IPTV architecture is required to support a means to avoid sending to an ITF content that is unable to be rendered.
- R 6.5.2.10-02: The IPTV architecture is required to support mechanisms, inhibitors, and interfaces for the ITF to control the streaming of video content, i.e., trick modes.
- R 6.5.2.10-03: The IPTV architecture is required to support IPTV terminal devices which constantly listen for emergency alert notification (EAN) messages.

- R 6.5.2.10-04: If required by national authorities, the IPTV architecture is required to support mechanisms for the ITF to decode EAN messages specified by the authorities.
- R 6.5.2.10-05: The IPTV architecture is required to support a mechanism for the ITF to synchronize between different content streams.
- R 6.5.2.10-06: The IPTV architecture is required to support the capability for the ITF to re-establish service without end-user intervention in the event of network outages.
- R 6.5.2.10-07: The IPTV architecture is required to support channel change functionality in the ITF.
- R 6.5.2.10-08: The IPTV architecture is required to support an extensible method for the service provider to query for the ITF's capabilities and status.
- R 6.5.2.10-09: The IPTV architecture is required to support mechanisms for the service provider to manage the ITF, associated peripheral devices, e.g., display or storage devices, and physical devices that implement the ITF.
- R 6.5.2.10-10: The IPTV architecture is required to support the ability of the ITF to display and allow user selection of program, content, and service descriptions.
- R 6.5.2.10-11: The IPTV architecture is required to support the ability of the ITF to decode and display subtitle or closed caption information.
- R 6.5.2.10-12: The IPTV architecture is required to support the ability of the ITF to decode and display emergency alert information.

Architecture recommendations

- RR 6.5.2.10-01: The IPTV architecture is recommended to support automated configuration capabilities for the IPTV devices.
- RR 6.5.2.10-02: The IPTV architecture is recommended to support the ability of the ITF to declare its usage environment description to the service provider.
- RR 6.5.2.10-03: The IPTV architecture is recommended to support the ability of the ITF to obtain the usage environment description from the service provider.
- RR 6.5.2.10-04: The ITF is recommended to support the status information report to the service provider.

Architecture options

- OR 6.5.2.10-01: The ITF can optionally provide mechanisms to detect and report service consumption events that are not detectable elsewhere in the IPTV infrastructure.

6.5.3 Remote management

Architecture recommendations

- RR 6.5.3-01: The IPTV architecture is recommended to allow the service provider to retrieve device information such as manufacturer name, model name and number, software version, firmware version and profiles supported.
- RR 6.5.3-02: The IPTV architecture is recommended to support the service provider to provide information related to the service provider, such as an URL for a home page or help desk. For example, to provide a means for the service provider to direct the end-user to a central information point which would allow the service provider to offer additional services or assistance in case of difficulty.
- RR 6.5.3-03: The IPTV architecture is recommended to allow the service provider to retrieve statistical information of usage, e.g., channels watched and duration with the end-user's permission.

- RR 6.5.3-04: The IPTV architecture is recommended to allow the service provider to access service transaction related information such as usage patterns, e.g., changing between linear IPTV channels.

- RR 6.5.3-05: The IPTV architecture is recommended to allow the service provider to be able to configure and monitor device connectivity, e.g., access network and home network parameters.

- RR 6.5.3-06: The IPTV architecture is recommended to allow the service provider to be able to access device, network and content metrics important for QoS, e.g., dropped packet rates, jitter, integrity of transport streams.

6.5.4   Home network

Architecture requirements

- R 6.5.4-01: The IPTV architecture is required to support IP filtering functions in the DNGF in order to prevent selected local multicast traffic on the home network side from appearing on the network side.

- R 6.5.4-02: The IPTV architecture is required to support mechanisms for transport of time of day to the home network.

Architecture recommendations

- RR 6.5.4-01: The IPTV architecture is recommended to support the ability for the DNGF to implement standard IP routing functions, per established IETF specifications.

- RR 6.5.4-02: The IPTV architecture is recommended to support the ability for the DNGF to support the routing of IP packets between interfaces on network and home network sides. Specifically, this means:
  – Routing is recommended to be supported between network interfaces and home network interfaces;
  – Routing is recommended to be supported between different home network interfaces.

- RR 6.5.4-03: The IPTV architecture is recommended to support the ability for the DNGF to support multiple logical IP interfaces (multiple attachment points at the IP layer) on any particular physical interface on the network side.

- RR 6.5.4-04: The IPTV architecture is recommended to support the ability for the DNGF to assign IP addresses to devices in the home network.

- RR 6.5.4-05: The IPTV architecture is recommended to support the ability for the DNGF to support channel change functions between the ITF and the service provider.

- RR 6.5.4-06: The IPTV architecture is recommended to allow multiple network providers for a single home network, i.e., the IPTV architecture is recommended to allow a single home network to connect to more than one network provider domain.

- RR 6.5.4-07: The IPTV architecture is recommended to allow different providers for the transport and service strata, i.e., the IPTV architecture must allow a single home network to be able to access separate network and service providers.

- RR 6.5.4-08: The IPTV architecture is recommended to allow for multiple providers for different or similar services, i.e., the IPTV architecture must allow a single home network to be able to access multiple service providers.

- RR 6.5.4-09: The DNGF is recommended to support status information reporting to the service provider.

- RR 6.5.4-10: The IPTV architecture (including DNGF) is recommended to support the ability to perform bandwidth management of the home network attached to the DNG.

- RR 6.5.4-11: The IPTV architecture (including DNGF) is recommended to support the ability to control local traffic within the home network attached to the DNG.

- RR 6.5.4-12: The IPTV architecture (including DNGF) is recommended to support the ability to perform admission control functions to protect the home network from excessive and harmful traffic within the home network, and between network and home network.

- RR 6.5.4-13: The IPTV architecture (including DNGF) is recommended to support the ability for the DNGF to perform policing functions on incoming network traffic and drop offending traffic to protect the home network.

- RR 6.5.4-14: The IPTV architecture (including DNGF) is recommended to support IP traffic routing based on mechanisms to guarantee QoS for different service classes.

- RR 6.5.4-15: The IPTV architecture (including DNGF) is recommended to support mapping downstream traffic to corresponding local flows to provide QoS for the different services. This includes Layer 3 to Layer 2 mapping.

- RR 6.5.4-16: The IPTV architecture (including DNGF) is recommended to support mapping upstream traffic generated within the home network to corresponding outgoing flows to provide QoS for the different services. This includes Layer 2 to Layer 3 mapping.

Home network recommendations

- RR 6.5.4-17: The home network functions in the end-user domain supporting IPTV services are recommended to support the authentication procedures required by the network and service providers.

- RR 6.5.4-18: The DNGF is recommended to support NAT/NAPT capability to map IP address and port numbers between the public WAN and the LAN(s).

Architecture options

- OR 6.5.4-01: The IPTV architecture can optionally support content sharing between devices in the home network.

6.6 Middleware, application and content aspects

6.6.1 General

Architecture requirements

- R 6.6.1-01: The IPTV architecture is required to support the ability to search for available content.

- R 6.6.1-02: The IPTV architecture is required to support the capability of receiving and processing the metadata for content available to the end-user coming from content providers.

Architecture recommendations

- RR 6.6.1-01: The IPTV architecture is not recommended to preclude support of the requirements related to the retransmission of the existing terrestrial, satellite and cable broadcast, such as regional and regulatory.

- RR 6.6.1-02: The IPTV architecture is recommended to support mechanisms for the end-user to log announced information of interest.

- RR 6.6.1-03: The IPTV architecture is recommended to allow the end-user to exchange user profile information among various devices.

Architecture options

- OR 6.6.1-01: The IPTV architecture can optionally support uniform media formats (UMF) for content provisioning, discovery, delivery and consumption.

6.6.2 Middleware

6.6.2.1 General

Middleware requirements

- <u>R 6.6.2.1-01:</u> The IPTV middleware is required to support terminal device start-up and initialization function.
- <u>R 6.6.2.1-02:</u> The IPTV middleware is required to support server-side device start-up and initialization function.
- <u>R 6.6.2.1-03:</u> The IPTV middleware, if trick mode is supported, is required to support play, pause and stop functions.

Middleware recommendations

- <u>RR 6.6.2.1-01:</u> The IPTV middleware is recommended to support application management (e.g., application lifecycles, application states).
- <u>RR 6.6.2.1-02:</u> The IPTV middleware is recommended to be hardware and operating system (OS) independent.
- <u>RR 6.6.2.1-03:</u> The IPTV middleware is recommended to support pause in a PVR capable terminal or system.
- <u>RR 6.6.2.1-04:</u> The IPTV middleware is recommended to manage skip forward and skip backward functions (e.g., by time period, interval, location in content).
- <u>RR 6.6.2.1-05:</u> The IPTV middleware is recommended to support executing of multiple simultaneous applications.
- <u>RR 6.6.2.1-06:</u> The IPTV middleware is recommended to support a means to change the style of EPG.
- <u>RR 6.6.2.1-07:</u> The IPTV middleware components are recommended to facilitate service processes interaction among IPTV devices (e.g., a server and its clients, such as STB, security system, or VoD server).
- <u>RR 6.6.2.1-08:</u> The IPTV middleware is recommended to be able to manage the IPTV application profile information.
- <u>RR 6.6.2.1-09:</u> The IPTV middleware is recommended to support presentation capabilities for multimedia data (e.g., audio, video, graphics, text and images) providing the browsing, the synchronization and the interaction of such data with the end-user.

Middleware options

- <u>OR 6.6.2.1-01:</u> The IPTV middleware can optionally support the decoding of service information (SI).
- <u>OR 6.6.2.1-02:</u> The IPTV middleware can optionally support shortcut mechanism for selection.
- <u>OR 6.6.2.1-03:</u> The IPTV middleware can optionally support metadata compression.

6.6.2.2 Middleware application programming interfaces

Middleware requirements

- <u>R 6.6.2.2-01:</u> The IPTV middleware is required to provide an API for stopping and starting the presentation of video and audio.
- <u>R 6.6.2.2-02:</u> The IPTV middleware is required to provide an API to communicate with service providers to implement media transmission and media control functions.
- <u>R 6.6.2.2-03:</u> The IPTV middleware is required to provide an API to access metadata information.

Architecture recommendations

- <u>RR 6.6.2.2-01:</u> The IPTV architecture is recommended to support an API to manage the resources for applications.

Middleware recommendations

- <u>RR 6.6.2.2-02:</u> The IPTV middleware is recommended to support an API to access information on removable storage device (e.g., USB key).

- <u>RR 6.6.2.2-03:</u> The IPTV middleware is recommended to support an API for controlling (e.g., selecting, showing and hiding) subtitle and closed captioning display.

- <u>RR 6.6.2.2-04:</u> The IPTV middleware is recommended to include an API to access user preferences (e.g., accessibility features and display settings) available on a removable storage device (e.g., smartcard).

- <u>RR 6.6.2.2-05:</u> The IPTV middleware is recommended to provide service enabling APIs.

- <u>RR 6.6.2.2-06:</u> The IPTV middleware APIs are recommended to be open, flexible, granular, self-contained and components-based.

- <u>RR 6.6.2.2-07:</u> The IPTV middleware is recommended to provide an API to support a variety of mixed media formats to be presented together (e.g., an HTML text page embedding a video stream).

- <u>RR 6.6.2.2-08:</u> The IPTV middleware is recommended to provide an API to support picture-in-picture.

- <u>RR 6.6.2.2-09:</u> The IPTV middleware is recommended to provide an API to manage captioning including the selection from a range of languages, speed and verbosity.

Middleware options

- <u>OR 6.6.2.2-01:</u> The IPTV middleware can optionally provide an API for recording programs locally.

6.6.3   Metadata

6.6.3.1   Metadata structure

Metadata requirements

- <u>R 6.6.3.1-01:</u> The IPTV metadata is required to support the indication of which accessibility features are available for a TV programme, i.e., captions, subtitles in various languages, supplementary video and supplementary descriptive audio.

- <u>R 6.6.3.1-02:</u> The IPTV metadata is required to support the description of accessibility features, including language.

- <u>R 6.6.3.1-03:</u> The IPTV metadata is required to be able to describe contents and be extensible.

Metadata recommendations

- <u>RR 6.6.3.1-01:</u> The IPTV metadata is recommended to be able to describe legacy channel number information specified by content providers.

- <u>RR 6.6.3.1-02:</u> The IPTV metadata is recommended to be able to describe user preferences (e.g., for personal favourite channels).

- <u>RR 6.6.3.1-03:</u> The IPTV metadata is recommended to support one or more UMF that integrate multiple representations about the content including media coding formats, SCP information and SCP tools information.

- <u>RR 6.6.3.1-04:</u> The IPTV metadata for any given IPTV metadata instance is recommended to be uniquely identified by an ID.

- RR 6.6.3.1-05: The IPTV metadata is recommended to support packages as per clause 3.
- RR 6.6.3.1-06: The IPTV metadata is recommended to be able to describe the date of the last modification and the expiration period of metadata instance.
- RR 6.6.3.1-07: The IPTV metadata is recommended to be able to describe the target audience.
- RR 6.6.3.1-08: The IPTV metadata is recommended to be able to describe the user created content (UCC).

Metadata options

- OR 6.6.3.1-01: The IPTV metadata can optionally provide the following configuration information: type of service, type of terminal device, type of transmission medium, user preferences, available QoS levels, codecs, profiles, encoding configurations.
- OR 6.6.3.1-02: The IPTV metadata can optionally be aligned with the metadata in existing broadcasting services.

6.6.3.2 Metadata for service navigation

Metadata requirements

- R 6.6.3.2-01: The IPTV metadata for service navigation is required to provide general information about a piece of content that does not change regardless of how the content is published or broadcasted.

  NOTE – General information may include title, synopsis, parental control, rating, encrypted or not, price and conditions of availability like the number of plays in duration, credit list, actors, characters, key talent, key characters, writer, composer, conductor, review, critic's review, identification of the original content provider, and access means to a pricing server.
- R 6.6.3.2-02: The IPTV metadata for service navigation is required to support the description of various types and groups of programs series and shows.
- R 6.6.3.2-03: The IPTV metadata for service navigation is required to support the description of service providers (e.g., name, owner, logo).
- R 6.6.3.2-04: The IPTV metadata for service navigation is required to support the description of groups of consecutive schedule events together, which spans a given time period on a single service.
- R 6.6.3.2-05: The IPTV metadata for service navigation is required to support the description of contents that can be acquired on demand (as opposed to broadcast), including start time of which content is available, end time of which content is unavailable.
- R 6.6.3.2-06: The IPTV metadata for service navigation is required to support newly assigned channel numbers for the respective IPTV services and the legacy channel numbers and the (geographical) location of the original broadcasters when retransmitted from broadcast networks.
- R 6.6.3.2-07: The IPTV metadata for service navigation is required to support the channel description including source type, service type and service provider.

Metadata recommendations

- RR 6.6.3.2-01: The IPTV metadata for service navigation is recommended to be able to describe advertisement content (e.g., commercial video).
- RR 6.6.3.2-02: The IPTV metadata for service navigation is recommended to be able to describe usage restriction, including regional restriction, output and DRM export control, trick mode (e.g., rewind, fast forward) enabled, maximum buffering size or duration.
- RR 6.6.3.2-03: The IPTV metadata for service navigation is recommended to be able to describe metadata publisher, owner and copyrights sign.

- **RR 6.6.3.2-04:** The IPTV metadata for service navigation is recommended to support various content rating standards (e.g., general audience (G), parental guide suggested (PG)).
- **RR 6.6.3.2-05:** The IPTV metadata for service navigation is recommended to support the description of audience information (e.g., channel number before and after channel change, time of change and user information for EPG service, and package identification, time of play and user information for package service).

6.6.3.3 Metadata for package service

Metadata requirements

- **R 6.6.3.3-01:** The IPTV metadata for package service is required to allow the description of single content items as well as the description of collection of content components defined as "package" as per clause 3.
- **R 6.6.3.3-02:** The IPTV metadata for package service is required to describe synchronization (temporal information) and spatial information between content components to allow contents to be consumed as the service provider intended.

Metadata recommendations

- **RR 6.6.3.3-01:** The IPTV metadata for package service is recommended to support the description of the various types of content components.

6.6.3.4 Metadata provisioning

Architecture requirements

- **R 6.6.3.4-01:** The IPTV architecture is required to be able to support the service provider with the capability of creating or amending the metadata associated with a particular content.

Architecture recommendations

- **RR 6.6.3.4-01:** The IPTV architecture is recommended to allow the content provider to create and amend the metadata associated with its own contents.

Architecture options

- **OR 6.6.3.4-01:** The IPTV architecture can optionally allow anyone with rights/permission to create and amend the metadata associated with a particular content (e.g., reviews, comments, synopsis, etc.).
- **OR 6.6.3.4-02:** The IPTV architecture can optionally support multiple metadata formats.

6.6.3.5 Metadata delivery

Architecture requirements

- **R 6.6.3.5-01:** The IPTV architecture is required to have a means to deliver the content metadata to the end-user, including terms and conditions (e.g., duration the viewer is entitled to consume the content, PPV, related expenses), available accessibility features (captions, subtitles, supplementary descriptive audio, and multiple supplementary video streams).

Architecture recommendations

- **RR 6.6.3.5-01:** The IPTV architecture is recommended to support both multicast and unicast metadata delivery.
- **RR 6.6.3.5-02:** The IPTV architecture is recommended to be able to support fragmented metadata delivery.
- **RR 6.6.3.5-03:** The IPTV architecture is recommended to support metadata protection (e.g., user preferences, usage history).

- RR 6.6.3.5-04: The IPTV architecture is recommended to allow metadata delivery independently of content delivery.

- RR 6.6.3.5-05: The IPTV architecture is recommended to support both the push and pull model for metadata delivery.

- RR 6.6.3.5-06: The IPTV architecture is recommended to support a mechanism for the IPTV terminal device to know about metadata instance modifications.

- RR 6.6.3.5-07: The IPTV architecture is recommended to support a metadata delivery protocol over IP in addition to the already existing MPEG-2 TS-based transport.

Architecture options

- OR 6.6.3.5-01: The IPTV architecture can optionally support a mechanism to allow the user-customized content list to be updated.

- OR 6.6.3.5-02: The IPTV metadata can optionally be provided in conjunction with the audiovisual contents.

6.6.4 Content

6.6.4.1 Content delivery

Architecture recommendations

- RR 6.6.4.1-01: The IPTV architecture is recommended to support mechanisms for content downloading.

- RR 6.6.4.1-02: The IPTV architecture is recommended to support the delivery of multiple audio streams (e.g., one with audio description).

- RR 6.6.4.1-03: The IPTV architecture is recommended to support fast forward and fast rewind of content at different speeds.

- RR 6.6.4.1-04: The IPTV architecture is recommended to support both a pull and a push method of content delivery.

- RR 6.6.4.1-05: The IPTV architecture is recommended to support the download of content regardless of its type, e.g., audio, video, text, graphics.

- RR 6.6.4.1-06: The IPTV architecture is recommended to be able to distinguish geographic regions to offer targeted services (e.g., for targeted advertising).

- RR 6.6.4.1-07: The IPTV architecture is recommended to allow the delivery of user created contents (UCC).

Protocol recommendations

- RR 6.6.4.1-08: The content delivery protocols are recommended to support multiple policies for content distribution (e.g., scheduled content pushing, dynamic content pulling, multiple sources for content pulling).

6.6.4.2 Video

Architecture requirements

- R 6.6.4.2-01: The IPTV architecture is required to maintain video and audio in sync (accurate lip-sync) as judged by the general viewer at all times.

Video requirements

- R 6.6.4.2-02: The video format is required to support a wide range of temporal sampling standards, bit-rates and picture resolutions.

Video recommendations

- RR 6.6.4.2-01: The video format is recommended to support interlaced and progressive format.

6.6.4.3 Audio

Audio requirements

- R 6.6.4.3-01: The audio format is required to provide audio depth equivalent to existing broadcasts, i.e., requiring a sampling rate of 48 kHz at 16 bits. Other sample rates and bit-depths can be optionally supported.

Architecture recommendations

- RR 6.6.4.3-01: The IPTV architecture is recommended to support single (mono), dual (stereo) and multichannel (at least 5.1 surround sound) audio transmission. Different modes may be supported using different codecs.

- RR 6.6.4.3-02: The IPTV architecture is recommended to support multiple language audio streams associated with each video.

Architecture options

- OR 6.6.4.3-01: The IPTV architecture can optionally support clean audio.

6.6.4.4 Content replay

Architecture recommendations

- RR 6.6.4.4-01: The IPTV architecture is recommended to allow the playback of recorded content in the same way as the playback modes provisioned in a typical DVD, e.g., normal speed play, fast forward (at various speeds), fast rewind (at various speeds), pause, frame by frame advance, slow forward, slow backward.

- RR 6.6.4.4-02: The IPTV architecture is recommended to support mechanisms to assist in locating random access points in the media stream.

Architecture options

- OR 6.6.4.4-01: The IPTV architecture can optionally allow replacement of interstitial materials (e.g., advertisers and broadcasters, on replay of recorded content, want to replace interstitial material with more relevant interstitials based on parameters such as time of viewing, environmental triggers (such as weather, season, etc.) and number of times seen).

- OR 6.6.4.4-02: The IPTV architecture can optionally allow the replacement of content (e.g., advertisement, expired content).

- OR 6.6.4.4-03: The IPTV architecture can optionally allow advertisers to ensure that their commercials are seen only by the appropriate audience (e.g., where a minor is replaying content, a commercial for an alcoholic beverage is recommended to be skipped).

6.6.4.5 Content provisioning and management

Architecture requirements

- R 6.6.4.5-01: The IPTV architecture is required to support a mechanism for the service provider to ingest and store VoD content.

Architecture recommendations

- RR 6.6.4.5-01: The IPTV architecture is recommended to provide content providers with content management capabilities, such as uploading, deleting and replacing content.

- RR 6.6.4.5-02: The IPTV architecture is recommended to support the integration and interoperability of all components necessary for the acquisition and processing of content during the ingestion phase (e.g., applying SCP, insertion of commercials, encoding, editing).

- RR 6.6.4.5-03: The IPTV architecture is recommended to support a transfer interface between content provider and service provider that is independent of content formats.

- RR 6.6.4.5-04: The IPTV architecture is recommended to support content streaming overlapped with content pulling.

- RR 6.6.4.5-05: The IPTV architecture is recommended to support metadata for content provisioning.

- RR 6.6.4.5-06: The IPTV architecture is recommended to support metadata for specifying re-encoding, transcoding of content and their output formats.

- RR 6.6.4.5-07: The IPTV architecture is recommended to support the ability to collect statistical information about content popularity, audience rating, connected time and other information according to user profiles.

Content management and provisioning recommendations

- RR 6.6.4.5-08: The content management functions are recommended to be able to track each content program and segment location in the distributed media servers.

- RR 6.6.4.5-09: The content management functions are recommended to be able to keep track of the content distribution sessions among media servers.

- RR 6.6.4.5-10: The content management functions are recommended to keep statistical and historic data of content delivery and copy sessions. These data could be used for calculating content popularity and guiding future content distribution.

Architecture options

- OR 6.6.4.5-01: The IPTV architecture can optionally offer the service provider and content provider the ability to specify and exchange content distribution metadata, including metadata for re-encoding, transcoding of content and their output formats.

Content management and provisioning options

- OR 6.6.4.5-02: The content management functions can optionally support request for bandwidth and congestion control capabilities.

- OR 6.6.4.5-03: The content location management functions can optionally keep track of the real time content distribution sessions in order to provide distribution bandwidth control in the provider's core network.

6.6.5 Service navigation

Architecture requirements

- R 6.6.5-01: The IPTV architecture is required to support IPTV content selection through an electronic content guide.

- R 6.6.5-02: The IPTV architecture is required to support IPTV service selection through an electronic service guide.

Architecture recommendations

- RR 6.6.5-01: The IPTV architecture is recommended to support the end-user capability to view the service navigation information either sorted or filtered or both by time or other criteria.

Service navigation system recommendations

- RR 6.6.5-02: The IPTV service navigation system is recommended to support exchange of information with other applications.

- RR 6.6.5-03: The IPTV service navigation system is recommended to support consolidation of program/content information from multiple IPTV metadata service providers.

- RR 6.6.5-04: The IPTV service navigation system is recommended to support IPTV service and content searching.

- RR 6.6.5-05: The IPTV service navigation system is recommended to present always up-to-date information.

Service navigation system options

- OR 6.6.5-01: The IPTV service navigation system can optionally support the customized presentation of the service and content information.

- OR 6.6.5-02: The IPTV service navigation system can optionally adapt the information presentation to various terminal types.

- OR 6.6.5-03: The IPTV service navigation system can optionally allow the end-user to store metadata about user-customized content list.

6.6.6 Service/content discovery and selection

Architecture requirements

- R 6.6.6-01: The IPTV architecture is required to support capabilities for service discovery.

- R 6.6.6-02: The IPTV architecture is required to support capabilities for the end-user to select the content to be delivered.

- R 6.6.6-03: The IPTV architecture is required to support the ability for the end-user to interact with service provider-managed services through a 2-way communication channel.

Architecture recommendations

- RR 6.6.6-01: The IPTV architecture is recommended to support several content selection modes (e.g., program navigation, channel switch, search).

Architecture options

- OR 6.6.6-01: The IPTV architecture can optionally support profile/encoding negotiation capabilities to adapt to heterogeneous usage environments.

6.6.7 Returned data

Architecture options

- OR 6.6.7-01: The IPTV architecture can optionally allow demographic data to be obtained from the IPTV terminal device.

    NOTE – Usage of these data may include targeting/restricting content items and advertisements to specific groups of users.

6.7 Public interest

6.7.1 Accessibility

Requirements in this clause are intended to benefit the people with disabilities or people with special needs and meet the minimum regulatory requirements.

These requirements provide accessibility for people with temporary environmental dysfunctions to include people with varied or different languages, to those with learning difficulties and to those whose capabilities are diminished by age and degeneration. There are about 18% of people worldwide living with some kind of disability, including those related to aging; 10% live with life-

altering disabilities, two thirds of which are in developing countries. Users with disabilities have a general need to be provided with means to control and use terminals and services in alternative ways and modes, suiting varied capabilities and preferences. Such requirements are best met by the inclusive design of the general provision of IPTV terminals and services [b-ITU-T TP.TACL] [b-ITU-T F.790].

It is also noted that some of these accessibility features are presently mainstream in their use and have been included in other clauses in this Recommendation.

NOTE 1 – Some of the following requirements below may have regulatory implications in some countries and may not be required for all IPTV applications. National regulations may place specific additional requirements that shall be honoured.

NOTE 2 – Other needs for users with disabilities to use emergency telecommunication services are handled in clause 6.7.2.

Architecture requirements

• R 6.7.1-01: The IPTV architecture is required to support mechanisms to support subtitles and captions.

• R 6.7.1-02: The IPTV architecture is required to support subtitles and captions' presentation in a separate window.

• R 6.7.1-03: The IPTV architecture is required to support the ability to select and receive two (related) video sources simultaneously (e.g., one with sign language translation).

• R 6.7.1-04: The IPTV architecture is required to support the ability to select and receive two (related) audio sources simultaneously (e.g., one with audio description).

• R 6.7.1-05: The IPTV architecture is required to provide the end-user the ability to select and switch between supplementary content that is associated with the main video content, if available.

• R 6.7.1-06: The IPTV architecture is required to support the end-user ability to select preferred supplementary content for sign language with a selectable preferred on-screen layout.

IPTV application and device requirements

• R 6.7.1-07: The IPTV applications and devices are required to be designed using principles of universal design so that a wider population with users of varying capabilities can access such applications and devices.

• R 6.7.1-08: The IPTV metadata is required to contain information about the provision of accessibility features.

Architecture recommendations

• RR 6.7.1-01: The IPTV architecture is recommended to support good quality audio transmission and reproduction to make it possible for people to perceive the sound well [ITU-T Y.1541].

• RR 6.7.1-02: The IPTV architecture is recommended to support video transmission with sufficient quality for sign language perception if there is sign language in the contents [b-ITU-T H-Sup.1].

• RR 6.7.1-03: The IPTV architecture is recommended to support video transmission with sufficient quality for lip reading perception [b-ITU-T H-Sup.1].

<u>IPTV application and device recommendations</u>

- <u>RR 6.7.1-04:</u> The recording of accessibility features is recommended to be done in such a way that, when watching the recording, they can be both switched on and switched off. Therefore, it is a good idea to record all accessibility feature streams and link them to the service as a whole.

6.7.2 Emergency telecommunications and regulatory information services

<u>Architecture requirements</u>

- <u>R 6.7.2-01:</u> The IPTV architecture is required to support emergency alert service, where required, by regulation or law of the country.

- <u>R 6.7.2-02:</u> The IPTV architecture is required to support interfaces for receipt of suitably authorized emergency alert information (including any accessibility messages) where emergency alert service is provided.

- <u>R 6.7.2-03:</u> The IPTV architecture is required to implement robust mechanisms for handling emergency telecommunications throughout the service and transport layers.

- <u>R 6.7.2-04:</u> The IPTV architecture is required to support priority channel(s) for emergency telecommunications.

- <u>R 6.7.2-05:</u> The IPTV architecture is required to support a high-priority interface to existing emergency telecommunications services (e.g., through PSTN or ISDN).

- <u>R 6.7.2-06:</u> The IPTV architecture is required to support routing of emergency telecommunications from the end-user to appropriate emergency response service(s).

- <u>R 6.7.2-07:</u> The IPTV architecture is required to support routing of emergency telecommunications from an emergency response service to end-user(s).

- <u>R 6.7.2-08:</u> The IPTV architecture is required to support the capability to give communication control to the emergency response service, thus only the emergency response service can terminate a communication and not the end-user.

- <u>R 6.7.2-09:</u> The IPTV architecture is required to support the capability to give the end-user's geographical location to the emergency response service(s).

- <u>R 6.7.2-10:</u> The IPTV architecture is required to support both authenticated and unauthenticated access to emergency telecommunication services.

- <u>R 6.7.2-11:</u> The IPTV architecture is required to support emergency telecommunications with alternative and multimedia content, e.g., video, real-time text, voice and any combination thereof, as well as other forms of messaging.

- <u>R 6.7.2-12:</u> The IPTV architecture is required to support the end-user ability to be notified and receive regulatory information services, e.g., EAN messages (un-associated with TV channels) whenever the IPTV terminal device is active (e.g., displaying an EPG or a channel).

- <u>R 6.7.2-13:</u> The reception of regulatory information services is required to trigger mechanisms to draw the end-user attention.

<u>Architecture recommendations</u>

- <u>RR 6.7.2-01:</u> The IPTV architecture is recommended to support the capability of logging and forwarding emergency alert notifications.

- <u>RR 6.7.2-02:</u> The IPTV architecture is recommended to support the delivery of the specific emergency messages to the corresponding user groups based on predefined policies (e.g., geographic location).

- RR 6.7.2-03: The IPTV architecture is recommended to support identification of the alerting message sources and to support the classification of such messages upon predefined policies.

IPTV terminal device recommendations

- RR 6.7.2-04: The IPTV terminal device is recommended to process emergency messages (including any accessibility messages) if they are made available via the transmission infrastructure.

6.7.3 Provider selection and number portability

Architecture recommendations

- RR 6.7.3-01: The IPTV architecture is recommended to support a mechanism for end-users to select IPTV network providers, IPTV service providers, and IPTV content providers according to their preferences.

Architecture options

- OR 6.7.3-01: The IPTV architecture can optionally support number portability capabilities.

Appendix I

Public interest cross-reference

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

Here are listed the items in the "Public interest" clause 6.7 with a cross-reference to the individual requirements clauses in the main body they relate to.

The IPTV architecture is required to support mechanisms to support closed captioning.

•   Related requirement(s): R 6.5.1.2-01

•   Related recommendation(s): RR 6.5.2-15, RR 6.5.2-19, RR 6.5.2-27

The IPTV architecture is required to support the ability of the ITF to decode and display closed captioning information.

•   Related requirement(s): R 6.5.1.7-01, R 6.5.2.10-11, R 6.6.2.2-03

•   Related recommendation(s): RR 6.5.2-38, RR 6.6.2.2-03

The IPTV architecture is required to support the ability to view the captions and vary its presentation in a separate window.

•   Related recommendation(s): RR 6.6.2.2-09

•   Related option(s): OR 6.5.2-17, OR 6.5.2-18

The IPTV architecture is required to support the ability to select and receive two (related) video sources simultaneously. (e.g., one with sign language translation).

•   Related requirement(s): R 6.5.1.2-01

•   Related recommendation(s): RR 6.1-06

The IPTV architecture is required to support the ability to select and receive two audio sources. (e.g., one with audio description).

•   Related requirement(s): R 6.5.1.1-02, R 6.5.1.2-01, R 6.5.2-03

•   Related recommendation(s): RR 6.6.4.1-02

The audio transmission and reproduction is recommended to be of good quality to make it possible for people to perceive the sound well.

•   Related option(s): OR 6.6.4.3-01

Video is recommended to be transmitted with sufficient quality for sign language perception if there is sign language in the contents.

•   Related recommendation(s): RR 6.2-04

Video is recommended to be transmitted with sufficient quality for lip reading perception.

•   Related requirement(s): R 6.6.4.2-01

•   Related recommendation(s): RR 6.2-04

The ITU-T accessibility checklist is recommended to be applied to the work on IPTV [b-ITU-T TP.TACL].

The IPTV applications and equipments are required to be designed using principles of universal design so that a wider population with users of varying capabilities can access such applications and equipment.

•   Related requirement(s): R 6.5.2-04

- Related recommendation(s): <u>RR 6.5.1.1-01, RR 6.5.2-10, RR 6.5.2-11, RR 6.5.2-12, RR 6.5.2-13, RR 6.5.2-14, RR 6.5.2-17, RR 6.5.2-34, RR 6.5.2.1-02, RR 6.5.2.1-03</u>

- Related option(s): <u>OR 6.5.2-10</u>

The IPTV metadata is required to contain information about the provision of accessibility features.

- Related requirement(s): <u>R 6.6.3.1-01, R 6.6.3.1-02</u>

- Related recommendation(s): <u>RR 6.6.3.5-01</u>

Any recording that the IPTV terminal makes is required to also include the appropriate accessibility features. The recording of accessibility features is recommended to be done in such a way that, when watching the recording, they can be both switched on and switched off. Therefore, it is a good idea to record all accessibility feature streams and link them to the service as a whole.

- Related requirement(s): <u>R 6.5.1.2-02</u>

- Related recommendation(s): <u>RR 6.5.1.2-03</u>

The IPTV architecture is required to support the end-user ability to be notified and receive regulatory information services (unassociated with TV channels) whenever the IPTV terminal device is active (e.g., displaying an EPG or a TV channel).

The reception of regulatory information services is required to trigger mechanisms to draw the customer attention.

The IPTV terminal device is recommended to process emergency messages if they are available in the transmission infrastructure.

- Related requirement(s): <u>R 6.5.1.2-02</u>

- Related recommendation(s): <u>RR 6.5.1.2-03</u>

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