

Recommendation **ITU-T H.741.5 (04/2024)**

SERIES H: Audiovisual and multimedia systems

IPTV multimedia services and applications for IPTV – IPTV
application event handling

**Application event handling: Overall aspects of
personalized IPTV services**



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Recommendation ITU-T H.741.5

Application event handling: Overall aspects of personalized IPTV services

Summary

A personalized Internet Protocol television (IPTV) service is an example of application event handling. With the end-users' permission, service providers are allowed to provide personalized services such as content recommendations, personalized user interfaces, personalized advertisements and some interactive services. The application can be realized based on the existing IPTV architecture to help in providing various kinds of IPTV personalized services (PS).

Recommendation ITU-T H.741.5 studies the requirement of personalized IPTV services and describes several use cases.

History *

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Enhanced interactions, IPTV application, IPTV architecture, IPTV service, personalized service, use cases.

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Recommendation ITU-T H.741.5

Application event handling: Overall aspects of personalized IPTV services

1 Scope

This Recommendation specifies personalized IPTV service, its requirements, lifecycle and use cases. Personalized IPTV service may improve IPTV user activation by optimizing audience experience which can help IPTV service providers to promote the increments of IPTV market shares.

2 References

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

- [ITU-T H.705.1] Recommendation ITU-T H.705.1 (2023), *Layered specification for the IPTV service platform functional architecture based on open service capabilities*.
- [ITU-T Y.1910] Recommendation ITU-T Y.1910 (2008), *IPTV functional architecture*.
- [ITU-T Y.3531] Recommendation ITU-T Y.3531 (2020), *Cloud computing – Functional requirements for machine learning as a service*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere.

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

3.1.2 application event [b-ITU-T H.740]: An application event is every user interaction or occurrence related to multimedia content in the IPTV applications. It includes an emergency event from the event notification services.

3.1.3 content [b-ITU-T T.174]: Encoded generic value, media or non-media data.

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

3.1.5 electronic programme guide (EPG) [b-ITU-T H.721]: A service navigation application that is used especially for scheduled linear programmes.

NOTE – In some traditional broadcast services, EPG is defined as an on-screen guide used to display information on scheduled live broadcast television programmes, allowing a viewer to navigate, select, and discover programmes by time, title, channel, and genre. This traditional definition does not cover "catalogues" for on-demand and download services (sometimes called electronic content guide (ECG), broadband content guide – BCG) and bi-directional interactive service (sometimes called the interactive programme guide – IPG) for end-user interaction with a server or head-end.

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

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

3.1.7 end-user behavioural information [b-ITU-T H.741.0]: A part of an audience measurement information that includes "application events" and/or "end-user context". An "application event" is information reflecting the behaviour of an IPTV service end user. "End-user context" is information relating to the situation when an "application event" was generated.

3.1.8 end-user information [b-ITU-T H.741.0]: "End-user info" is information about an IPTV service end user. It includes "identifying end-user information" and "non-identifying generic user information".

3.1.9 IPTV [b-ITU-T Y.1901]: Multimedia services such as television/video/audio/text/graphics/data delivered over IP-based networks managed to support the required level of quality of service (QoS) / quality of experience (QoE), security, interactivity and reliability.

3.1.10 IPTV terminal device [b-ITU-T Y.1901]: A terminal device that has IPTV terminal function (ITF) functionality such as a set-top box.

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

3.1.12 machine learning [b-ITU-T Y.3172]: Processes that enable computational systems to understand data and gain knowledge from it without necessarily being explicitly programmed.

NOTE 1 – This definition is adapted from [b-ETSI GR ENI 004].

NOTE 2 – Supervised machine learning and unsupervised machine learning are two examples of machine learning types.

3.1.13 machine learning model [b-ITU-T Y.3172]: Model created by applying machine learning techniques to data to learn from.

NOTE 1 – A machine learning model is used to generate predictions (e.g., regression, classification, clustering) on new (untrained) data.

NOTE 2 – A machine learning model may be encapsulated in a deployable fashion in the form of a software (e.g., virtual machine, container) or hardware component (e.g., IoT device).

NOTE 3 – Machine learning techniques include learning algorithms (e.g., learning the function that maps input data attributes to output data).

3.1.14 privacy [b-ITU-T X.800]: The right of individuals to control or influence what information related to them may be collected and stored and by whom and to whom that information may be disclosed.

3.1.15 service [b-ITU-T Y.101]: A structure set of capabilities intended to support applications.

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

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

3.1.18 video-on-demand (VoD) [b-ITU-T Y.1901]: A service in which the end user can, on demand, select and view a video content and where the end user can control the temporal order in which the video content is viewed (e.g., the ability to start the viewing, pause, fast forward, rewind, etc.).

3.2 Terms defined within this Recommendation

This Recommendation defines the following terms:

3.2.1 bullet-screen: Real-time comments such as words, sentences, links to web pages, or even pictures and videos from viewers to fly across the screen like bullets.

3.2.2 feature vector: A digital representation of a set of features, consisting of the feature value and their weights.

3.2.3 personalized IPTV service: A service that refers to providing and recommending programs to users through the collection, collation and classification of user-related information under the premise of obtaining user permission to meet user preferences and needs.

3.2.4 user feature: A set of tags extracted from a user profile, usually composed of keywords that can describe the characteristics of the user.

3.2.5 user tag: An abstract classification and generalization of a user's information property and its value (tag value).

3.2.6 user portrait: A user model with user tags that is abstracted from information such as user information data and behavioural data.

4 Abbreviations and acronyms


This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
EPG	Electronic Programme Guide
IPTV	Internet Protocol Television
ITF	IPTV Terminal Function
QoE	Quality of Experience
QoS	Quality of Service
PS	Personalized Service
VoD	Video-on-Demand

5 Conventions

In this Recommendation:

- The keywords "is required to" indicate a requirement which must be strictly followed, and from which no deviation is permitted, if conformance to this document is to be claimed.
- The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.
- The keyword "functions" is defined as a collection of functionalities. It is represented by the following symbol in the context of IPTV architecture:



Functions

- The keywords "functional block" are defined as a group of functionalities that have not been further subdivided at the level of detail described in this Recommendation. It is represented by the following symbol in the context of IPTV architecture:

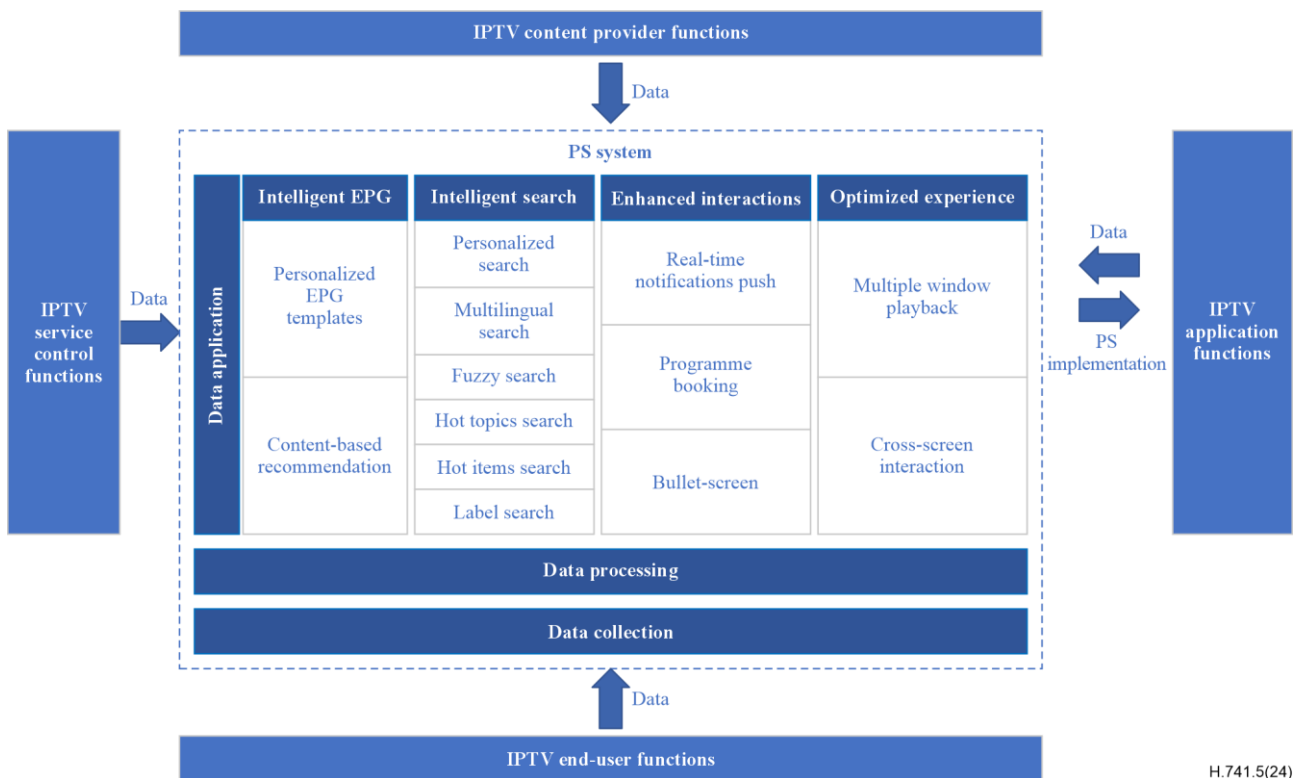
Functional block

NOTE – In the future other groups or other Recommendations may possibly further subdivide these functional blocks.

6 Overview

A personalized IPTV service can provide a special service suitable for the users. By collecting and processing data from IPTV systems, a variety of personalized IPTV applications can be provided. For example, an intelligent electronic programme guide (EPG) showcases different contents for different users. It displays the programmes that users may like in a prominent position so that the users can click and watch it conveniently. Intelligent search can help users quickly retrieve what they want to watch, even when they do not know the search terms. It can also provide enhanced interactions and an optimized experience which can help make the IPTV business more interesting and attractive.

Figure 6-1 provides an overview of the personalized IPTV service system.



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Figure 6-1 – Overview of personalized IPTV service system

The personalized service (PS) system consists of a data collection functional block, a data processing functional block, and a data application functional block.

7 Requirements

7.1 General requirements

A personalized IPTV service has the function to provide various kinds of IPTV personalized services. IPTV architecture with personalized service is called a PS architecture.

- GR-01: The PS architecture is required to display personalized pages for the end-users.
- GR-02: The PS architecture is required to provide programmes with titles, references, genres, keywords, directors, actors, ratings, comments, etc.
- GR-03: The PS architecture is required to display the programmes' rank-ordered lists of different genres.
- GR-04: Considering the different privacy sensitivity of different end-users, the PS architecture is required to provide the option of disabling recommendations.
- GR-05: The PS architecture is required to support the end-users to select recommended content, such as requiring to be recommended to a certain type or shielding to recommend a certain type.
- GR-06: The PS architecture is recommended to support the social networking functions. The PS architecture is recommended to support the end-users to share programmes or comments and follow each other.
- GR-07: The PS architecture is required to support different user modes, such as normal mode, child mode and elder mode.
- GR-08: The PS architecture is recommended to support an external interface application programming interface (API) in order to support advertisers' targeted advertising, social networking sites or applications and third-party data import.
- GR-09: The PS architecture is required to have the authorization function for user data use. The data range available to the system is required to be selected by the end-users.
- GR-10: The PS architecture is required to protect the end-users' information by encryption or desensitization to ensure that the user data is not leaked or tampered with.

7.2 Requirements for IPTV service with PS

- SR-01: The IPTV system with PS is recommended to infer the end-user's interests and preferences and provide the end-user with the most likely interested programmes on the EPG.
- SR-02: The IPTV system with PS is recommended to support the end-user to click on the correspondent hyperlink of every actor's or director's name to go to the details page, which provides a profile of the actor or director and links to all their works.
- SR-03: The IPTV system with PS is required to allow the end-user to subscribe and bookmark the programmes.
- SR-04: The IPTV system with PS is required to allow the end-users to rate the programmes.
- SR-05: The IPTV system with PS is recommended to support the end-users to comment on the programmes. The comments are recommended to be liked, re-commented and shared.

7.3 Requirements for IPTV terminal devices

- TDR-01: IPTV terminal device is recommended to have the function that the end-user can turn on or turn off the personalized IPTV service.
- TDR-02: IPTV terminal device is recommended to have the function of collecting and reporting user operation data, and the end-user can turn on or turn off the notification of the application event with the privacy information.
- TDR-03: IPTV terminal device is required to have the function to generate and notify the application events.
- TDR-04: The terminal equipment is required to have good performance and can support the real-time collection and upload of user data.

7.4 Requirements for IPTV service providers

SPR-01: IPTV operators are required to provide users with detailed privacy policies and descriptive information about data collection and use when requesting user permission, so that users can decide whether to use the personalized services.

7.5 Requirements for IPTV architectures

AR-01: IPTV architecture is recommended to support multiple PS service providers.

AR-02: IPTV architecture is recommended to allow IPTV operators to select their PS service providers.

AR-03: IPTV architecture is recommended to support communication and monitoring of PS functions.

8 IPTV architecture and personalized IPTV service

Figure 8-1 provides the IPTV functional architecture defined in [ITU-T Y.1910] with the enabling of personalized service.

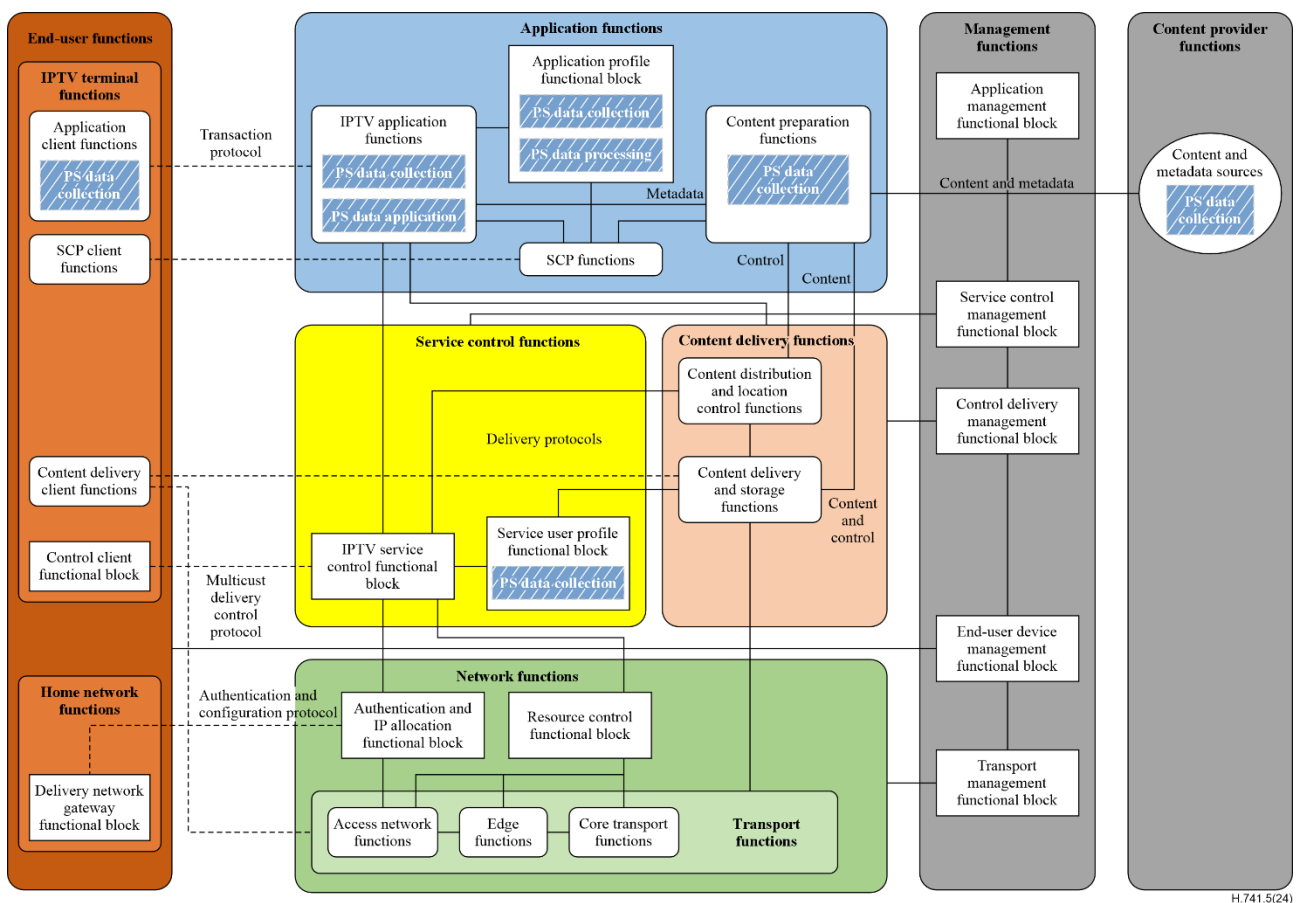


Figure 8-1 – IPTV with personalized service architectural overview as per [ITU-T Y.1910]

Based on the IPTV function architecture defined in [ITU-T Y.1910], the PS data collection functional block, the PS data processing functional block and the PS data application functional block are added to realize IPTV with personalized service architecture.

The PS data collection functional block is added to the application client functions, the IPTV application functions, the application profile functional block, the content preparation functions, the service user profile functional block, and the content and metadata source to collect the relevant data used by PS.

The PS data processing functional block is added to the application profile functional block to process the data collected by the PS data collection functions.

The PS data application functional block is added to the IPTV application functions to implement the IPTV personalized service.

For detailed information on the layered architecture of the IPTV service platform, please refer to [ITU-T H.705.1].

8.1 Data collection

Data collection gathers raw data, including that which is structured, unstructured, and semi-structured (see clause 6.2 of [ITU-T Y.3531]). Data on programs and users will be collected and used as the basis for the entire system.

The data collection functional block can collect data in the following modules of the IPTV architecture refer to Figure 8-1:

- Application client functions in end-user functions
- IPTV application functions in application functions
- Application profile functional block in application functions
- Content preparation functions in application functions
- Service user profile functional block in service control functions
- Content and metadata sources in content provider functions

8.2 Data processing

Since raw data is generally cluttered, duplicated, and incomplete, it must be processed to apply to machine learning models and tools. Data processing handles data to improve machine learning performance or create meaningful information from data (see clause 6.2 of [ITU-T Y.3531]). Data on programmes and users will be processed and serve as inputs for a personalized algorithm model.

After data processing, programme portrait and user portraits will be obtained. Based on the programme portrait, programme feature attributes and feature vectors can be constructed. Similarly, the feature attributes and feature vectors of the user can be obtained.

The data processing functional block can be embedded in the application profile functional block in the application functions of the IPTV architecture (see Figure 8-1).

8.3 Data application

Data application provides users with a variety of personalized applications, which can effectively improve the user experience. Data application includes intelligent EPG, intelligent search, enhanced interactions, and optimized experience. The data application functional block can be embedded in the IPTV application functions of the IPTV architecture, see Figure 8-1.

9 Personalized IPTV service lifecycle

The personalized IPTV service lifecycle consists of four stages:

- 1) Obtain permission from the end-user and the IPTV service provider:
 - a) The end-users turn on the service actively.

- b) The IPTV service provider has turned on the service and received permissions from the end-users.
- 2) Data collection functional block collects and stores data.
- 3) Data processing functional block processes and computes data:
 - a) Building programme portraits based on the programmes' information data.
 - b) Building programme features vectors based on the programme portraits.
 - c) Building user portraits based on user data.
 - d) Building user features vectors based on the user portraits.
- 4) Data application functional block implements the personalized service.

Figure 9-1 illustrates the personalized IPTV service lifecycle.

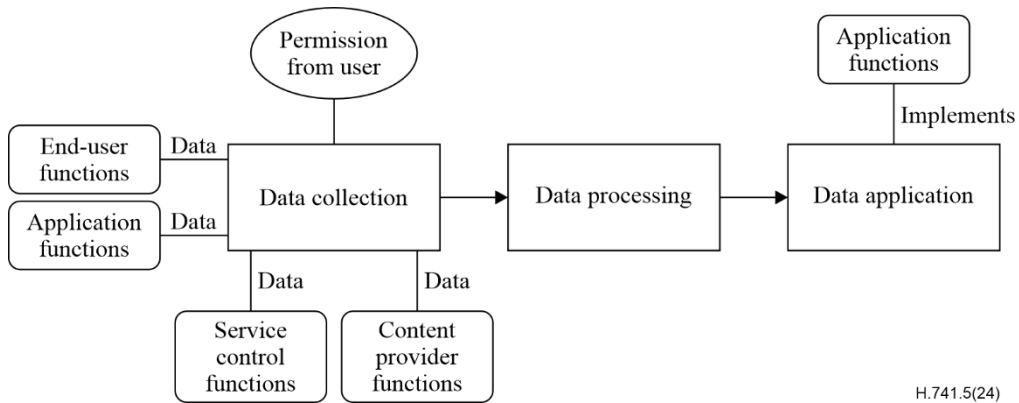


Figure 9-1 – Personalized IPTV service lifecycle

Appendix I

Use cases for personalized IPTV service

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

I.1 Intelligent EPG

Intelligent EPG is not only a traditional electronic program guide service but also a portal for audiences to enter digital TV. With the growth of interactive TV and value-added services, EPG is no longer based on simple tabular programme introductions, but a complete set of electronic programme operational systems.

The intelligent EPG should support the following functions:

- Multidimensional EPG information: users can quickly find their favourite programmes and content through different types of tags.
- Abundant EPG information: users can see more detailed data on TV programmes, such as posters, directors, guests, and other information.
- Diversified EPG interaction functions: such as collection, appointment, comment, sharing, etc.
- Personalized EPG information: different EPG interfaces are presented for different users.

I.1.1 Personalized EPG templates

Through visual editing tools, operators can design and adjust an EPG.

Taking the user terminal as an example, the system uses the terminal grouping function to perform service diversion for users. The terminal grouping calculation conditions include a terminal version number, region, IP number segment, purchased products, user equipment label, source of user, etc. One terminal group binds one service number. The service number is used to represent terminal services. Terminal services can include a home page recommendation UI interface, media asset classification interface, channel list, product ordering, black and white media asset list, etc. The service number realizes service inheritance and customization through a tree structure. That is, a main service number can contain multiple sub-services. Each sub-service inherits all the contents of the service at the previous level and carries out personalized customization according to the characteristics of the sub-service at the current level.

- Calculate the terminal group through the user's attributes after the user terminal is powered on. Then find the corresponding service number or sub-service number.
- Obtain service data through this service number or sub-service number to complete UI rendering and service processes.
- For the new service number, if it is a sub-service and there is no configuration data for it, the parent service data will be automatically searched up and the terminal service will be automatically inherited.
- When the new service number and the sub-service number are inherited, the contents can be adjusted from another user group according to the similarity. The sum of the weights of all the parties to a new parent service number is 100%, and the sum of the weights of all the parties to a new sub service number is 100%, which is the difference between the inherited part and the parent service number.
- Integrate all the contents for the new service number or sub service number.

Figure I.1 illustrates the process of personalized EPG templates.

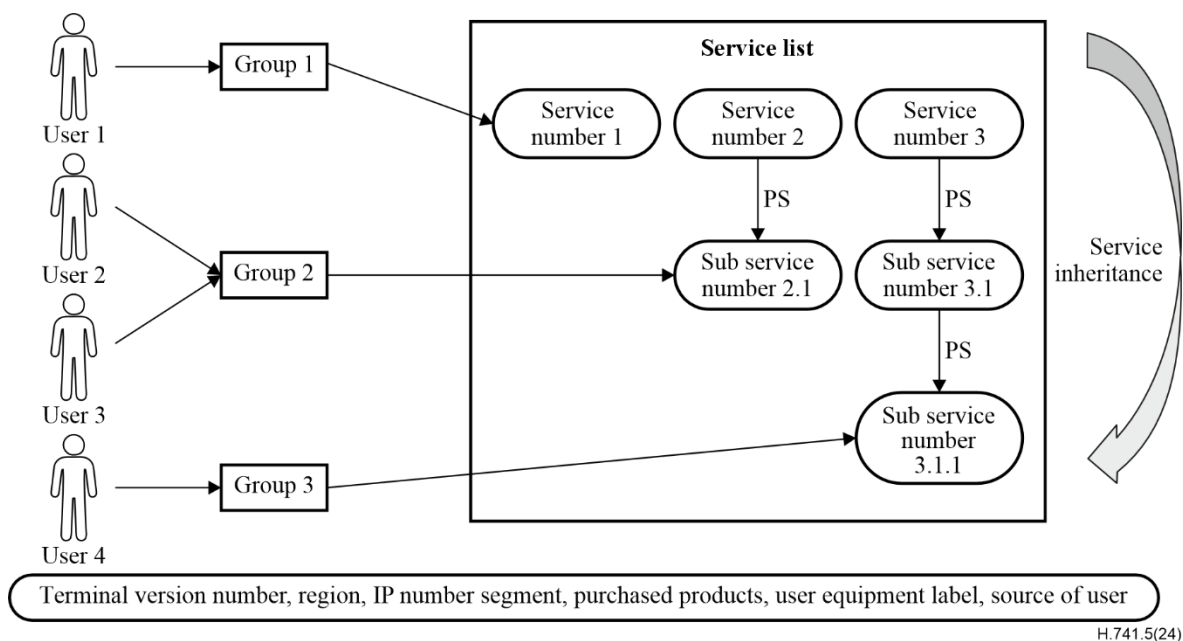


Figure I.1 – Process of personalized EPG templates

I.1.2 Content-based recommendation

- Intelligent recommendation of liner TV: The system can recommend channels for users at different time intervals based on the live schedule and the tags associated with the programme according to the users' preferences.
- Intelligent recommendation of video-on-demand (VOD): The user portrait is formed through the user's viewing preferences. Personalize the content on the home page, column page, details page, and other recommendation sites. The system can customize fixed recommendation bits and personalized recommendation bits through backstage configuration and can also automatically create guessing columns according to the different user behaviours and hobbies.
- Liner TV to VOD recommendation: The system may recommend the relevant VOD content according to the liner TV content such as actors, directors, friends, etc.
- Association recommendation: When users are watching liner TV or VOD programmes, the system can intelligently recommend the advertisements associated with the programme and achieve one click jump.
- Hotspot recommendation: By collecting and analysing the user's popular VOD video content or popular actors, directors and other data, the system recommends users with different dimensions of video programmes in real time, such as popular content (Top 10 of popular movies), popular actors (Top 10 of popular actors), and popular directors (Top 10 of popular directors), so that users can quickly find real-time popular content.
- Group recommendation: The system supports the division of users into groups to achieve differentiated push services for users in different groups.
- Manual intervention recommendation: The system supports manual intervention on the recommended content, manual content filtering for dimensions such as programme time, type, theme, etc., and the introduction of algorithm models to achieve programme content recommendation. The manual intervention recommendation content supports the page presentation in a visual framework and supports the weight setting.

I.2 Intelligent search

I.2.1 Personalized search

The PS architecture (in the following, 'The system' is used instead of 'The PS architecture') can support mining users' search preferences, group users based on different preferences, and recommend search keywords with similar tastes which can help users quickly find the content they might be interested in or want to search for.

I.2.2 Multilingual search

The PS architecture supports multilingual search. The search box supports multi-language input, and the system returns the results based on the entered languages.

I.2.3 Fuzzy search

The PS architecture supports the fuzzy matching of keywords by the initial input. When the user enters an initial letter, the EPG displays a drop-down list that meets the requirements for the user to select.

I.2.4 Hot topics search

To improve search efficiency, the PS architecture provides hot topics for users to select and search.

I.2.5 Hot items search

The PS architecture provides search suggestions for TOP 10 popular movies and TOP 10 popular actors under the search box. When users cannot determine the search keywords, they can click the keywords of hot items to search.

I.2.6 Label search

The PS architecture supports users to use labels to search for content such as romance, comedy, action and so on. When users do not know what content they want to see, they can quickly find the content they want to see by clicking the label.

I.3 Enhanced interactions

I.3.1 Real-time notifications push

The PS architecture supports real-time notifications push. The system supports setting the response level and push the scope for the notifications. The notifications support graphic displays and skip links.

The notifications include the following types:

- Series reminder: the system supports prompting users to watch when there is an update of the series they are following.
- Marketing activities' tips: the system supports notifying users to participate when the system has activities suitable for them.
- Product recommendation: the system supports recommending paid products based on the user preferences.
- Payment notice: when the user is in arrears, the system can timely remind them.
- Homepage pop-ups: when the users enter the home page, the message pop-ups will be displayed. The message pop-ups can be configured in the system. The home page pop-up is forcibly displayed and will not be closed automatically. Users need to manually click the OK button to close it. For each batch of reminder messages, the user sees and clicks OK, and the pop-up is regarded as known to the user, and the system will not pop up for this user in the current reminder period.

I.3.2 Programme booking

- Liner TV: When users enter the list of liner TV channels and select programmes that have not been broadcast, a window will pop up to ask whether to set a reminder. Users can add more than one programme reminder and can manage the reminder time in the personal settings.
- VOD: For the upcoming new series or popular dramas, users can use the booking function to realize the pop-up reminder of the new series launch or the launch of popular video content. For videos that users prefer, the system will automatically remind users to watch when there are updates to the videos.

I.3.3 Bullet-screen

The PS architecture supports bullet-screen. Users can choose to enter an internal video or an external video link.

If an IPTV internal video is selected as a bullet-screen, when the user clicks the bullet-screen, the video referred to by the bullet-screen will be played on the current video in the form of a picture in the picture. Users can open multiple bullet-screen videos at the same time, realizing multi-channel video playing in picture-in-picture mode. And the main video and the picture-in-picture video can be switched.

If the external video link is selected as the bullet-screen, when the user clicks the bullet-screen, the prompt link will jump out, and the user can jump to the video address outside the station pointed by the bullet-screen.

I.4 Optimized experience

I.4.1 Multiple window playback

Multi window playback provides users with the function of watching multiple videos at the same time. It provides great convenience for users to monitor the video of multiple channels or compare the different videos.

Multiple playback windows can be arranged in a variety of ways, including tiling windows, overlapping different size windows, etc. The video of each window can be exchanged.

The first way to realize the live broadcast multi window function is to integrate different live broadcast channels into the same video stream. In this way, the TV screen is divided into different small screens to display the live broadcast content independently. This function needs to be supported by the headend device or set-top box.

The second way to realize the live broadcast multi window playing function is to decode multiple live video streams simultaneously through the set-top box. In this way, the TV screen is divided into different small screens to display the live broadcast content independently. This feature requires set-top box support.

I.4.2 Cross-screen interaction

Add favourites cross-screen: Users can add, delete, and manage the favourites folder after logging in with a unified account at different terminals. The system allows the users to browse and delete the favourites list at different terminals and takes effect after logging in at different terminals.

Breakpoint continuation cross-screen: After the same user logs in to different terminals, the video content that has not been watched at different terminals can be played at the location of the unfinished movie. The system allows the users to browse and delete the continuation history list at different terminals and takes effect after logging in at different terminals.

Social sharing: Users can share their watching or favourite film and television content with others through social platforms.

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