

**Telecommunications and Internet converged Services and
Protocols for Advanced Networking (TISPAN);
Service Layer Requirements to integrate
NGN Services and IPTV**



Reference

RTS/TISPAN-01059-NGN-R3

Keywords

IP, layer 7, service, TV

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

1 Scope

The present document is to describe the Service Layer requirements for IPTV service within NGN especially focusing on the integration of IPTV services with the communication services defined in TISPAN.

This work complements the working item initiated for addressing the transport layer network capabilities in order to support IPTV services.

The present document is complementary to the TS 181 014 "Requirements for Network Transport Capabilities to support IPTV Services" [3].

The present document shall not preclude the service to be supported in a converged (fixed - mobile) scenario.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] OMA-RD-BCAST-V1_0-20090212-A: "Mobile Broadcast Services Requirements".

NOTE: Available at http://member.openmobilealliance.org/ftp/Public_documents/BCAST/Permanent_documents/OMA-RD-BCAST-V1_0-20090212-A.zip.

- [2] ETSI TS 181 001: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Videotelephony over NGN; Stage 1 service description".
- [3] ETSI TS 181 014: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Requirements for network transport capabilities to support IPTV services".
- [4] ETSI TS 182 008: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Presence Service; Architecture and functional description [Endorsement of 3GPP TS 23.141 and OMA-AD-Presence-SIMPLE-V1-0]".
- [5] ETSI TS 181 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Direct Communication Service in NGN; Service Description [Endorsement of OMA-ERELD-PoC-V1]".

- [6] ETSI TS 122 340: "Universal Mobile Telecommunications System (UMTS); IP Multimedia Subsystem (IMS) messaging; Stage 1 (3GPP TS 22.340 version 7.0.0 Release 7)".
- [7] ETSI TS 181 002: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Multimedia Telephony with PSTN/ISDN simulation services".
- [8] ETSI TS 187 001 (V2.1.5): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN SECURITY (SEC); Requirements".
- [9] ETSI TS 181 005: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Services and Capabilities Requirements".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] ETSI TR 180 000: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Terminology".
- [i.2] ETSI TS 187 005: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Release 2 Lawful Interception; Stage 2 definition".
- [i.3] ETSI TS 182 019: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Content Delivery Network (CDN) architecture - Interconnection with TISPAN IPTV architectures".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

broadcast TV: television programming transmitted and intended for reception by anyone within range of the transmitter or lawfully connected to a cable distribution system but where the consumer has no control over the content or timing of what he receives, apart from the ability to select a particular channel

NOTE: There is no interactivity between user and the service or content providers. It is sometimes referred to as "Linear TV".

channel change: specific action initiated by an end-user (e.g. push remote control button) at time t_0 through which the presentation of a previous channel is replaced by the presentation of the new channel of broadcast TV service, as selected by the end-user

channel change time: time elapsed between the moment the end-user selects a new channel and the moment this channel is presented at the final quality level of the channel

consumer: domain where the IPTV services are consumed

NOTE: The consumer domain may consist of a single terminal used directly for service consumption or may be a complex network of terminals and related devices, including consumer operated mobile devices. The domain itself may also be a mobile end device. In this case, the delivery system of a transport provider would be a Wireless Wide Area Network (WWAN). A single consumer domain may be connected via two or more networks to a number of service providers obtaining content from multiple content providers.

consumer network: network owned and operated by an end-user relying on the services of a transport provider for external connectivity; in this context, the definition includes home networks, wireless "hot spots", hotel networks, etc.

Consumer-Originated Content (COC): content generated by a user for the purpose of making it available to other users

NOTE: The content may be private, or intended for a restricted audience or intended for unrestricted audience. It is the equivalent of User-Generated Content.

content aggregation: aggregation of Broadcast Channels (BC) and content titles (CoD) among content and service providers

Content on Demand (CoD): users can select their required content with the assistance of the Electronic Programme Guide (EPG) at the user preferred time

NOTE: The content is then transmitted uniquely (unicast) to that consumer who can usually use VCR-like functionalities (for example, fast-forward, rewind or pause) to control their viewing of the content. A special form of Content on Demand (CoD) is Video on Demand (VoD).

Content Provider (CP): entity that owns or is licensed to sell content or content assets

downloadable applications: interactive applications downloaded to IPTV Terminal device if and when invoked by subscriber, or service provider

Electronic Programme Guide (EPG): assistance tool which helps users to locate the content they want and to facilitate the selection of IPTV services for watching, recording, etc.

Electronic Service Guide (ESG): enables service and content providers to describe the services and content they make available, or offer for subscription or purchase

NOTE: It also enables a method for describing how to access the services. From the user perspective the ESG can be seen as an entry point to discover the currently available or scheduled services and content and to filter those based on their preferences. Furthermore, the ESG provides the entry point to interactive services. The ESG consists of both EPG and interactivity data.

external content: content which the consumer acquires from a CP which is not the IPTV SP, but which is acquired via the IPTV SP

NOTE 1: A business relationship needs to exist between the CP and the IPTV SP prior to the acquisition. The IPTV SP delivers the content to the consumer making use of the services capabilities provided by the NGN SP. External content may be recommended by the IPTV SP or integrated into the IPTV SP content offers.

NOTE 2: The content provider role includes content brokers acting as CP and is not limited to content producers.

interaction channel: logical channel for point-to-point communication through which the UE interacts with the IPTV Services

interactive TV: delivers functionality beyond that generally associated with the traditional television reception where the consumer can interact with the program content

interactivity data: contains information that is used by the UE to offer interactive services to the user, where the services are associated with the broadcast or on-demand content

inter-destination media synchronization: synchronization of media units such that they are outputted simultaneously at different destinations

NOTE: These interactive services enable users to e.g. vote during TV shows or to obtain content related to the broadcast content.

IPTV Service Provider: entity that offers IPTV services to the Customers making use of the services capabilities provided by the NGN Service Provider

IPTV solution: composition of functions and interfaces needed to provide the IPTV service

media action data: information about actions that are performed to control the media

NOTE: These actions may have been performed by the user, by network elements that constitute the IPTV solution or by external applications.

native applications: interactive applications that are part of the in-built software or permanently downloaded with the IPTV Terminal Device software in order to interact with the IPTV Terminal device hardware and to provide a quick response

NGN Service Provider: entity that offers NGN based services which shares a consistent set of policies and common technologies

near CoD: similar to CoD but sent to the user by multicast rather than unicast

NOTE: Service providers often transmit the same material over several channels, each with a different start time and may decide to open channels to successive users can receive the content from whatever point it has reached when they join (much like Broadcast TV). Users can also opt to join the programme at its next scheduled start time.

non-IPTV terminal device applications: web or mobile applications that interact with the IPTV system to modify the settings of the IPTV environment or extend the IPTV experience to these devices

non-linear AV services: any audiovisual media services where the user decides upon the moment in time when a specific programme is transmitted on the basis of a choice of content selected by the service provider

Pay Per View (PPV): offering of pay-television broadcasts to consumers in such a manner that they can make a "one-off" purchase of a particular programme event (for example, a boxing match) separately from their regular package or subscription

NOTE: The programme event is shown at the same time to everyone ordering it (as opposed to a CoD programme event).

Personalized Channel: particular list of programs that is scheduled on the basis of the user profile, in which each program is selected from the EPG/ESG that is available to the user, including BC channels or packages and CoD categories

NOTE: Personalized Channel is equivalent to Virtual Channel or Personal Channel.

Personalized Service Composition: service offering alternative streams, either alternative video streams (e.g. camera-angles), audio streams (e.g. audio languages) or text streams (e.g. subtitles), where users can select their preferred content streams for personalized consumption

Personal Video Recorder (PVR): service whereby the user can store video content from Broadcast TV and replay it at any convenient time

NOTE: This can be achieved using either a client device or cPVR where the storage device forms part of the consumer network or a network facility (nPVR). Consumers can lease disk space from a provider and select content for storage, as required. Recording takes place at the network server and can be downloaded at a later time as required, again using VCR-like functionality.

Push CoD: service where content is pre-loaded to the IPTV terminal equipment local storage by the IPTV Service Provider based on user subscription

NOTE: The user may have no direct control of what content is downloaded. The IPTV Service Provider may make the choice based on users' preferences and habits. Content is available on local storage for direct consumption by user and the user has control over viewed content.

Quality of Experience (QoE): purely subjective measure from the user's perspective of the overall value of the service provided

NOTE: Apart from its being user dependent, it will invariably be influenced by the user's terminal device (LD or HDTV), his environment (in the car or at home), his expectations (mobile or corded telephone), the nature of the content and its importance (a simple yes/no message or an orchestral concert). Mean Opinion Score used for assessing the quality of telephone connections is a limited form of QoE measurement process, relating to a specific media type, in a controlled environment and without specific user expectations. For video, the methods of monitoring objective performance are discussed in other organizations such as ITU-T. For example, there exists related work on "FR"(Full Reference), "RR"(Reduced Reference) and "NR"(No Reference) concepts.

Scalable Video Coding: video coding scheme that allows for hierarchical compression in the sense that decoding a particular layer depend on one or more enhancement layers

NOTE 1: Scalability may be in three dimensions, i.e. spatial (resolution), temporal (frame rate), and quality (SNR).

NOTE 2: Such encoding schemes depend on the targeted application. Depending on the context, the enhancement layers could be transmitted or filtered in any node the stream crosses, including the sender and the receiver.

server-based applications: network-accessible interactive applications that are accessed via remote terminal services, for example to save on the processing and storage requirements on the IPTV Terminal equipment, these can be run externally on Interactive Application Servers

service discovery: process through which the UE acquires the information about available services including location of Electronic Service Guide (ESG)

Service Provider (SP): entity providing a service to the subscriber

NOTE: Different types of service providers may be relevant for television services on IP, see IPTV Service Provider and NGN Service Provider.

time-shift TV: facility whereby audio visual information can be stored in the network (see nPVR) whilst it is being broadcast and remain available for later viewing

NOTE: The user is able to start the playback before or after the recording finishes, or use any of the usual VCR functions, as required.

transport provider: entity connecting consumers and Service Providers

NOTE: The delivery system usually is composed of access networks and core or backbone networks, which may use a variety of network technologies and be owned by a number of different operators.

trick modes: facility to allow the user to control the playback of content, such as pause, fast and slow playback, reverse playback, rewinding, jumping forwards or backwards, playing at double speed, etc.

User-Generated Content (UGC): content generated by a user for the purpose of making it available to other users

NOTE: The content may be private, or intended for a restricted audience or intended for unrestricted audience. It is the equivalent of Consumer-Originated Content.

VCR functions: common functionalities of a video cassette recorder, such as select/cancel, start, stop, pause (with or without freeze frame), fast forward, reverse, scan forward or reverse (both with or without image), and setting and resetting memory marks

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

API	Application Programming Interface
AV	AudioVisual
BC	Broadcast Channels
CB	Content Broker

CBMS	Convergence of Broadcast and Mobile Services
CDN	Content Delivery Network
COC	Consumer-Originated Content
CoD	Content on Demand
CP	Content Provider
cPVR	client Personal Video Recorder (see also PVR, nPVR)
DRM	Digital Rights Management
DVB	Digital Video Broadcasting
DVB-H	Digital Video Broadcasting - Handheld
DVB-SI	Digital Video Broadcasting - Service Information
DVD	Digital Video Disk
EPG	Electronic Programme Guide (see also IPG)
ESG	Electronic Service Guide
FR	Full Reference
HD/HDTV	High Definition (TV)
HLFR	High-Level Functional Requirement
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPG	Interactive Programme Guide (see also EPG)
IPR	Intellectual Property Rights
IPTV	Internet Protocol TeleVision
ISDN	Integrated Services Digital Network
LD	Low Definition (TV)
LI	Lawful Interception
MCD	Media Content Distribution
nCoD	near Content-on-Demand (see also CoD)
NGN	Next Generation Network
nPVR	network Personal Video Recorder (see also PVR, cPVR)
NR	No Reference
PAP	Picture and Picture
PDA	Personal Digital Assistant
PIP	Picture In Picture
PPV	Pay Per View
PSTN	Public Switched Telephone Network
PVR	Personal Video Recorder
QoE	Quality of Experience
QoS	Quality of Service
RR	Reduced Reference
SD	Standard Definition (TV)
SD&S	Service Discovery and Service selection
SNR	Signal to Noise Ratio
SP	Service Provider
SR	Special Report
STB	Set-Top Box
TR	Technical Report
TS	Technical Specification
UE	User Equipment
UGC	User-Generated Content
UMTS	Universal Mobile Telecommunications System
UP	User Profile
VCR	Video Cassette Recording
VoD	Video on Demand
VoIP	Voice Over Internet Protocol
WWAN	Wireless Wide Area Network

4 Overview on TISPAN IPTV services

Several standards on IPTV services are evolving in other standards organizations, including DVB, ATIS IIF and OMA. The ETSI TISPAN architecture shall provide the necessary capabilities to support the IPTV service requirements considering the services covered by the present document.

The TISPAN-NGN network should be aware of an ongoing IPTV service provision in order to be able to provide the correct handling of IPTV service.

IPTV services require that the video be stored in multiple coding schemes (and DRM methods) to support a variety of screen resolutions and access bandwidths. IPTV services support in Fixed Mobile Convergence network is required.

The present document is complementary to TS 181 014 [3].

4.1 IPTV roles

To provide IPTV services to the users, different roles could be identified within an NGN. Figure 1 represents all the roles identified for IPTV service.

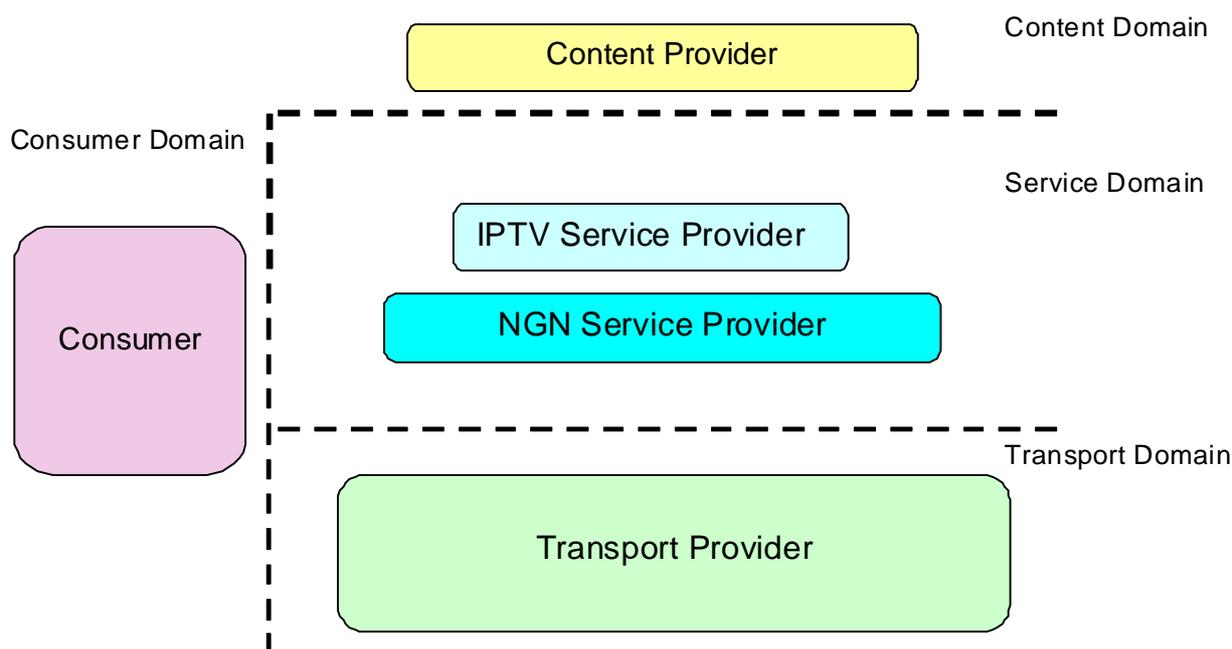


Figure 1

Grouping of some or all of the different roles under the same administrative environment is an operator option, as defined in **NGN operator role** in [9]. For example the IPTV Service Provider and the NGN Service Provider may belong to the same administrative environment, or the Content Provider, the IPTV Service Provider, the NGN Service Provider and the Transport Provider may all belong to the same or different administrative environments.

The roles are described as follows:

The **Content Provider** is the entity that owns or is licensed to sell content or content assets. Although the IPTV Service Provider is the primary source for the Consumer, a direct logical information flow may be set up between Content Provider and Consumer, for example for rights management and content protection. How the Content Provider receipts content from its owners is outside the scope of the present document. Consumers may also be originators of content. The **IPTV Service Provider** is the entity that offers IPTV services to the Customers making use of the services capabilities provided by the NGN Service Provider. It can perform user authentication at the application level. This entity may also provide metadata, content encryption and physical binaries. How the IPTV Service Provider receipts content from the Content Provider is outside the scope of the present document. The IPTV Service Provider may offer wholesale content aggregation services to Content Providers enabling the dynamic delivery of Broadcast Channels (BC) and content titles (CoD) between Content Domain and Service Domain.

NOTE 1: This role is based on the Application Provider role defined in [9] and it is specialized in the context of the IPTV service.

The **NGN Service Provider** is the entity that offers NGN based services which shares a consistent set of policies and common technologies. The NGN Service Provider provides common functionalities e.g. user service authentication and identification, service control, charging, etc. Several IPTV Service Providers can use the same NSP to deliver IPTV services to the Customers. The NGN Service Provider may also provide IPTV service.

NOTE 2: This role is based on the NGN Service Provider role defined in [9] and it is specialized in the context of the IPTV service.

The **Transport Provider** is the entity connecting the Consumer and the Service Providers.

The **Consumer** is the entity where the IPTV services are consumed.

4.2 TISPAN IPTV services

The IPTV service description can best be built by categorizing the baseline components that will compose the complete service. The following is the list of categories that have so far been identified and which will be used to derive the initial requirements for the IPTV service and to ensure that the architectural requirements are reasonably comprehensive for the service evolution.

A list of IPTV service categories considered in the present document is listed below. More information on these can be found in annex A.

- Entertaining:
 - Broadcast TV (with or without trick modes).
 - Trick Modes.
 - Pay Per View.
 - Content on Demand (CoD).
 - Personal Video Recording (PVR).
 - Near CoD.
 - Interactive TV.
 - Push CoD.
 - Audio.
 - User Generated Content (upload, download, upstreaming, downstreaming).
 - Personalized service composition.
- Advertising.
- Regulatory:
 - Emergency Information.
 - Applications for the disabled.
 - Content Advisories.
 - Educational facilities.
- Hybrid Services.
- External Content.
- Content Aggregation.

There is another category of services, non-video related, delivered from the provider to the consumer that play a critical role in the interaction with the NGN services. This category is called "Service Information" and consists of the following features/services.

- Electronic Programme Guide (EPG).
- Service Discovery and Selection.
- IPTV User Profile.
- Parental Control Service.
- Notification Services.
- IPTV user profiling.
- IPTV Content Recommendation Service.

TISPAN NGN services shall not be impacted by IPTV services, however some interworking between IPTV services and NGN services should be considered. This interworking shall allow the IPTV services to use the capabilities of the networks to provide the user with an optimized and user friendly solution.

Therefore, consideration for the interaction of the IPTV services and TISPAN NGN services is required, leading to the following category of services:

- IPTV and NGN Service Interaction:
 - Watching Apart Together.
 - Presence based games.
 - Incoming call management.
 - Seamless switching among devices.
 - Content sharing on a multimedia conference.
 - Sharing the remote control.

5 Service requirements

NOTE: When referencing the OMA BCAST requirements [1] following OMA BCAST specific words should be replaced throughout the requirements with TISPAN specific words as shown below:

- "Mobile Broadcast" replaced with "Broadcast".
- "Wireless network" replaced with "network".
- "Broadcast Service" replaced with "Broadcast TV service".

5.1 General

- 5.1.1 The IPTV solution shall support the individual addressability of devices acting as UEs located in the Consumer Network.
- 5.1.2 One user can access a service through multiple UEs simultaneously.
- 5.1.3 One user can access multiple services through an UE simultaneously.
- 5.1.4 The interactive IPTV solution shall be an open solution, that is Operators and Service Providers shall be able to create new service logics that involve both multimedia and communication features.

- 5.1.5 The interactive IPTV solution may support downloading service logics on the end-devices (for example via Open API on the STB).
- 5.1.6 To allow for integrated service logics, the IPTV solution shall have the ability to authenticate the user not just the device.
- 5.1.7 The interactive IPTV solution shall allow multiple users in front of one TV-SET to communicate their status.
- 5.1.8 Users shall be able to pick pieces of the IPTV content (if allowed by relevant policies) and to send them directly to other users on their IMS devices (also other than TV).
- 5.1.9 IPTV services should include operator controlled services, where the operator provides authorization to the user to use these services.
- 5.1.10 The IPTV solution should support the ability to provide the IPTV services in a FMC and seamless mobility environment.
- 5.1.11 The NGN network need to be aware of the IPTV application/service of the session to provide the required QoS for that session.
- 5.1.12 The IPTV solution should reuse the existing NGN architecture (subsystems, components and protocols) to achieve the requirements and enable service control convergence.
- 5.1.13 Interworking with existing IPTV systems needs to be considered, allowing legacy IPTV equipment to operate in NGN networks efficiently.
- 5.1.14 The following OMA Broadcast High-Level Functional Requirements of [1], clause 6.1, table 2 apply: HLFRR-01, HLFRR-03, HLFRR-06, HLFRR-08, HLFRR-09 and HLFRR-12.
- 5.1.15 The IPTV solution shall support the addressing of each user, within a single subscription, individually towards the device where the user has made himself accessible.
- 5.1.16 The IPTV solution shall support the capability of accessing the IPTV and NGN services from different type of devices depending on their capabilities (PCs, TVs, PDAs or game consoles at home or in the office).
- 5.1.17 The IPTV solution shall support the adaptation of media format (e.g. video in TV format or in compressed format for mobile devices) to accommodate different UEs or different network conditions.
- 5.1.17A The IPTV service shall be able to perform the adaptation of media format at anytime during the lifetime of the IPTV session according to the network conditions.
- 5.1.17B The IPTV should support scalable video coding.
- NOTE 1: Analysis of the impact of scalable video codecs and transport mechanisms on the IPTV and other NGN subsystems is out of scope of the current release.
- 5.1.18 The IPTV solution shall support the capability of moving/transferring an ongoing IPTV service from any type of device to another.
- 5.1.18A The IPTV solution shall support the capability of replicating an ongoing IPTV service from any type of device to another.
- 5.1.19 It shall be possible to define the minimum set of capabilities for UE (e.g. standard definition TV).
- 5.1.20 The IPTV solution shall support the capability of making available the UE characteristics (e.g. related to picture resolution) so they can be taken into account for delivering of content and/or access to different services.
- 5.1.21 Different picture aspects and resolutions for display must be supported (e.g. covering the range from the smallest screen of portable terminals to the largest flat screen TV).

- 5.1.22 The IPTV solution should support the preparation of content for efficient delivery to consumers. (e.g. transcode the content into a lower bit rate, from HD to SD, or by removing some parts, e.g. audio tracks in languages not needed, to reduce the size of content, etc.).
- 5.1.23 The IPTV subsystem shall support the capability to provide service resilience (e.g. resilience against single point of failure in the media, broadcast or application server).
- 5.1.24 The IPTV solution shall provide the capability of receiving and correctly processing the metadata for content coming from the service/content providers.
- 5.1.25 Metadata may be provided in conjunction with the audiovisual contents of the IPTV service.
- 5.1.26 The metadata delivery without the audiovisual contents of the IPTV service should be possible.
- 5.1.27 The IPTV solution should support both multicast and unicast metadata delivery.
- 5.1.28 The IPTV solution should support 3rd parties metadata (e.g. content recommendations) in addition to metadata from service/content providers.
- 5.1.29 The IPTV solution shall support mechanisms to address and identify each of the user's UEs.
- 5.1.30 The IPTV solution should support mechanisms to recognize UEs belonging to one or more specific end-users.
- 5.1.31 The IPTV solution shall support mechanisms for personalized channel set-up and control on a per subscription basis.
- 5.1.31A The IPTV solution should support mechanisms for flexible, personalized service composition set-up and control.
- 5.1.32 The IPTV solution should provide mechanisms to allow distribution of content and metadata between content provider and IPTV service provider.

NOTE 2: Specification of the Content Delivery Network (CDN) within the IPTV Service is provided in TS 182 019 [i.3]. Specification of Media Content Distribution (MCD) external to the IPTV Service domain is outside the scope of TISPAN, and may be coordinated with ETSI TC MCD and other relevant external organizations.

- 5.1.33 The IPTV solution should enable ingress of content from external sources (e.g. Web based TV).
- 5.1.34 The IPTV solution should enable interaction/integration with internet services (e.g. e-mails, web pages or other multimedia services, etc.).
- 5.1.35 The IPTV solution should support multiple pay-per-X scenarios (e.g. Pay per view /time / number of plays).
- 5.1.36 The IPTV solution should provide Multimedia TV messaging.
- 5.1.37 The IPTV solution shall support mechanisms for emergency alerting based on different aspects (e.g. type of emergency situation, priority, locality).
- 5.1.38 The IPTV solution should provide hybrid PVR services (as combination of PVR related services like cPVR and nPVR, remote recording, etc.).
- 5.1.39 The IPTV solution should support the reuse of reserved resources where appropriate (e.g. media channels reused for subsequent content with same characteristics upon a switch).

5.2 Generic Entertainment Requirements

- 5.2.1 The IPTV solution shall support the following entertainment services:
- Broadcast TV with or without trick modes.
 - Time-shift TV.

- Trick Modes using a PVR.
- Personal Video Recorder (PVR).
- Pay Per View.
- Content on Demand (COD).
- Near CoD (nCoD).
- Interactive TV.
- Push CoD.
- Audio.
- User Generated Content (UGC).
- Personalized service composition.

- 5.2.2 The IPTV solution shall support the capability of for an IPTV service to making available its characteristics (e.g. bit rate, coding format, etc.).
- 5.2.3 The IPTV solution shall support a capability of flexible multiple screen rendering (e.g. Picture In Picture (PIP), split screen as in side by side or Picture and Picture (PAP), or multiple pictures in an NxM mosaic) of multiple video streams of broadcast TV and VoD.
- 5.2.4 The IPTV solution should support the capability of controlling broadcast with trick modes services (e.g. pause, play).
- 5.2.5 The IPTV solution should support the capability of controlling PVR services (e.g. schedule program recording, delete schedule).
- 5.2.5A The IPTV solution should enable a user to share control of his access to the user's PVR services with other users in accordance with legal aspects and operator policies.
- 5.2.6 The IPTV solution shall support mechanisms and interfaces for the UE and external applications to control the streaming of video and audio content (e.g. trick modes).
- 5.2.6A The IPTV solution should support restricted trick play functions on any segment of content (e.g. restrict fast forward during an advertisement rendering or copyright announcement).
- 5.2.7 The IPTV solution shall support mechanisms for an IPTV service provider to share information in real time with the user. The information can be about operations and maintenance issues or charging related issues like total expenditure to date.
- 5.2.8 The IPTV solution should support mechanisms for the user to content marker IPTV service information and/or content.
- 5.2.9 The IPTV solution should support mechanisms for the IPTV Service Provider to offer personalized content markers to the users.
- 5.2.9A The IPTV solution should enable a user to share content marker(s) with other users in accordance with legal aspects and operator policies.
- 5.2.9B The IPTV solution should refer to content (BC, CoD or other) in a way that is independent of the address where the content can be retrieved.
- 5.2.9C The IPTV solution should support mechanisms to resolve references to content (BC, CoD or other), e.g. to find the address where referenced content can be retrieved.
- NOTE 1: Requirements 5.2.9B and 5.2.9C are applicable to content (BC channel, CoD title or other) referenced in an Electronic Program Guide, through IPTV Presence, in IPTV Content markers and other.
- 5.2.10 The IPTV solution should be able to include unicast and multicast contents sequentially or in parallel in the same IPTV service session.

- 5.2.11 The IPTV solution should support upload of user generated content.
- 5.2.12 The IPTV solution should support upstreaming of user generated content.
- 5.2.13 The IPTV solution should support download of user generated content.
- 5.2.14 The IPTV solution should support downstreaming of user generated content.
- 5.2.14A The IPTV solution should support buffering/storage of user generated content.
- 5.2.14B The IPTV solution should support real-time consumption of upstreaming user generated content.
- 5.2.15 The IPTV solution should support mechanisms for publishing UGC content information (e.g. via EPG) to the users.
- 5.2.16 The IPTV Solution should provide a mechanism for the user who has generated the content to control access to the content by other users.
- 5.2.17 The IPTV solution shall be able to allow any permitted/authorised device to remotely control IPTV services on another device include scheduling PVR recording (for cPVR and/or nPVR), uploading of UGC, etc.
- NOTE 2: Copyright laws of many countries prohibit users to upload or stream copyrighted materials without permission of the copyright owner. Technical provisions may be needed to curb illegal user behaviour. Examples of such provisions are identity registration, removal of illegally stored content and blocking of illegally streamed content.
- NOTE 3: Peer-to-peer VoIP clients, on-line games, user generated content and many other applications might be used to carry (voice) communication between users. As such, user-generated content may be subject to lawful interception of such communications. Future regulatory changes in this direction are always a possibility.
- NOTE 4: User-generated content has the property that some of it may become very popular in a very short time. This may result in flooding of the network. In the past, Telephony Service Providers have made provisions to handle mass calling and protect emergency services. IPTV Service Providers may take similar provisions to protect the network from too popular user-generated content.
- 5.2.18 The IPTV solution should support mechanism for user to upload or modify a description for the content they create (e.g. home movie description).
- 5.2.19 The IPTV solution should support mechanisms for exchanging media action data between the UE, external applications and network elements of the IPTV solution.
- 5.2.20 The IPTV Service Provider should be able to initiate download of content (e.g. recorded Broadcast program, CoD) to the local storage of either specific users or groups of users.
- 5.2.21 In the Push CoD services, the content shall be downloaded into the local storage of the user, and then be available for direct consumption, after the user selection is confirmed.
- 5.2.21A The IPTV Service Provider should be able to offer and initiate consumption of IPTV service (e.g. BC service, CoD service) on behalf of the user. After confirmation from the user, the IPTV service can be delivered in real time.
- 5.2.22 The users should be able to make their comments for specific content available to other authorized users.
- 5.2.23 The IPTV solution should support mechanisms for users to make their history of viewed content available to other authorized users.
- NOTE 5: Requirements 5.2.22 and 5.2.23 do not mandate the mechanism(s) to be used for content specific comments or history of viewed content.
- 5.2.24 The IPTV solution should support mechanisms to provide content preview to the users, either for live content (e.g. BC program) or on-demand content (e.g. CoD content).

- 5.2.25 The IPTV solution should provide mechanism to combine cPVR and nPVR based on user or system based rules.
- 5.2.26 The IPTV solution should provide mechanism to distribute (by streaming or download) any nPVR records to local storage of end devices with defined record parameters (e.g. encoding, resolution) and related metadata.
- 5.2.27 The IPTV solution should support alternative streams to allow a flexible, personalized service composition of video, audio and text (subtitle) streams.

NOTE 6: Copyright laws or agreements with content providers may prohibit modification of copyrighted materials (e.g. replacing an audio stream) without permission of the copyright owner.

5.3 Security

The security requirements for IPTV are described in clause 4.13 of TS 187 001 [8].

5.4 Charging

- 5.4.1 Charging; NGN operator controlled charging should be considered for the IPTV services.

5.5 Service Discovery

- 5.5.1 The IPTV solution shall support service discovery.
- 5.5.2 The IPTV solution shall support the discovery of services provided by different service providers.
- 5.5.3 The IPTV solution shall support personalized service discovery (e.g. the service discovery based on user preferences (subscription, habit etc.) and device capabilities).
- 5.5.4 The IPTV solution may support service discovery based on the location of the user.
- 5.5.5 The IPTV solution shall support pushing and/or pulling of ESG from the IPTV Service Provider to the UE.

5.6 Service Delivery

- 5.6.1 The IPTV service shall define mechanisms to appropriately distinguish different types of incoming sessions.
- 5.6.2 The IPTV solution shall support services delivered to a Consumer Network from one or more service providers over an IP transport stream.
- 5.6.3 The IPTV solution should support roaming as defined in [i.1].
- 5.6.4 The IPTV solution should support nomadism of UEs as defined in [i.1].
- 5.6.5 For roaming users, the IPTV solution shall support mechanisms for discovering and selecting home provider IPTV services.
- 5.6.5A For roaming users, the IPTV solution should provide a mechanism to share the user information (e.g. user account, charging information, service authentication information, etc.) based on the business agreement between IPTV Service Provider in the home network and the IPTV Service Provider in the visited network.
- 5.6.6 The IPTV solution shall support regionalized delivery of content and metadata in accordance with applicable regulations.

5.7 User Profile

- 5.7.1 The IPTV solution shall support mechanisms for IPTV service providers to add/delete/modify user profiles.
- 5.7.2 The IPTV solution shall provide a mechanism for the user to add, remove and modify his or her user profile (e.g. edit a preference data used for content recommendation).
- 5.7.3 The user should be able to maintain his/her preferences regarding IPTV services as such and in combination with other available services to the user in the NGN network.
- 5.7.4 The network shall support the user option to change (permanently or temporarily) his user profile from any device capable to access his user data.
- 5.7.5 It shall be possible to define users, within the subscription, with administration rights over other specified users.
- 5.7.6 The IPTV subsystem shall support the capability to personalize service based upon user profile or group of user profiles (e.g. resolve personalized content).
- 5.7.7 The IPTV subsystem shall support the capability for different profile based service personalization (e.g. advertisements, news, traffic information, retrieved from search engines, other).

5.8 Parental Control

- 5.8.1 It shall be possible for a user (defined to have administrative rights) to modify user profiles to place controls on users, belonging to the same subscription, for access to services and content (e.g. prevent purchases, set purchasing limits, etc.).
- 5.8.2 It shall be possible to authenticate the user with administrative rights when placing controls on other users.
- 5.8.3 An authorization framework must be supported to enforce parental controls based on some type of criteria. The criteria shall be set up on one or more specific classification of the program.
- 5.8.4 When a user requests an IPTV service, it should be possible to dynamically request authorization from a user who has administrative rights over the user consuming the content.

5.9 Interoperability

- 5.9.1 The following OMA Broadcast Requirement of [1], clause 6.1.3, table 5 applies: IOP-01.

5.10 Internationalization

- 5.10.1 The IPTV service should be capable of supporting various content rating standards to avoid improper access to content.
- 5.10.2 The IPTV solution should be capable of supporting the various TV picture definitions that are in common use.
- 5.10.3 The IPTV solution should be capable of supporting various the various TV aspect ratios that are in common use.

5.11 Terminal Provisioning

- 5.11.1 The Terminal provisioning function for IPTV Services shall be defined.

5.12 Service Provisioning

- 5.12.1 The following OMA Broadcast Requirements of [1] clause 6.2.6 table 13 apply: PROV-2, PROV-3.
- 5.12.2 It shall be possible to permit visiting end user to subscribe to content or services.

5.13 Quality of Experience

- 5.13.1 The IPTV solution may support QoE concepts such as Full Reference (FR), Reduced Reference (RR) and No Reference (NR) to validate the quality of delivered IPTV services to the IPTV consumer.
- 5.13.2 An IPTV solution supporting QoE concepts should provide a framework that identifies the key QoE components and measurement points.
- 5.13.3 The IPTV solution should support channel change times which support good QoE to the user.

5.13a Application Level QoS

- 5.13A.1 The IPTV solution should support solution(s) for inter-destination media synchronization.
- 5.13A.2 The IPTV solution should support solution(s) for synchronizing media streams from different origins.

5.14 User profiling and Recommendation

- 5.14.1 The IPTV solution shall support mechanisms for an IPTV service provider to collect information about user consumption of content and services over a period of time, e.g. watched programs on broadcast TV channels, consumed CoD assets, frequently used integrated IPTV and NGN services.
- 5.14.2 The IPTV solution shall support mechanisms for an IPTV service provider to use this information for IPTV content and service recommendations.
- 5.14.3 The IPTV solution may provide a mechanism for evaluating how many users are currently accessing a particular content or service, e.g. are watching football match on a broadcast TV channel.

NOTE: Any collection of user information related to the consumption of IPTV services should comply with local regulations. The information should be handled privately and securely within IPTV solution.

- 5.14.4 The IPTV solution shall support mechanisms for an IPTV service provider to offer an IPTV Content Recommendation Service to specific users or user groups on a per subscription basis.
- 5.14.5 The IPTV Content Recommendation Service shall support mechanisms for a subscriber to access and set his recommendation profile e.g. to switch on/off receiving recommendations, or to set the criteria of accepting or blocking certain content recommendation and so on.
- 5.14.6 The IPTV Content Recommendation Service should support mechanisms for an IPTV service provider to recommend IPTV contents related to specific user or service provider criteria, e.g.:
- Related to the program being watched by the user.
 - Based on user profile, IPTV UE capabilities or user preferences.
 - For upcoming programs, or popular movies, etc.
- 5.14.7 The IPTV Content Recommendation Service should support mechanisms for an IPTV service provider to provide content recommendation information based on the presence status of IPTV UE or user (e.g. online, offline, or other presence information like willingness to be disturbed by recommendations).

5.15 Advertising

- 5.15.1 The IPTV solution shall support traditional broadcast advertising.
- 5.15.2 The IPTV solution should support IPTV advertising targeted towards individual users or specific user groups (targeted advertising which they subscribe or permit). IPTV advertising may be based on multiple criteria, e.g. user profile, preference, presence information, shopping habits or location.
- 5.15.3 The IPTV solution should support mechanisms to provide interactive IPTV advertising (e.g. Opt-in ad, Click-to-call, etc.) which contains active user interactions/actions (e.g. purchase of advertised product or order of the content).
- 5.15.4 The IPTV solution should support one or more delivery mechanisms (e.g. multicast, uni-cast, or file download) for IPTV advertising.
- 5.15.5 The IPTV solution should provide mechanisms to collect/aggregate, store and manipulate with information about user actions on specific IPTV advertising. This capability may be subject to local/regional regulation or user privacy.

5.16 External content

- 5.16.1 The IPTV solution shall support a mechanism that delivers external content to a Consumer making use of same delivery mechanisms that are used for content that is stored inside the IPTV SP domain.

NOTE 1: This requirement does not introduce a new IPTV role (see the roles in figure 1), rather it clarifies tasks of the Content Providers and IPTV Service Providers. The consumer needs to have a business relation with the IPTV SP. In addition the consumer might have a business relation with the CP that offers external content. The case with a single business relation (i.e. the consumer having a business relationship with the IPTV SP only) can be described as the IPTV SP offering "white labelled" external content.

- 5.16.2 The IPTV solution shall support interaction with content aggregation services, including, but not limited to:
- Content aggregation for the delivery of Broadcast (BC) television channels.
 - Content aggregation for the delivery of Content on Demand (COD).

NOTE 2: This requirement does not make any assumption on the business model (e.g. wholesale) or direction of money flow between the IPTV Service Provider and the Content Provider.

- 5.16.3 The IPTV solution should support delivery of external content with QoS or QoE. In this case IPTV SP could provide IPTV capabilities, such as content storage, to place external content to locations where the content is likely to be consumed.
- 5.16.4 The IPTV solution should support integration of external content with other IPTV services, e.g. Recommendation Service.
- 5.16.5 The IPTV solution should support mechanisms to exchange relevant information about the consumer between the IPTV SP and the CP that offers the external content.

6 Interaction of IPTV Services and other TISPAN Services

6.1 General

TISPAN NGN services shall not be impacted by IPTV services, however some interworking between IPTV services and NGN services should be considered. This interworking shall allow the IPTV services to use the capabilities of the networks to provide the user with an optimized and user friendly solution.

Therefore, consideration for the interaction of the IPTV services and TISPAN NGN services is required. The general interaction related requirements are presented below:

- 6.1.1 The IPTV solution shall be able to integrate with (and eventually reuse) the NGN communication services in a way that enable users to intercept and manage incoming call, to send messages, to make video and audio calls, to open data sessions, to use presence information (e.g. "the watched channel", "do not disturb"), and to accept contents that embed communication activities (audio/video/messaging).
- 6.1.2 The IPTV solution in NGN should be aware of an ongoing IPTV service provision taking into account user subscription, presence, etc. That will allow it to manage other communications accordingly, for example, the IPTV solution should know how to handle other communications while e.g. the IPTV Content on Demand service is on (send voice calls to the STB for example), managing QoS based on session profile, etc.
- 6.1.3 It shall be possible to support NGN applications and NGN communication services.

The following clauses provide some, and non exhaustive, examples of NGN services which may interact with IPTV.

6.1.1 Presence

The presence service results in presence information of a user and information on a user's devices, services and service components being managed by the network. While channel and content metadata is typically available from SD&S, it is also possible to associate presence information to IPTV channels or content. Such information can include e.g. program status (on air, delayed 5 minutes, current genre, currently running title, etc). Consumers of related presence information could be users as well as other NGN services, e.g. the Personalized Channel Service.

The presence service provides access to presence information to be made available to users or services including IPTV services.

A presence-enabled service, as observed by the user, is a service in which the user can control the dissemination of his presence information to other users and services, and also be able to explicitly identify which other users and services to which he provides presence status.

Example services might include:

- Electronic Program Guide (EPG) personalization based on presence on top of locally stored data.
- Targeted advertising based especially when correlated with time of day.
- Use of presence with the user profile to request special services.
- Use of presence with authentication for TV based shopping services as a credit card substitute.
- A genre based Presentity Service distributing a list of channels on which movies belonging to their associated genre are currently running. Using Presence allows e.g. to reach non-IPTV Devices.

Presence is an attribute related to, but quite different from mobility information, and is a service that can be exploited to create additional services.

Presence service in NGN is defined in TS 182 008 [4].

Presence will enable the users of IPTV services to show their ability and willingness to be reached for communication by defining, e.g. a set of information for the devices the user is using and the services he/she is using. This information is known as presence information and may also be referred to as "user generated presence". "Network generated presence" information relates to status information inside the network, e.g. on the program status as mentioned before.

Users' presence information may be related to, e.g. their connection status, location information, channel currently accessed or acceptable communication means. Presence information on channel currently accessed may be used by another user to instruct his set-top box with a single click to switch to the identified channel, or to instruct his set-top box to keep following identified channel changes. There may be significant delays in this following, depending on the update speed of the presence service.

Any published presence information should only be disseminated to users that are authorized to receiving this presence information according to the presentity policies.

Users can also define a set of access rules to control access to their presence information. The presence specific interaction requirements are presented below:

- 6.1.1.1 It shall be possible to define presence information related to the IPTV experience, e.g. channel currently accessed. The identification of the channel currently accessed shall be machine-readable. Language dependent information may also be made available to watchers.
- 6.1.1.2 It shall be possible to have presence information presented on TV screen.
- 6.1.1.3 It shall be possible to manage the IPTV-related presence information that is shown to each person on a user's watcher list.
- 6.1.1.4 The IPTV solution should be able to access presence information.
- 6.1.1.5 The IPTV solution should be able to provide presence information.
- 6.1.1.6 The watched channel should be reflected in the user's presence status and external application, e.g. another user, should be able to use it together with other presence information (e.g. NGN Communication Presence).
- 6.1.1.7 The user shall have control on who has access to his/her presence information.
- 6.1.1.8 It should be possible to distribute IPTV service data information (e.g. on IPTV channels, IPTV content genres, individual IPTV content or personalized EPG services) through the Presence Service.

6.1.2 Direct Communication

Direct Communication service enables real-time communication one-to-one and one-to-many with the press of a button.

Direct Communication provides the use of the generic capabilities of the IMS and the Push to Talk Service defined by OMA, ensuring global interoperability.

Direct Communication in NGN is described in TS 181 006 [5].

6.1.3 Immediate Messaging

There are many different types of messaging services available both in the wired and wireless worlds. Some messaging services are supported in both environments; others are only to be found in one. The expectations of the services differ in that some are designed to be used in what is perceived as "real" time, whereas others are designed as a "mailbox" service where the message is stored ready for collection or delivery at a later stage.

NGN Messaging services incorporate one or more of the following messaging types immediate messaging and Session based messaging.

With Immediate messaging the sender expects immediate message delivery in what is perceived as real time.

With Session based messaging a communications association is established between two or more users before communication can take place. In the simplest form Session based messaging maybe a direct communication between two users.

The messaging services for NGN are described in TS 122 340 [6].

- 6.1.3.1 The IPTV solution should provide a mechanism for users who subscribe to an IPTV immediate messaging service and have the right to send immediate messages to other users in an immediate messaging service group watching the same program. Immediate messaging shall be limited to users who have expressed their willingness to be accessed by the immediate messaging service and particular sender.

6.1.4 Video Telephony

Video telephony is a real time conversational service using video media and audio or other types of media. The service is assumed to be applicable only to dedicated terminal equipment with video capabilities. The video telephony service may be considered as a specific instance of an IP multimedia service, or as part of the Multimedia Telephony with PSTN/ISDN Simulation Services.

The Video Telephony Service in NGN is defined in TS 181 001 [2].

6.1.5 Multimedia Telephony

From the human user point of view, Multimedia Telephony with PSTN/ISDN simulation services, provides a suite of services that are, in most aspects, the same as those already existing in the PSTN/ISDN.

Multimedia Telephony makes use of IMS, which is an inherently multimedia service control platform.

Therefore, Multimedia Telephony with PSTN/ISDN Simulation Services, whilst drawing on the existing service features in the PSTN/ISDN, is not limited to voice media as in PSTN/ISDN, but generally applicable regardless of the media used (voice, video, etc.).

In addition to the capabilities to establish a bi-directional point-to-point communication between two parties, a selected number of PSTN/ISDN Simulation services was defined, corresponding to perceived popular PSTN/ISDN supplementary services. Among them, the following are the mandatory services:

- Communication Diversion.
- Identity Presentation and Restriction services.
- Malicious Communication.
- Anonymous Communication Rejection.

The Multimedia Telephony Service in NGN is defined in TS 181 002 [7].

7 Interaction with IPTV Services

7.1 Interaction Channel

- 7.1.1 The following OMA Broadcast Requirements of [1] clause 6.2.2 table 9 apply: IC-01, IC-02, IC-03 and IC-04.

7.2 Notifications

- 7.2.1 The following OMA Broadcast Requirements of [1] clause 6.2.8 table 15 apply: NOTIF-01, NOTIF-02 and NOTIF-03.

Annex A (informative): TISPAN IPTV services descriptions

A.1 Entertaining

In the particular case of entertainment, the services so far identified are described and listed below.

A.1.1 Broadcast TV

Broadcast TV service on the IPTV platform corresponds to the classic form of television offered by cable, terrestrial broadcasters and direct broadcast satellite providers, in which the programme content is transmitted according to a schedule defined by the service provider and is intended for real-time consumption by the end user. The service therefore provides an essentially continuous stream flowing from the content provider to the terminal device in the consumer network. This type of service is sometimes known as a "linear broadcast" or "push content" service.

Channel selection to receive the desired broadcast stream ("signal") is supported, but users have no direct control over broadcast content. A limited form of interactivity may be available in some cases. Examples include the case of a user watching a Quiz Show who may be able to compete for prizes by submitting answers. Alternatively, a user watching a current affairs programme may want to send a comment to the interviewer. Both these interactions use a separate channel. Other users will be unaware of the comments received unless these are quoted by the interviewer or displayed as on-screen text messages.

Content may be received from the originator by the service provider via satellite or other means. The content provider may replicate the content stream to several service providers, who in turn may replicate it to multiple delivery networks. Each delivery network will usually replicate the stream to multiple consumer networks. Individual Service Providers may provide additional processing of the video stream, e.g. insertion of local content channels, advertising, etc.

A.1.1a Time-shift TV (tsTV)

Time shift TV is the service where the IPTV service provider can store (record) the broadcast content in the network for later viewing. The recording can be done for a time window (e.g. days or weeks or individual show based on EPG), where some or all the programs from the window can be offered later to IPTV users and delivered as CoD assets. TsTV differs from trick modes using a PVR because it does not require user interaction to retain or remove content. Trick modes may be allowed.

Catch-up on time shift TV is the service where during Fast Forward a user is automatically switched by the network to live TV stream, when Fast Forward reaches the current live stream.

A.1.2 Personal Video Recording

Although Broadcast TV is intended for real time consumption, some end users may wish to record the broadcast content for later viewing. Whilst this can be accomplished simply with a VCR the increasing availability of PVR has led to greater "trick mode" functionality. By copying the broadcast content to a PVR the consumer is enabled to enhance his experience by pausing, rewinding, jumping forwards or backwards, playing at double speed, etc. during such later viewing, all using the inherent storage capability of the PVR.

The PVR itself may be a separate physical device (set top box) or it may be a logical device (addressable hard disk storage in some multi-purpose unit) either in the Consumer Network (cPVR) or, provided by the SP (nPVR). In any of these cases, the user can replay the programme at any convenient time and the nPVR feature is sometimes regarded as "time-shift TV", enabling a viewer to receive and view the desired content at some later time.

In case of cPVR, an authorized remote device that may be located outside of the Consumer Network can be used to control PVR recording.

A.1.3 Pay Per View (PPV)

Pay Per View (PPV) is an offering of pay-television broadcasts to consumers in such a manner that they can make a "one-off" purchase of a particular programme event (for example, a boxing match) separately from their regular package or subscription. The programme event is shown at the same time to everyone ordering it (as opposed to a CoD programme event).

The qualities of IPTV PPV include:

- The PPV session is a multicast session.
- The Service Provider determines the schedule of when the content is transmitted.
- The content is an object that has finite boundaries, meaning it has a defined beginning and end.
- The user cannot control the transmission source to randomly move through the content object.

A.1.4 Content on Demand (CoD)

The Content on Demand (CoD) service provides an essentially two phased distribution from the Content Provider to the terminal device in the Consumer Network. The Service Provider acquires the content from the Content Provider via physical media delivery, electronic interconnection or other means and may provide additional processing of the video stream, for example, the insertion of branding, local content, advertising, etc.

The Service Provider then makes the content available to the consumer's terminal equipment. There may be multiple independent unicast viewing sessions for a given piece of content. A navigation screen enables the consumer to access the desired content, as and when required.

CoD services usually include VCR-like functions (Pause, play, rewind and fast forward of the video) as well as trick-play support (e.g. jump five minutes backward). CoD is differentiated from broadcast video in that:

- The user is in control of what is selected and transmitted for viewing.
- The user is in control of when a given item of content is viewed.
- The CoD content is an object that has finite boundaries, having a defined beginning and end.

A.1.5 Near CoD (nCoD)

Near CoD is similar to CoD but is sent to user by multicast rather than unicast. Usually, a specific piece of content is transmitted at scheduled intervals, for example a particular film may be started every fifteen minutes on different channels. A viewer can either register a wish to see a particular rendition of it, as selected from an EPG or can be directed to a particular channel at the next scheduled starting time, depending on the service provider's policy. Some networks operate an "open channel" policy, where the start of the play-out may be triggered by the first request for the specific content item and subsequent viewers can join the channel at any time, picking up the programme from whatever point it has reached.

A.1.6 Interactive TV

Interactive TV applications deliver functionality beyond that generally associated with the traditional television reception. The enablement of interactive TV features generally increases the appeal and popularity of broadcast channels and is a key mechanism to allow differentiation between service offerings.

Interactive TV applications often include:

- Non-IPTV Terminal Device applications: Web or mobile applications that interact with the IPTV system to modify the settings of the IPTV environment.
- Server-based applications: Network-accessible interactive applications that are accessed via remote terminal services, for example to save on the processing and storage requirements on the IPTV Terminal equipment, these can be run externally on Interactive Application Servers.

- Downloadable applications: Interactive Applications downloaded to IPTV Terminal device if and when invoked by subscriber, or service provider.
- Native applications: Interactive Applications that are part of the in-built software or permanently downloaded with the IPTV Terminal Device software in order to interact with the IPTV Terminal device hardware and to provide a quick response.
- Hybrid Interactive Applications: a combination of native and downloadable interactive applications.

Interactive Applications can be invoked in a number of ways regardless of whether they are associated with a particular programming event (e.g. the Big Brother voting application) or they are standalone (e.g. gaming applications):

- Click to action: interactive applications that ask for consumer interaction to either invoke or dismiss (e.g. interactive advertisement, call forwarding application, voting application).
- Informational: Additional data to provide more details on a particular subject or channel (for example, news, weather information, stock information, live election results, etc.).
- Notification or Event Driven: Interactive Applications that respond to service provider or regulatory events to generate an alert/notification for the consumer to take a specific action (e.g. payment overdue notice, bill paid notification, calling line identifier).

A.1.7 Push CoD

In streaming video content distribution services such as broadcast TV or streaming CoD, the rendering of the content on the display device occurs simultaneously, or at least overlaps with the distribution of the content.

A download based content distribution service, in contrast, downloads a complete logical content element (a programme, an episode of a programme series, etc.) to local storage (for example, as part of the set top box function) in a first phase that then enables the consumer to trigger the rendering of the video content at a later time. Such triggering may be allowed at any time after receipt of the content, only at or after some later time determined by the service provider or after some later trigger signal sent by the content or service provider.

A.1.8 Audio

Audio is another form of content that can be offered by the service operator to the consumer; similarly to video content, it can be offered in a variety of fashions including, but certainly not limited to:

- Dedicated music channels (per genre of music).
- Music on Demand.
- Download store or play later.
- IP Radio Multicast.
- Rolling news broadcasts.
- Audio books.

A.2 Regulatory and Governmental requirements

Traditional communications and broadcasting services are strictly regulated throughout Europe and in most countries of the world. It is reasonable to suppose that governments will seek to impose similar regulations on NGN communications providers including IPTV service operators.

A.2.1 Emergency Information

IPTV networks must be compliant with these regulatory requirements for emergency alerts. These regulations typically require the carriage of emergency alert messages issued by national, state or local authorities. IPTV systems will in practice require secure mechanisms to acquire, verify and inject the appropriate content after ensuring that it comes from an authorized source. The emergency alerts will only achieve their purpose if they are correctly decoded and rendered on the user equipment, and when they alert the public promptly, accurately and efficiently. This means that any delay associated with the transmission or decoding of this content must be minimized.

The interaction of emergency alert system with other non-video IPTV services (e.g. voice messaging) is a subject for further study.

A.2.2 Lawful Interception (LI)

IPTV systems are capable of carrying person-to-person communications as such may in some jurisdictions be regarded as telecommunications channels and thus required to comply with local legislation and regulatory requirements concerning lawful Interception of communications. Refer to TS 187 005 [i.2] for more information. This may be a subject for further study, possibly in ETSI TC-LI.

A.2.3 Applications for the disabled

The physical design of user equipment and its operation to facilitate its use by consumers with disabilities is beyond the scope of this paper and is for further study, possibly by ETSI TC-HF.

However, a number of countries already require that the audio content of many television programmes be made available to hearing disabled users by displaying the audio as text or in sign language on the television screen, a trend which is likely to continue.

It is expected that IPTV services will likewise be required to display the audio component as text or in sign language, and to provide audio description services where appropriate, on much the same basis as today's broadcast television.

Administrations requiring the use of sub-titles or sign language usually also have requirements on the selection of programmes for provision of these additional access services; details of this are beyond the scope of the present document, as are the requirements for speed and verbosity of the speech or captioning. These matters and the details of overlay positioning are largely matters for national regulation and the content providers.

A.2.4 Content advisories

A content rating system for TV content providing guidance for parental controls is a legal requirement in most countries and is implemented by a variety of technologies. This may mean that several different "flavours" of the control mechanism will be required. The necessary data are normally provided by the content provider, usually based on statutory ratings. IPTV terminal equipment will be expected to support equivalent capabilities to the content advisories and parental controls specified for traditional television services.

A.2.5 Educational facilities

IPTV services will provide a video content distribution of a variety of types - broadcast, on demand and interactive. While these services are usually regarded as a consumer medium, similar services can be provided to educational establishments, carrying relevant programming. Whereas traditional broadcast services usually make educational content available according to a fixed schedule, IPTV services offer significantly greater flexibility in scheduling their content to the needs of educational institutions, especially in conjunction with the use of CoD, nCoD or nPVR facilities. Thus, together with their greater capability for interactivity, IPTV network services are potentially of great interest in distribution of educational content at all levels.

IPTV services, also have the potential for another educational application, that the provision of remote access to educational content for "distance learning". The remote site in this service is more typically characterized as a consumer or small business location rather than a large institutional setting, though its use in correctional institutions may be appropriate, especially where only a small number of detainees have a specific learning requirement.

A.3 Advertising

Traditional television services often incorporate advertising content, usually as a means of revenue generation. It is therefore to be expected that IPTV services will include traditional advertising and probably introduce new concepts.

A.3.1 Advertising mechanisms

"Ad insertion" can be performed locally, regionally or nationally in IPTV services using serving streaming server as a part of a schedule or combined media asset. IPTV serving streaming server can produce a combined output stream from main program and personalized assets. Personalization, referred to also as advertising, can target large groups, small groups, users or account profiles.

"Ad insertion" may be performed locally, regionally or nationally using an "ad-splicer" which is a form of switch which can produce a combined video output stream by locating and using video splice points from the digital cue tones to trigger an "ad server" to play out the relevant advertising content between programme items or during specially scheduled programme breaks. Such breaks are often regulated as to their duration and frequency and may be timed for climactic points in the programme to avoid losing viewers by "channel-hopping". In addition, inserted advertisement may be rendered with restricted trick play functions. For example, users may prefer to choose contents having been paid by advertiser for free, and in exchange, they will not be able to perform trick play function during the advertisement segment.

"Banners" are advertisements or programme content that typically run across the top or bottom of a TV screen during the programme content. "Interstitials" are additional pages between informational text pages, whilst "pop-up" ads do just that!

IPTV consumers are expected to be able to "opt-in" to targeted direct marketing initiatives using their "user-specific" data, for example giving them the opportunity of being included in special promotions. IPTV will open new opportunities for localization and personalization of advertising content, thus reinforcing its relevance and will be able to provide information about who is watching what programs and what channels. The opportunity to aggregate this information will enable advertising to be targeted to specific groups producing a dramatic improvement over current methods of audience measurement. Near real-time monitoring could be utilized to further refine the placement of relevant ads.

The inherent addressability of IPTV will allow ads can be targeted at large groups, small groups, or even individual television sets. Advertisements may be constructed from individual elements such as different scenes and languages to convey messages targeted to particular groups of consumers. IPTV advertising will be made far more relevant in IPTV services than in today's broadcast TV world.

A.3.2 Traditional broadcast advertising in IPTV

Broadcast TV advertisements can already be inserted on a national, regional or local basis sometimes using complicated scheduling to accomplish all three mechanisms in a single commercial break. As IPTV becomes more widely available and its flexibility understood, advertisers will clearly wish to exploit the new capabilities available to them, some of which are enumerated in the succeeding clauses.

A.3.3 Advertising developments

Future IPTV advertising developments might include those based around the consumers' personal lifestyles, for example.

Shopping habits - Consumers may wish to register such things as their store loyalty cards or other preferences with their IPTV service providers as a means of receiving targeted ads.

Personal preferences - Consumer will be able to specify their willingness to watch certain types of advertising either by: Specifying products, subjects or goods in which they are interested or those in which they have no interest.

Interactive advertising - Could be:

- Multi-dimensional, allowing the user to navigate links within the advertisement to find additional details of the products shown or to access special offers. If a consumer "opts in" to the ad, their contact information may be downloaded by the advertiser to enable direct marketing.
- Consumers could have an interactive session with commercials, perhaps using the remote control.
- A "click to call" feature could enable the consumer to initiate a telephone call to discuss the product.
- Content Advertisement to enable consumers to look for specific items or services where the advertisements are content in their own right and can be sought by users.
- TV Guide advertising - advertising content could be associated with the programme content.
- Advertising of business services on IPTV could include simple directory listings or more complex multimedia advertising.
- IPTV services could include an application allowing the delivery of direct mail advertising which may be in text or multimedia format.
- Polling applications could incorporate advertising content.
- A "ticker" application could deliver continuous advertising messages, perhaps in exchange for "free" entertainment content.

Advergaming - is a feature predicted by some marketers looking for new ways to place their products before their potential consumers in the future. This might take two forms:

- The ads themselves being the games.
- In-Game advertising, where the game includes references to products being marketed and where the outcome of the game is influenced by the player's responses.

Consumer Log - IPTV could give consumers an option to create a database of interesting advertising messages delivered during a TV broadcast and to allow the review those messages later, to request further information or to make a purchase. When an advertising message is thus stored on the consumer's PVR, the advertising targeting application could use the information to trigger the presentation of a more detailed message.

Many of these processes may currently be under laws to protect consumers' privacy thus advertisers and service providers would have to give considerable attention to their processes, not least to create and maintain a sufficiently robust audit trail of such activity.

A.4 Service information

These services usually consist of non-video services that are delivered from the service provider to the consumer, either explicitly (perhaps requesting or enabling the consumer to take a particular action or to provide EPG data) or implicitly (for example, to apply a control the consumer network equipment).

A.4.1 Electronic Programme Guide (EPG)

The EPG (otherwise known as the Interactive Programme Guide (IPG)) is a service facilitated by middleware, which provides the consumer with detailed information about the content available to them. The user is able to interact with the network using the remote device to control the STB and thus to receive the EPG information.

This user interaction will usually result in a network control action, which may include:

- Push mode.
- Pull mode.
- Transmission of specific content.

- Query of Content.
- Transmitting full content information.
- Transmitting selected partial content information.
- Filtering of the content (e.g. parental control).

There is a variety of standards associated with EPG, the most important of which are the DVB-SI standard from DVB and the A/55 standard from ATSC. These define the data tables for interpretation by the middleware. Even though there are differences in the terminology of the different sponsoring bodies, they have common aims and these same aims must be supported by the IPTV architecture. The standards address the typical method of broadcast, in which all channels available to a consumer are transmitted simultaneously. In the IPTV model where only requested channels will be transmitted, some of the concepts that drive the EPG will vary. In the IPTV model, a master list mapping every channel to its multicast server address will be required at every consumer's terminal. The EPG will use this information to display available programmes which can be searched by the consumer, to enable a selection to be made. The terminal must have data about the channels and the events. The delivery of these data from the network is dependent on the employment by the service provider of either:

- Push model, where the consumer's terminal equipment receives and stores content from EPG server and updates to the content are automatic, thus the programme information available to the consumer is always up-to-date.
- Pull Model, where updates have to be manually requested from the EPG server; whilst this data is usually stored in the consumer's terminal equipment, it is not necessarily up-to-date.

A.4.2 Electronic Service Guide (ESG)

The Electronic Service Guide (ESG) enables service and content providers to describe the services and content they make available, or offer for subscription or purchase. It also enables a method for describing how to access the services. From the user perspective the Service Guide can be seen as an entry point to discover the currently available or scheduled services and content and to filter those based on their preferences. Similar to the retrieval of EPG data, an ESG can be either pushed or pulled onto the consumer premises.

An interesting property of the ESG, distinguishing it from an EPG, is that it provides the entry point to interactive TV services, such as those mentioned in clause A.1.6. That is, the ESG can contain information on interactivity with content that is related to what is on TV or interactivity with actual TV programme content. This interactivity is described in the interactivity data. The ESG consists of both EPG and interactivity data, as shown in figure A.1.

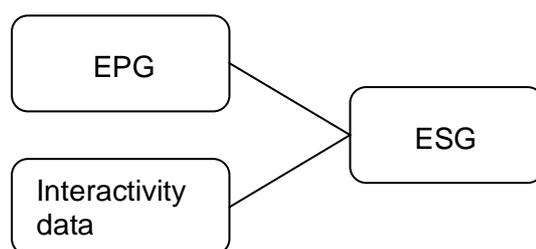


Figure A.1

Relating to the IPTV roles from clause 4.1, the IPTV Service Provider aggregates EPG and interactivity data into an ESG and makes it available to the consumer. Interactivity data is generated by either the IPTV Service Provider or the Content Provider.

A.4.3 Service Discovery and selection

Service Discovery (SD) is a mechanism which discovers the available IPTV services that are compatible with the available Consumer Network equipment. Service Discovery may also enable the user to request a specific service to be delivered to the Consumer Network for rendering on a particular terminal device. Once the user has requested the execution of the service then the Service Discovery will ensure that it is delivered in a format and to a device that is able to execute the service. For instance, an HDTV session will not be opened towards a low resolution receiver.

A.4.4 IPTV User Profile

The IPTV User Profile contains information about how a user can make use of the IPTV Services as such or in combination with other available services to the user in the NGN network. It can, for example, contain the services available to the user, the viewing preferences for a specific user or the rights associated with the user.

The User Profile enables users to modify the default service delivery details and to customize their personal preferences for their range of services.

A.4.5 Parental control services

Many parents are concerned about their young children watching programs with content that is more suitable for older children or adults.

Most parents are concerned that their younger children might watch programs with unsuitable content and it is with this in mind that most countries have rating systems in place such that the content transmitted on commercial television services is defined as suitable for different age groups. These ratings are usually assigned by national bodies, employing strict guidelines to define their rating process. These rating systems provide the mechanism for deciding the suitability of a particular content for a minor based on the child's age. The ratings are usually hierarchical, and hence ratings applicable for a certain viewer age group indicate that the content is suitable for viewers whose age is greater than the rating.

Music and games are similarly rated in many countries and sometimes those with explicit lyrics or pictures are specifically marked to warn parents of their content.

In addition to these controls, commercial TV networks are restricted in most countries from broadcasting inappropriate material during times when children are likely to be watching. The IPTV service should enable the consumer to control access to content that is accessible at any given time based on its classification, rating, age of audience or other optional criteria such as: cost, channel number, actor, start time, length, etc. This feature could also be available to restrict access to a particular channel though this is perhaps more appropriate as a terminal device function or as a user preference. The set restriction could also be removed by providing a means to prove authority for viewing a particular channel or content. Parental controls may also be made available for other services provided by the IPTV service provider (e.g. electronic games or the purchase content).

Parental Controls can be enforced at two different points; at the platform level (by the consumer) and at the policy level (by the service provider). At the platform level, the consumer can create multiple users, each having different access rights. Dependent on the system, a "child profile" user may not even be able to see reference to "adult" material on the EPG. At the policy level, the service provider can set limitations (with or without the consumer's knowledge!) per user profile.

Parental Controls can also be enforced dynamically at IPTV session activation. Even if the rating suits well with the requested program or CoD, the parent may want to be alerted when the child starts an IPTV session. He may find that the child wants to watch a content at inappropriate time. The use case could be the following: a child wants to watch a CoD and starts a CoD session initiation. An SMS is sent to the parent to request authorization. If the parent answers "yes", the IPTV CoD session can start. If not, the IPTV CoD session activation is stopped. The service logic could also set timer in order not to interrogate the parent anytime the child wants to watch a content. For example, if the answer is "no", next session that occurs before the timer has elapsed would be denied without any alerting to the parent.

A.4.6 Notification services

Notification services (for example Caller ID, Alert Messages, etc.) refer to services that can be displayed, (usually as overlaid text) on a consumer's television while they are watching video content. These messages are displayed in a window varying in size depending on the application and the preference of the user or the IPTV service provider.

Depending on the circumstance, this window can be initiated at a time specified by the consumer (for example, to act as an alarm clock) or by the service provider or by a system event. It may or may not be accompanied by an audio event, and may or may not require a specific action for its dismissal or invocation, for example, click to close. An appropriate signalling mechanism is used to convey the notification from its source, via the IPTV platform to the terminal device for rendition onto the consumer's screen.

A.4.7 Content Recommendation

Content recommendation is aiming to provide guidance and recommendation about actual or future available IPTV contents to specific users or user groups who have subscribed to this service based on the user profiles content metadata (e.g. user preferences, watching habits, user characteristics). The recommended content can be BC programs, COD contents, advertisements, or any IPTV applications which should be possibly interesting to the users.

Content recommendation may be based on several Program related recommendation criteria as follows:

- Recommendation which is related to the program that the user is currently watching. The recommended contents are evaluated according to the metadata of current program. This type of recommendation is usually for specific user.
- Recommendation which is based on the user profile. The recommended contents are evaluated based on the user profile. This type of recommendation is usually for specific user or user group.
- Recommendation which relates to user profiling, e.g. information about user consumption of content and services over a period of time such as previously watched programs on broadcast TV channels, consumed CoD assets, frequently used integrated IPTV and NGN services.
- Recommendation which is for new movie publications, upcoming programs, or popular movies and so on. The recommended contents may have no relationship with what the user is currently watching, e.g. the user may be watching TV, browsing EPG, or playing game. This type of recommendation can be provided to all users, specific user group, or even individual user.

Presence information may be used for delivering "off-line" and "on-line" content recommendations as follows:

- Off-line: recommendation when the IPTV UE is offline. There is a relationship between the IPTV UE and other UE (e.g. mobile equipment like cell phone) to which IPTV service provider may send recommendation.
- On-line: recommendation when the IPTV UE is online and the user has provided other presence information. IPTV service provider may send recommendation to the IPTV UE.

A.5 Hybrid services

The IP delivery channel may be used for a consumer's complete service offering or may be combined with other TV services in a hybrid service offering. For example, a service provider may chose to offer broadcast services via an independent channel whilst providing interactive, download or CoD TV services via the IP network.

A number of variants of such hybrid services are possible. The non-IP content may be delivered over a completely independent delivery network, such as terrestrial broadcast, direct-to-home satellite, hybrid fibre-coax or optical distribution network. Such hybrid approaches can offer advantages both to the service provider and the consumer, perhaps reducing the risk from new technologies, giving faster time to market and providing a degree of resilience in overall service delivery.

A.6 External Content and Content Aggregation

Compared with broadcast TV services, a major benefit of IPTV service is its ability to deliver a wider variety of content. Any particular IPTV service provider will be able to hold only a finite content library and carry only a limited number of broadcast channels, but by allowing access to "third party" content providers catering for specific or minority interests, such content (both broadcast channels and stored content) being most likely to be delivered via a CoD-like mechanism. The overall service becomes very much more appealing to its consumers. A consumer might acquire external content from several CP via its IPTV SP. Figure A.1A illustrates the difference of external content and content not characterized as external content.

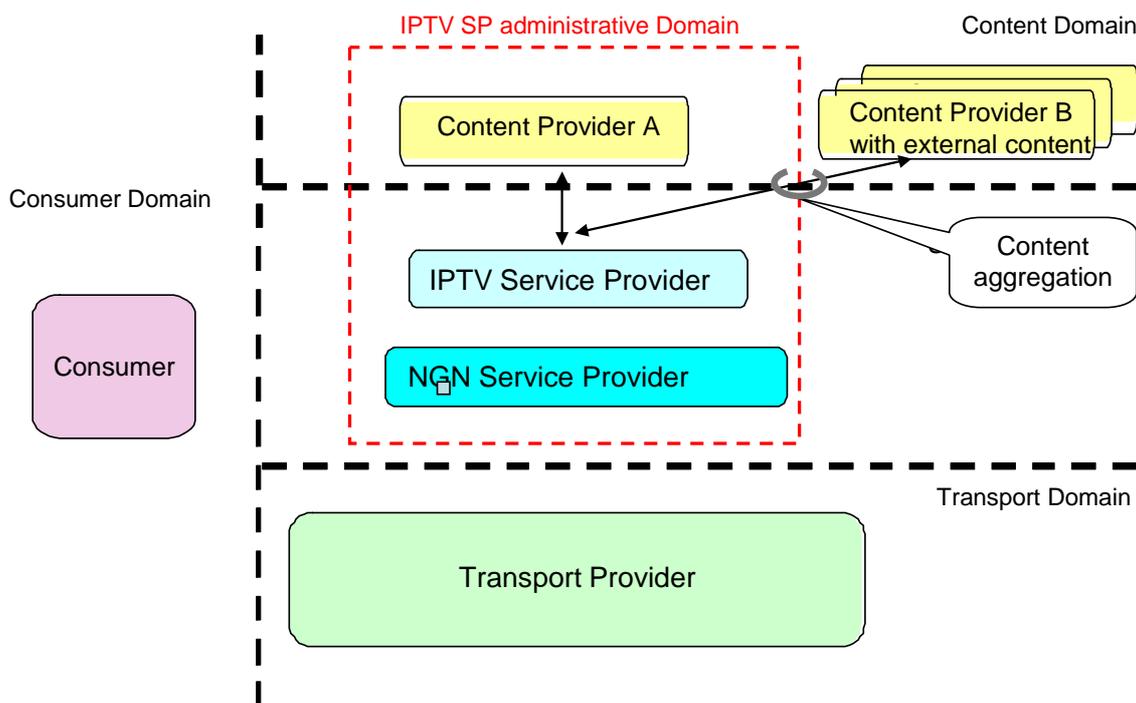


Figure A.1A: External content and content aggregation

This means that in order to provide a comprehensive offering an IPTV Service Provider (SP) could need to have business relationships with a large number of Content Providers (CP), some of whom may be extremely specialized, thus effectively providing a "library" service to their consumers. In turn, this necessitates an effective indexing system as to what content is available and where it is located. This may suggest the need for a Content Broker (CB). Whilst this is not seen as a "domain", as described in clause 4.1 of the present document, such content brokers would provide liaison between the Content Provider (CP) and the IPTV Service Provider (SP) domains.

In such cases, it is envisaged that the consumer would ask his preferred IPTV SP either for specific content, e.g. "I want to watch a film of the 1966 Football World Cup final" or request a more generalized search e.g. "What Charlie Chaplin films are available for download?". The SP would first search the resources of his preferred CPs and if the specific material was available advise the consumer as to how to retrieve it and at what cost. If the material was not available or for generalized requirements, the SP would pass the request to the CB who would locate the required material in his index and advise the relevant CP of the requirement, and tell SP where the material was located, how it could be retrieved and at what cost. The SP would then inform the consumer who could then choose whether or not to complete the transaction. The whole process bears comparison with that of an internet search engine.

Alternatively, IPTV SP could have a business relationship with some Content Providers to deliver their content with QoS or QoE. The IPTV SP delivers the content to the consumer making use of the services capabilities provided by the NGN SP. The IPTV SP could provide IPTV capabilities, such as content distribution service to place some of the content to locations where the content is likely to be consumed or provide other services, e.g. restrict unauthorized redistribution. IPTV SP could also include content from the "preferred" CPs into other IPTV services, e.g. Content Recommendation. There might be a direct business relationship between the Consumer and one or more Content Providers, as long as the content is delivered via the IPTV Service Provider platform. However, even though there is a business relationship directly between the consumer and CP, a separate business relationship must exist between third party CP and IPTV SP.

Uncontrolled redistribution of such content is not to be supported, thus it will need to be appropriately protected by a DRM scheme. The required content may be carried via the network interfaces shown in clause 4.1 or there may be additional signalling interfaces between the SP and CP to enable appropriate access to the content.

This example describes a consumer requirement in terms of CoD or download services, but in the general case the external content could equally be a broadcast channel, perhaps a requirement from an expatriate Australian in London wanting to watch the broadcast television coverage of the Melbourne Cup.

A.7 Use case examples for IPTV and NGN services interaction

The integration of IPTV services with other NGN services allows for new value-added services in which the basic Broadcast, CoD and N-PVR services can be extended and/or combined with other NGN services, such as Presence, (Multimedia) Telephony and more complex services. This interworking allows the IPTV services to use the capabilities of the network to provide the user with an optimized and user friendly solution. In this clause a non-exhaustive list of use case examples is given to indicate the possibilities for service orchestration and interaction.

A.7.1 Watching Apart Together

The combination of basic IPTV services such as Broadcast, CoD and N-PVR, with Presence, allows a user to search for other users, e.g. buddies or people having similar interests, that are watching TV or viewing a CoD/N-PVR content at the same time the user is consuming that service. That user may then consider communicating with these other users in a number of ways, e.g. through an instant-messaging chat service or by having an audio and/or video conferencing session. These services lead to a situation where users, while physically separated, can watch apart together, increasing their sense of co-presence.

A.7.1.1 Use case: chatting during live TV

For example, user A is watching a football match by having a BC session in place. Since he would like to discuss the match with friends or fans of the team X he supports, he can open an instant messaging client and search for "young supporters of team X watching the match now that are available for chatting". The user then receives a list of other users that fulfil the search criteria and he can continue to select user B and start a chatting session with him.

A.7.1.2 Use case: videoconference during live TV

Instead of having an instant-messaging session in place, user A and user B can also decide to communicate through a multimedia telephony session. By having a microphone and/or webcam connected to the set-top box, both users can have the incoming videoconference session placed as picture-in-picture on their TV, while the associated audio signals are routed through the TV speakers or a separate audio path.

A.7.1.3 Use case: recommending programs

In a third example, user A is watching an interesting program. He can see on his buddy list that user B is watching a different program. User A would like to notify user B about the show he is watching. He can select user B on his buddy list and send him a recommendation. User B receives a pop-up, stating that user A is watching a program he might like. User B can then directly switch to the program that user A is watching. User A receives a notification that informs him about the choice user B has made.

A.7.2 Presence based games

User A is watching the TV. He receives an instant message on the TV screen that says "In a minute some adverts will be transmitted... watch carefully the spot of new FJ TVBOX... do not switch the channel, and you could win the new STB by FJ".

The message is sent to all the users that are not using a FJ TVBOX, and the winner is chosen among all of them that really watched the spot.

A.7.3 Incoming call management

The combination of basic IPTV services such as Broadcast, CoD and N-PVR, with Telephony, allows a user to have increased control over incoming calls when watching TV.

While User A is watching TV, he receives a notification that warns him about an incoming call. The caller-ID shows him that the call is from user B. User B, who calls him from his telephone. User A can then select between several options to handle the incoming call:

- Accept on TV; the TV signal is paused or muted and the incoming voice signal can be heard over the TV speakers.
- Accept on mobile; the call is forwarded to user A's mobile phone. According to his user profile, the TV can either be paused or can continue.
- Route to mailbox; user A does not answer the call. Instead, the call is forwarded to his voicemail box.
- Refuse; user A does not answer the call.

User B may receive a notification that informs him about the option that user A has selected.

If the user's response to the incoming call leads to a change in IPTV service state through a media control operation by the user (e.g. user pauses the TV), external service logic is informed about this change and its cause. Similarly, if the user's response to the incoming call leads to a change in IPTV service state through a media control operation by external service logic, the user equipment and/or the relevant network elements of the IPTV solution are informed about this change and its cause.

A.7.4 Seamless switching among devices

User A is watching the TV and has activated the TV Call Manager for his mobile phone.

User A receives a video communication on his mobile phone and, as described in the previous use case on Multiple Incoming call management, a little pop-up on the TV warns User A that there is an incoming video communication on his mobile, shows the caller id, and asks for instructions.

User A initially accepts the video communication on the mobile.

Then the user can choose to:

- switch the video communication on the TV set, reducing the TV program on a smaller picture (with automatic switch of audio of the program in mute mode);
- split the media components of the video communication among the mobile phone (audio component) and the TV (video component) reducing the TV program on a smaller picture on the TV.

A.7.4a Seamless Replication of an IPTV service among devices

User A is watching the TV or any content on demand with his family. He has to leave the room and would like to continue viewing the same content from his mobile device or from another room without interrupting the first session.

A.7.5 Content sharing on a multimedia conference

User A, employee of FJ Company, is watching the communication of FJ's CEO on TV.

User A considers the program very interesting and would like his colleague User B to watch the same program.

Therefore User A calls his colleague User B and adds the specific content streaming to the conference, so inviting User B to watch the program too.

A.7.6 Immediate messages sharing with all the user watching the same program

User A is watching a program on the TV. The program is discussing about "The reason for the weather being warmer and warmer" among several experts.

User A is interested in this discussion, and he wants to join and shares his own views.

User A opens the immediate message client on the TV. He inputs his views and pushes the button marked with "VIEW" to send them. All users watching the program could receive his views. And other users' views are also shown on his TV.

A.7.7 Sharing the remote control

The control over basic IPTV services such as Broadcast, CoD and N-PVR lies with the user. Exposing this control functionality, e.g. trick-play, to the network and/or other users enables a large variety of value-added services.

A.7.7.1 Use case: joint control over CoD movie

For example, user A is watching a CoD movie. From his buddy list he observes that user B is also watching TV. He invites user B to join him in watching the movie. Both user A and B now can have full trick-play control over the movie. If user A pauses the movie, the movie is automatically paused for user B as well.

A.7.7.2 Use case: follow a buddies' zapping behaviour during live TV

In another example, user A can see on his buddy list that user B is also watching TV. User A invites user B to take over his remote control. User B accepts and from that point on, he controls both his own as well as user A's zapping behaviour.

A.8 Service examples defined by other organizations

The above service examples gave a good overview of different IPTV services. However, there are several organizations that have defined service descriptions and use cases which may be variations of the abovementioned or which were not listed above at all. In this clause some references are made to relevant work written by other organizations.

A.8.1 Service examples from OMA BCAST

OMA BCAST working group has specified an OMA broadcast service. The use cases are mobile specific broadcast use cases, but similar in the nature as TISPAN NGN IPTV broadcast services.

The following use cases are considered applicable. When referencing the OMA BCAST requirements, the following OMA BCAST specific words should be replaced throughout the requirements with TISPAN specific words as shown below:

- "Mobile Broadcast" replaced with "Broadcast".
- "Wireless network" replaced with "network".
- "Free-to-air" replaced with "free of charge".

Use Case	Clause in [1]
Discovering and the available Mobile Broadcast Services and their descriptions	5.1
Protected Mobile Broadcast Services and content delivered within	5.2
Mobile Broadcast Service with auxiliary data and interaction	5.3
Mobile broadcast file distribution - example of news service	5.4
Personalized news broadcast	5.5
Communications related broadcast	5.6
Rich media news broadcast	5.7
Activation of already downloaded Broadcast Service content	5.8
Scalable Viewing of Mobile Broadcast Content	5.9

A.8.2 Service examples from DVB CBMS

DVB CBMS (Convergence of Broadcast and Mobile Services) has defined Use Cases that are relevant to the ongoing work in TISPAN WG1 on IPTV (WI 01042). Below is a table listing the DVB use cases that are relevant also to TISPAN IPTV work.

Use Case	Clause in [i.3]
Mobile TV and Radio	5.1
Interactive TV	5.2
Download of audiovisual content/applications/services/ software to devices	5.3
Broadcast of audiovisual streams along with auxiliary information streams to be rendered synchronously and (optionally) containing interaction entry points	5.4
Unattended information download with off-line consumption and interaction entry points	5.5
Broadcast of a common core of services to all terminals, together with a set of services unique to an individual operator	5.6

A.9 Miscellaneous service examples

A.9.1 User-Generated Content

A feature of the IP-enabled networks on which the offerings are deployed, is the ability for subscribers to upload content they create, and make it available to any other subscriber for viewing, live or offline. Description of the content may also be added or modified by the subscriber who created it. The description should be provided to other subscribers to let them know more about this content when they watch it. The content may be private (for example, the output of home security devices), intended for a restricted audience (for example, family and friends or a TV game show in which the user participates) or intended for unrestricted audience. In this service, the user acts as a content source to the service provider. The service provider then enables distribution of the content through the regular IPTV services, freely available or PPV, and listed on the EPG or accessible via the searching or browsing facilities. Figure A.2 is a conceptual illustration how user generated content reaches watching users.

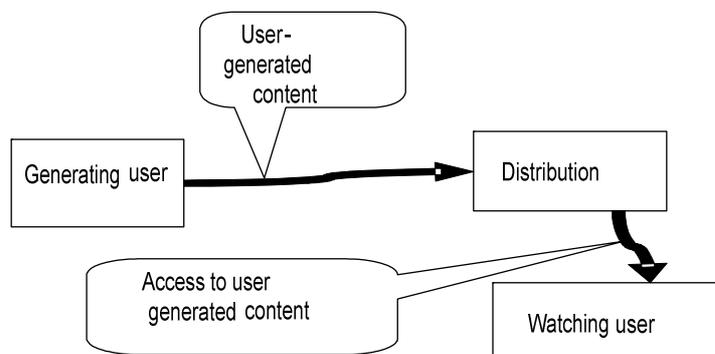


Figure A.2: Conceptual illustration of generation and distribution of user generated content

Different methods of distributing user-generated content into the network may be distinguished:

- Upload: the IPTV network receives user-generated content by file upload.
- Streaming: the IPTV network receives streaming user-generated content.

A.9.1.1 Use case: Home movie sharing, upload

For example, user A has recorded a nice home video of his family picnic and has stored it on his PVR. He uploads the video to the network and then publishes the video metadata so others (e.g. family members) can now see the video at their convenience.

A.9.1.2 Use case: Home movie sharing, streaming

For example, user A has recorded a nice home video of his son's football game and has stored it on his PVR. He receives a request from user B (e.g. a family member) to share the video. User A starts streaming the video into the network and user B can directly watch the video without having to wait.

A.9.1.3 Use case: UGC on STB without storage

For example, user A has a webcam connected to his STB and is making a movie of him and his daughter playing a game. Since his STB has no storage facilities, the movie is streamed and recorded in the network. User B (e.g. a family member) can now view this recorded stream at a later time instant.

A.9.1.4 Use case: Game show participation

For example, user A has a webcam connected to his STB and wants to participate in a game show. During the game show, he receives an invite to participate. When user A starts participating, the live feed from his webcam is streamed into the network and merged into the game show broadcast. Other users watching the game show now see user A appearing in the show as participant.

There must be an interface to the platform for users to be able to upload or make content available to other users. There must be an interface to the platform that enables other users to access user generated content.

These services can be made available to a configurable set of users, or generally available with or without subscription or usage fees. These services may be protected from viewing by unauthorized consumers by DRM mechanisms and must include parental guidance and content ratings where appropriate.

NOTE: The management of uploading of UGC may be by a remote device.

UGC content information needs to be published to the users (e.g. via EPG), so that the authorized users are able to access the UGC content information (e.g. via EPG), and view the content which they are interested in.

The user can use any permitted/authorized device to remotely start another IPTV device uploading UGC content. For example, the user is at work in his office, and he wants to monitor the home circumstance, but the monitoring device is not uploading the content at that moment, so the user uses his mobile phone to request the monitoring device to start uploading the home circumstance content.

A.9.1.5 Use case: Live User Generated Content consumption

For example, user A is making live User Generated Content broadcasts. Whenever user A has some interesting facts or clips to share, he starts an upstreaming user-generated-content session. User B and user C both have a subscription to the user A broadcasts. They receive a notification when user A comes "on the air". User B happens to be present when he receives the notification, and he watches the user A broadcast in real time. User C is not home, but he has set his C-PVR to record all transmissions from user A.

A.9.2 Games

Electronic Games are inherently entertainment service growth areas and include a number of aspects which impact and interact with a service and network operator's IPTV infrastructure. Electronic Games consist largely of the following two products:

- Multi-Player games - gamers play against other users over network links (gamers therefore need to first purchase and load the game into their console or game device).
- Single player games (Games-on-Demand) - gamers play premium games directly downloadable through broadband connection.

A.9.3 Pictures

The popularity of digital still and video cameras has contributed to the growth of digital images being stored by consumers on home devices such as PCs or on internet web-sites that offer storage services. In addition there is a growing trend for media devices such as television receivers and DVD players to offer the ability to support the presentation of digital pictures. As such the IPTV platform should also be able to support these media formats thus enabling consumers to share their personal content.

The ability to store, manage and view digital pictures is hence an important service that may be offered by service providers in addition to the video related services. The IPTV pictures service is very similar in concept to the user contributed video service except that the contributed content is still images rather than video content.

A.9.4 Content markers

While watching a content of any IPTV Service (e.g. BC Service, COD, PVR), it should be possible for the user to identify a position in the content (a "content marker") for the later use. The content marker may consist of the point in time of the content marked by user, and additionally, some descriptions or name may be added by the user for himself (personalized content marker description).

The user should be able to create and name content markers for actually viewed content or future content (e.g. from EPG) on any IPTV device (e.g. a home TV), and may be able to retrieve, or view content markers from another authorized device (e.g. a mobile phone).

The user should be able to manage his content markers, such as deleting, renaming or modifying his content markers or their descriptions.

When a user begins to watch content, the related content markers they had set before should be available to the user (e.g. show them via user interface) and then take subsequent actions. For example, if the user selects one of the content markers, the content will skip and start directly from the particular point identified by the content marker. Meanwhile, the content marker information (e.g. user's content marker name and description for this particular user) should be shown to user via EPG (as additional information to generic EPG) or during the content viewing process, etc.

A.9.5 User participation

Television shows stimulate more and more the participation of users. Starting from simple messaging to a TV show or dialling in by phone, users will become live participants in TV shows with live streaming footage through user webcams and fast, real-time interaction between the participating users and the TV show.

Figure A.3 is a conceptual illustration how signals from the studio and participating user(s) are mixed and broadcast to television-watching users. This mixing capability could be offered as a service from a Service Provider to small Content Providers that may not be able to afford this type of advanced mixing capability.

NOTE 1: This example does not make any assumption on the mixing capability nor on its architectural location.

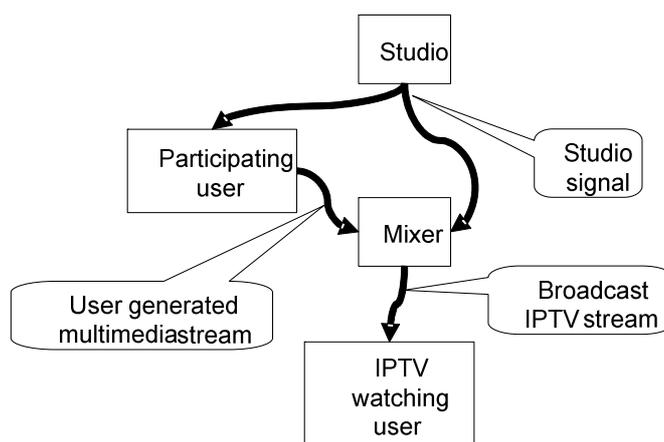


Figure A.3: Conceptual illustration of user participation in the generation of content

Figure A.4 is a conceptual illustration how users may participate in a game within the context of studio content.

NOTE 2: If the studio Content Provider and the gaming Service Provider are not the same party, then there should be a business relationship between the two, or at least an understanding that this type of value added services is allowed.

NOTE 3: This example uses the gaming service for illustration purposes only.

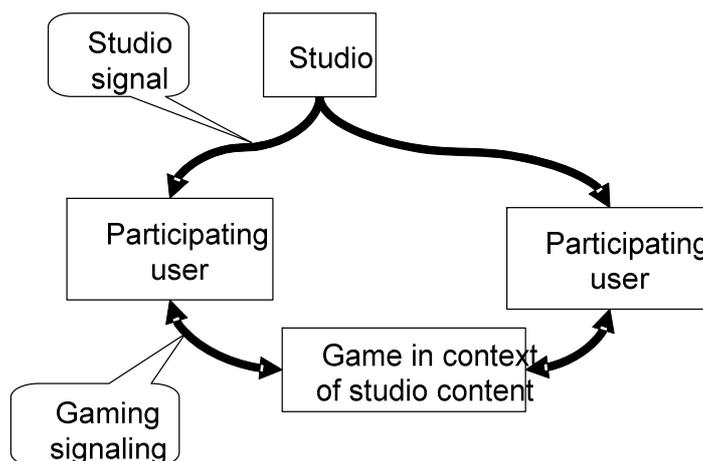


Figure A.4: Conceptual illustration of user participation with content, "gaming apart together"

A.9.6 Synchronization-sensitive interactive services

IPTV services like BC and CoD may be used as components for services that combine communication, context and content into a blended user experience. IPTV delays and delay differences may spoil the quality of experience of some of such services. This clause presents examples in which excessive delays would be detrimental to the interactive service experience.

NOTE 1: The examples are not IPTV services as such, but interactive services that may use IPTV services as service component.

NOTE 2: Some of the examples are also described elsewhere in the present document from different perspectives, e.g. from the perspective of service interactions.

A.9.6.1 Watching Apart Together

Figure A.5 illustrates the "Watching Apart Together" use case, which is a form of indirect user participation with content. User A and User B are watching the same soccer match, while simultaneously having an open communication line (e.g. voice, webcam, text chat, etc.) between them. Even though User A and User B are at different locations, they share the same soccer-match experience. However, delay difference will spoil this experience. If User A sees a goal happening a significant time before User B, then User B cannot directly share the excitement of User A about the goal. Delay difference of a second are already significant and spoil the watching-apart-together experience.

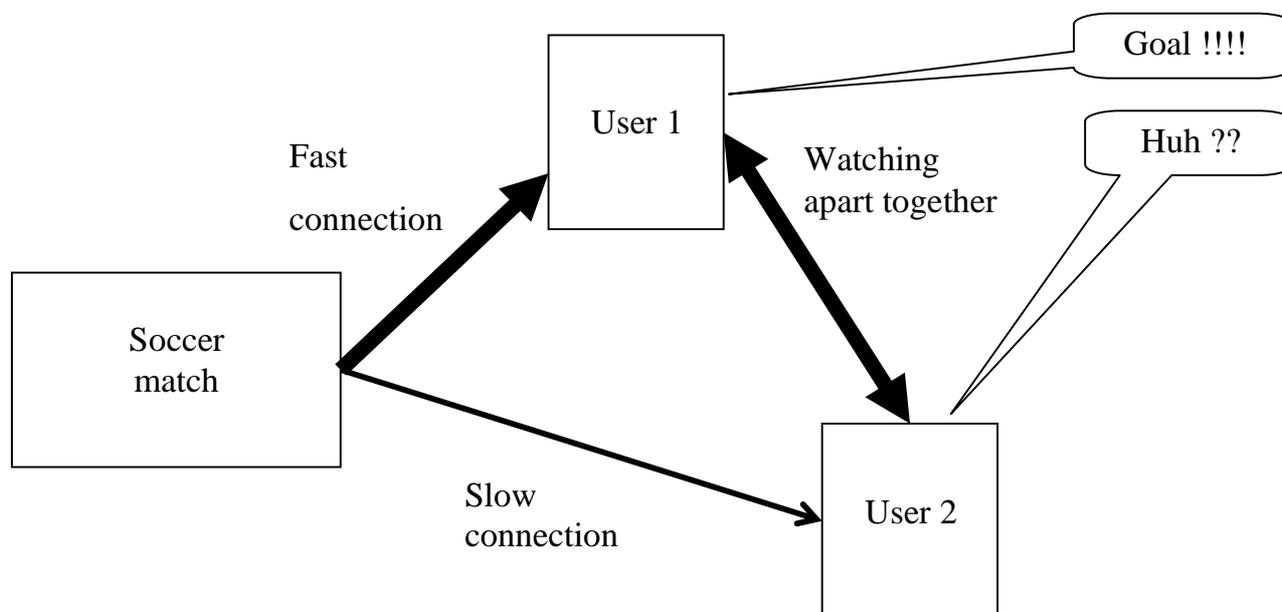


Figure A.5: Delay differences spoiling a watching-apart-together experience

A.9.6.2 Gaming Apart Together

A use case similar to watching apart together is gaming apart together. Two viewers may play against each other using a broadcasted game-show as a basis. The gaming-apart-together service could be delivered by a third party that adds value to broadcasted game shows. As responsiveness is essential to such a service, delay differences of as little as 100 ms could already spoil the fairness and hence experience of gaming apart together.

A.9.6.3 Remote game show participation

A use case related to the previous one is when people at home participate in a live television game show, e.g. by phoning in or using the webcam. Delays of more than a few 50 ms would already impede smooth interaction between the game show and the participant.

A.9.7 Use Cases for Hybrid PVR

Hybrid PVR service allows combination of network PVR features and local or client PVR functionalities. There exist multiple scenarios or situation when client PVR is disabled to record show (e.g. end device is disconnected in time of scheduled recording or network parameters are not sufficient to stream or missing capacity of storage in local device) IPTV solution should record in network and later deliver to end device. Second use case can apply in case of different end device capabilities (resolution, encoding, etc.) record by nPVR can be done in several formats but appropriate record will be distributed to end device storage to later preview.

A.10 Use case examples for Personalized Channel

A Personalized Channel, also called a *Virtual Channel* or *Personal Channel*, is a particular list of programs that is scheduled on the basis of the user profile, in which each program is selected from the EPG/ESG that is available to the user, including BC channels or packages and CoD categories. As a result of this scheduling, each program in the personalized channel is allocated to a single time slot, and there may be overlapping or breaks between two time slots, in which cases particular controls on the channel are handled (e.g. content targeting during breaks, PVR triggering when overlapping occurs).

After the personalized channel has been configured for a specific user, all programs included in the personalized channel can be played one after another according their time slots respectively, which liberates the user from complex actions about channel switching, movie searching etc. and enhances the user's experience.

A.10.1 Use case: personalized channel configuration

User A is browsing the EPG. At some moment he presses a key on the remote control and there appears indication information which allows User A to create a personalized channel that fits his personal preference. User A then enters a new name, for example "UserA_Channel001", to identify the personalized channel. For every time slot on the channel, User A can arrange his favourite programs coming from other BC channels, CoD categories, etc.

After these steps are completed, a new channel with its program schedule is available to User A. The channel "UserA_Channel001" is then displayed together with other BC channels on the TV whenever User A browses the EPG at a later time.

Moreover, User A can modify the existing configuration of his personalized channel, e.g. insert a new program into the list (with a specific time slot), change the schedule time of (on-demand) programs in the list and delete one or more programs from the schedule.

A.10.2 Use case: startup with personalized channel

A personalized channel, for example "UserA_Channel001" has been created for User A, and when User A turns on the TV, content scheduled at user's current time in his personalized channel is displayed on the screen directly after User A is registered.

A.10.3 Use case: content targeting during personalized channel breaks

User A has pre-configured his preference, shopping habits etc. in his profile at an earlier time. Now he is watching his personalized channel, for example "UserA_Channel001". If one program has just ended but the next one will be available 5 minutes later (e.g. live program), i.e. there may be a 5-minute break between the two programs. During this time segment there will be no program for User A but a series of commercial advertisements that meets User A's preference and shopping habits.

User B has configured to accept recommendation of IPTV content. Now he is watching his personalized channel, for example "UserB_Channel002". During a break, one or more recommended content items are played one by one according to User B's subscription (preference for IPTV content). The recommended programs may include forms of movie highlights, bookmarks, content previews etc.

A.11 Use case examples for content preview

There are scenarios for service provider to offer content preview to enable the user to evaluate his interest on the content before he could choose to enjoy or pay for it.

Content preview may provide part of the content (e.g. segment collections) or much lower resolution of the content or both, so that the users have a quick view on the content, based on which appropriate choice can be made by the users, e.g. to enjoy or order the regular content.

The preview content may have its own content identifier to enable the content selection, e.g. from the content guide, in which case the preview content can be provided as an integral part of the offering for CoD service (e.g. trailer, highlights from movie, etc.). For example, access to preview content could be provided, for free, and could be logically coupled with the regular CoD asset (e.g. linked via metadata). Both preview content and CoD should be provided using the same mechanism.

In a second use case there is only one content identifier for both preview and regular content (e.g. CoD or BC content). In order to watch or preview this content it is required to indicate whether preview or regular content viewing is requested. Based on this indication either preview or regular content itself is played.

It is noted that preview of live content is likely played in real time, showing the live content, e.g. as regular BC channel.

A.12 Use case examples for Personalized Service Composition

This clause presents use case examples for the personalization of the TV viewing experience for both broadcast and content-on-demand.

A.12.1 Use case: personalized broadcast service composition settings

User A is watching a football match on a German TV channel. He can configure his preference for English language, so that he receives the English-spoken comments with the match. The user sees in his EPG that also written comments are available in the form of subtitles, so he decides to add these subtitles to the TV channel. He also sees that he can select different camera positions, so during the match User A can regularly switch camera positions to get different views of the match. The next time User A starts watching the German TV channel, his preconfigured preferences ensure that he again receives English spoken comments together with subtitles.

A.12.2 Use case: personalized content-on-demand service composition settings

User A wants to watch a movie (CoD). He can configure his preference for English language, so that he receives the English-spoken sound track with the movie. The next time User A requests CoD, his preconfigured preferences ensure that he again receives English-spoken sound track.

A.13 Use case examples for IPTV Roaming

This clause presents use case examples for IPTV roaming. Please note that for home network and visited network. Both Transport Provider and NGN Service Provider are in different domain.

A.13.1 Use case: IPTV Roaming without IPTV Service Provider in visited network

Alice subscribes IPTV services from SP A in location X. When she moves to location Y where no IPTV Service Provider is in but only Transport Provider and NGN Service Provider, Alice use her IPTV terminal to connect to SP A and to consume IPTV services provided by SP A in home network.

A.13.2 Use case: IPTV Roaming with IPTV Service Provider in visited network

Carl subscribes IPTV services from SP A in location X. When she moves to location Y where SP B is in, there are three circumstances as follows.

- If SP A and SP B are the same IPTV Service Provider, then Carl use her IPTV terminal to connect to SP A to consume the services provided by IPTV SP A in home network.
- If SP A and SP B are not the same IPTV Service Provider and there is business agreement between these two providers. Content in SP A can be delivered to SP B, then she can access and watch the content from SP B.
- If SP A and SP B are not the same IPTV Service Provider and there is no business agreement between these two providers. In this circumstance, it is the same as clause A13.1 for Carl to consume IPTV services.

Annex B (informative): Change history

Date	WG Doc.	CR	CR Rev	CAT	Title / Comment	Current Version	New Version
30-05-08	17bTD299r1	001		B	Use cases and requirements on user-generated content	3.0.0	3.0.1
30-05-08	17bTD059r3	002		B	Use cases on service interaction	3.0.0	3.0.1
30-05-08	17bTD060r3	003		B	Requirements on IPTV services with service interaction	3.0.0	3.0.1
30-05-08	17bTD066r3	004		B	W11059 Use cases on user participation	3.0.0	3.0.1
30-05-08	17bTD120r5	005		B	Requirements on Advertising of IPTV service	3.0.0	3.0.1
30-05-08	17bTD119r4	006		B	Requirements on immediate messaging	3.0.0	3.0.1
30-05-08	17bTD121r2	007		B	Use cases and requirements on Personal Channel	3.0.0	3.0.1
30-05-08	17bTD122r2	008		B	Overview of Content Recommendation on IPTV service	3.0.0	3.0.1
30-05-08	17bTD123r3	009		B	Requirement on Parent Control	3.0.0	3.0.1
30-05-08	17bTD124r2	010		C	Requirements of multiple screen rendering in IPTV	3.0.0	3.0.1
30-05-08	17bTD125r2	011		B	Requirements for supporting content bookmark in IPTV	3.0.0	3.0.1
30-05-08	17bTD191r2	012		B	Mix between streaming and broadcast flows in the same session	3.0.0	3.0.1
30-05-08	17bTD192r3	013r1	1	B	Introduction of PVR controlled by a remote device	3.0.0	3.0.1
30-05-08	17bTD116r3	014		B	Release 3 - IPTV requirements	3.0.0	3.0.1
02-07-08	18WTD049r2	015		B	Requirements on service interaction	3.0.1	3.0.2
02-07-08	18WTD051r2	016		B	Requirements on user generated content	3.0.1	3.0.2
02-07-08	18WTD053r2	017		B	Use cases & requirements on synchronization sensitive services	3.0.1	3.0.2
02-07-08	18WTD058r2	018		B	Requirements on wholesale IPTV services	3.0.1	3.0.2
02-07-08	18WTD137r1	019		F	Clarifying recommendation service	3.0.1	3.0.2
02-07-08	18WTD183r2	020		C	Dynamic parental control	3.0.1	3.0.2
02-07-08	18WTD198r1	021		D	Editorial changes to uses cases	3.0.1	3.0.2
02-07-08	18WTD250r2	022		C	IPTV Content Recommendation Service stage 1	3.0.1	3.0.2
02-07-08	18WTD251r2	023		B	Requirements on Push CoD	3.0.1	3.0.2
02-07-08	18WTD088r5	024		B	Requirements on UGC	3.0.1	3.0.2
02-07-08	18WTD297r2	025		B	Management of UGC upload	3.0.1	3.0.2
02-07-08	18WTD069r3	026		B	New requirements of UGC	3.0.1	3.0.2
02-07-08	18WTD087r3	027		B	Requirements on IPTV Presence	3.0.1	3.0.2
02-07-08	18WTD184r2	028		B	Scalable video coding requirement	3.0.1	3.0.2
					All CRs TB approved at TISPAN#18	3.0.2	3.1.1
26-09-08	18bTD104r1	029		B	Editorial corrections for Sub-clause A.4.1 of W11059	3.1.1	3.1.2
26-09-08	18bTD127r2	030		B	Use Case on TV Personalization	3.1.1	3.1.2
26-09-08	18bTD074r4	031		B	Network Managed PVR Function	3.1.1	3.1.2
26-09-08	18bTD075r3	032		B	Requirement of content preview	3.1.1	3.1.2
26-09-08	18bTD088r3	033		B	Clarification the concept of Push CoD	3.1.1	3.1.2
26-09-08	18bTD089r3	034		B	Requirement of Push CoD	3.1.1	3.1.2
26-09-08	18bTD140r3	035		B	Sharing PVR Content and Personal Bookmarks Between Multiple IPTV Users	3.1.1	3.1.2
26-09-08	18bTD200r2	036		F	User profiling	3.1.1	3.1.2
26-09-08	18bTD201r2	037		F	Time-shift TV service	3.1.1	3.1.2
26-09-08	18bTD204r2	038		F	Clarifications of relationship with the third party CP	3.1.1	3.1.2
26-09-08	18bTD090r6	039		B	Requirement of network initiated service	3.1.1	3.1.2
26-09-08	18bTD219r3	041		B	Release 3 - IPTV requirements	3.1.1	3.1.2
26-09-08	18bTD220r3	042		B	Hybrid PVR service	3.1.1	3.1.2
05-11-08	19WTD052r2	043		B	User Generated Content Synchronization	3.1.2	3.1.3
05-11-08	19WTD048r2	044		B	User Generated Content Amateur TV	3.1.2	3.1.3
05-11-08	19WTD049r3	045		B	User Generated Content in Real Time	3.1.2	3.1.3
05-11-08	19WTD054r2	046		B	Personalized Stream Composition Definition	3.1.2	3.1.3
05-11-08	19WTD055r2	047		B	Personalized Stream Composition Requirements	3.1.2	3.1.3
05-11-08	19WTD098r4	048		B	User Cases for IPTV Roaming	3.1.2	3.1.3
14-11-08					CRs 029 to 048 except 040 TB approved at TISPAN#19 and clean-up by ETSI Secretariat	3.1.3	3.2.0
28-11-08	19bTD111r4	049		B	Location Independent Bookmarks	3.2.0	3.2.1
28-11-08	19bTD127r2	050		B	Requirements of IPTV Roaming	3.2.0	3.2.1
28-11-08	19bTD177r6	051		F	Clarifications of relationship with the third party CP	3.2.0	3.2.1
28-11-08	19bTD057r6	052		B	Requirement on Reuse Media Channel	3.2.0	3.2.1
23-01-09	19tTD204r3	053		C	Linking Presence Information, IPTV channels, content and personalized EPG services	3.2.1	3.2.2
23-01-09	19tTD217r3	054		B	Channel Change Clarifications	3.2.1	3.2.2
27-02-09	20WTD095r1	055		B	Editorial Alignment	3.2.2	3.2.3
27-02-09	20WTD105r2	056		F	Cleanup of IPTV Bookmark Terminology	3.2.2	3.2.3
27-02-09	20WTD119r1	057		F	Numbering correction of stage 1 TS	3.2.2	3.2.3
27-02-09	20WTD287r2	058		D	Proposal to editor's notes	3.2.2	3.2.3
27-02-09	20WTD289r1	059		B	Include Requirement and use case for IPTV service replication	3.2.2	3.2.3
27-02-09	20WTD077r2	060		C	Revision of clause 5.16 - Third party content and wholesale content aggregation	3.2.2	3.2.3
27-02-09	20WTD078r2	061		C	Revision of clause A6 - Third Party Content and wholesale content aggregation	3.2.2	3.2.3
					Publication	3.2.3	3.3.1

Annex C (informative): Bibliography

- ETSI TR 102 473: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Use Cases and Services".
- ETSI TS 102 034: "Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks".
- CM-IPTV0430: "Commercial Requirements for Fast Channel Change".

History

Document history		
V3.3.1	July 2009	Publication