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International Telecommunication Union
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Recommendation

ITU-T H.705.1 (09/2023)

SERIES H: Audiovisual and multimedia systems

IPTV multimedia services and applications for IPTV – General aspects

Layered specification for the IPTV service platform functional architecture based on open service capabilities

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Recommendation ITU-T H.705.1

Layered specification for the IPTV service platform functional architecture based on open service capabilities

Summary

Recommendation ITU-T H.705.1 describes a layered architecture of Internet protocol television (IPTV) service platform intended to provide open service capabilities for diversified IPTV services. In comparison with the high-level IPTV functional architecture defined in Recommendation ITU-T Y.1910, the layered architecture decouples service logic from data resources and decomposes the functions of the IPTV service platform into more granular modules. This Recommendation specifies the fine-grained functional modules and reference points, by considering the aspects of service offering and operational management. It also defines typical procedural flows on content preparation, service presentation and content consumption in appendices.

This Recommendation provides a reference for IPTV service providers to construct the open platform of IPTV services and enables automatic deployment and fast iteration of multimedia applications in the platform. It is of benefit in promoting the service capability of IPTV and further enhances user experience on using diversified IPTV services.

History [*]

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T H.705.1	2023-09-13	16	11.1002/1000/15633

Keywords

Fine-grained service module, IPTV, IPTV service platform, layered architecture.

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Layered specification for the IPTV service platform functional architecture based on open service capabilities

1 Scope

This Recommendation describes a layered specification for the functional architecture of the Internet protocol television (IPTV) service platform intended to provide IPTV services with open service capabilities based on IPTV service requirements [b-ITU-T Y.1901] and architecture framework [ITU-T Y.1910]. It addresses detailed functional requirements that are not considered in the IPTV functional architecture. Starting from a general description of a horizontal layered structure, this Recommendation specifies service-oriented modules and interfaces that provide more granular definitions for the IPTV service platform.

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.644.3] Recommendation ITU-T H.644.3 (2020), *Functional architecture of multimedia content delivery networks*.

[ITU-T H.644.5] Recommendation ITU-T H.644.5 (2022), *Functional architecture of content request routing service in multimedia content delivery networks*.

[ITU-T H.721] Recommendation ITU-T H.721(V3) (2022), *IPTV terminal devices: Basic model*.

[ITU-T H.741.5] Recommendation ITU-T H.741.5 (2024), *Overall aspects of personalized IPTV service*.

[ITU-T H.750] Recommendation ITU-T H.750 (2008), *High-level specification of metadata for IPTV services*.

[ITU-T H.751] Recommendation ITU-T H.751 (2013), *Metadata for rights information interoperability in IPTV services*.

[ITU-T H.752] Recommendation ITU-T H.752 (2015), *Multimedia content provisioning interface for IPTV services*.

[ITU-T H.753] Recommendation ITU-T H.753 (2019), *Scene-based metadata for IPTV services*.

[ITU-T H.760] Recommendation ITU-T H.760 (2009), *Overview of multimedia application frameworks for IPTV services*.

[ITU-T H.770] Recommendation ITU-T H.770 (2015), *Mechanisms for service discovery and selection for IPTV services*.

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

[ITU-T Y.2019] Recommendation ITU-T Y.2019 (2010), *Content delivery functional architecture in NGN*.

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 service [b-ITU-T T.174]: A set of functions provided by a (server) software or system to a client software or system, usually accessible through an application programming interface.

3.1.3 metadata [b-ITU-T Y.1901]: Structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment, and management of the described entities.

3.1.4 application programming interface (API) [b-ITU-T Y.110]: This is an implementation interface between equipment and a software module and does not have any physical realization as it is internal to the equipment.

3.1.5 content delivery [b-ITU-T Y.2080]: In the context of the distributed service networking (DSN) functional architecture, the operation of sending and receiving content between the requested peer and the requesting peer or client.

3.1.6 content distribution [b-ITU-T Y.2080]: In the context of the distributed service networking (DSN) functional architecture, the whole process of content sending from one or more content sources, and sharing among DSN nodes.

3.1.7 Internet protocol television (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 QoS/QoE, security, interactivity and reliability.

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

3.1.9 reference point [b-ITU-T Y.2012]: A conceptual point at the conjunction of two non-overlapping functional entities that can be used to identify the type of information passing between these functional entities.

NOTE – A reference point corresponds to one or more physical interfaces between pieces of equipment.

3.1.10 service navigation [b-ITU-T H.720]: The process of presenting information that allows the end-user to discover, select and consume services.

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

3.1.12 user interface (UI) [b-ITU-T F.902]: Software and hardware components through which a user can interact with a system.

3.1.13 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 in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AMS Audience Measurement Service
APCS Access Permission Control Service
API Application Programming Interface
APMS Application Profile Management Service
BCMS Broadcast Content Metadata Service
BCPS Broadcast Content Processing Service
BTSS Back-To-Source Service
CAAS Charging And Accounting Service
CAS Content Acquisition Service
CAS Content Authorization Service
CCSS Content Consumption Statistic Service
CDCS Content Delivery Configuration Service
CDMS Content Distribution Management Service
CDS Content Distribution Service
CMS Cast Metadata Service
CPAS Content Protection Authorization Service
CPCS Content Processing Control Service
CPPS Content Pre-Processing Service
CPRS Content Popularity Ranking Service
CPS Content Protection Service
CRM Customer Relationship Management
CRS Content Rating Service
CSS Content Searching Service
DASH Dynamic Adaptive Streaming over HTTP
HTTP Hypertext Transfer Protocol
IPTV Internet Protocol Television
MAFR Multimedia Application Framework
MCDS Multicast Content Delivery Service
MPPS Metadata Post-Processing Service
NCMS Navigation Category Metadata Service
PMS Picture Metadata Service
PRS Personalized Recommendation Service
QoE Quality of Experience
QoS Quality of Service
RTSP Real-Time Streaming Protocol

SAMS Service/Application Metadata Service

SCSS Service/Content Subscription Service

SMS Session Management Service

SPMS Service/content Package Management Service

TD Terminal Device

UAS User Authentication Service

UCDS Unicast Content Delivery Service

UECSS User Events Collecting and Sharing Service

UI User Interface

UITMS UI Template Management Service

UPMS User Profile Management Service

URL Universal Resource Locator

URSS User Request Scheduling Service

VCMS VoD Content Metadata Service

VCPS VoD Content Processing Service

VOD Video On Demand

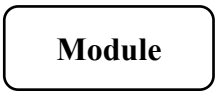
VR Virtual Reality

5 Conventions

In this Recommendation:

Layer: In the context of IPTV service platform layered architecture, "layer" is defined as a functional tier with a collection of modules. It is represented by the following symbol:

Module: In the context of IPTV service platform layered architecture, "module" is defined as a collection of functionalities. It is represented by the following symbol:



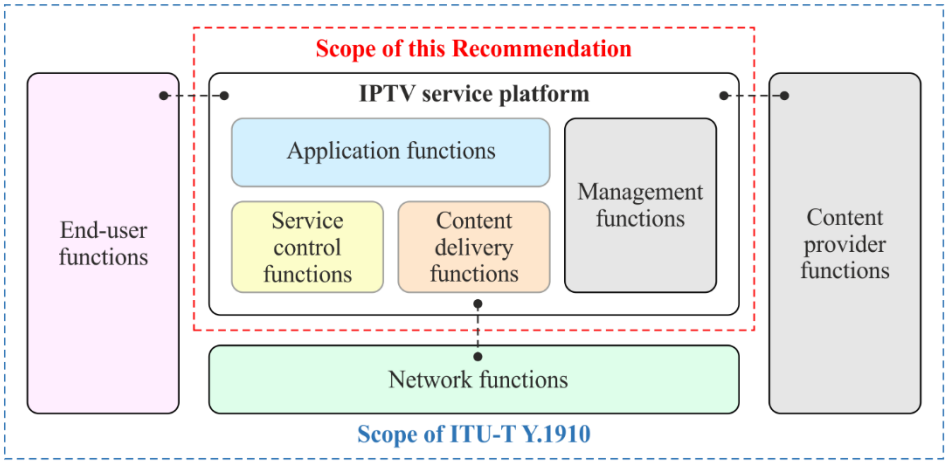
Fine-grained service module: In the context of IPTV service platform layered architecture, "service module" is defined as a group of functionalities that cannot be further subdivided at the level of detail in this Recommendation. It is represented by the following symbol:

6 Overview

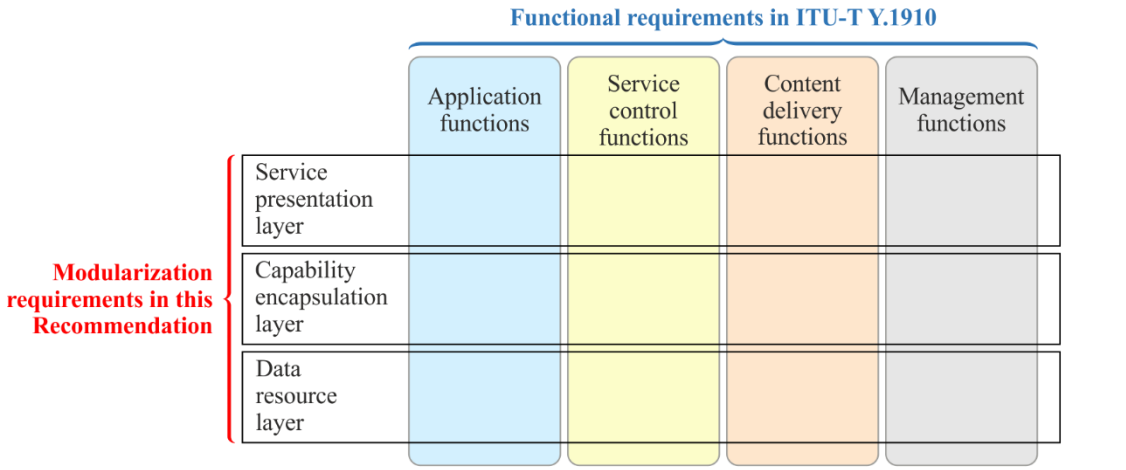
This Recommendation intends to comply with the existing technical framework of IPTV recommendations and to introduce a new architecture approach to the IPTV service platform, which further breaks down the functions or functional blocks defined in [ITU-T Y.1910] into a horizontal layered structure and more fine-grained modules, and aims at user experience enhancement from

the platform point of view. It intends to be a supplement of platform functional architecture to [ITU-T Y.1910] and provides references for open platform construction.

Figure 1 presents the relationship between [ITU-T Y.1910] and this Recommendation. This Recommendation mainly focuses on four functions defined in [ITU-T Y.1910] and further puts forward their modularization requirements in order to facilitate the scalability and performance of IPTV services. How these functions are mapped into physical entities is out of the scope of this Recommendation. Other functions, such as end-user functions, content provider functions and network functions, can be seen as external functions to the IPTV service platform in this Recommendation. The interfaces between the IPTV service platform and external functions, as shown in Figure 1, are kept aligned with [ITU-T Y.1910].



a) Research scope on functions (From definition of Recommendation ITU-T Y.1910)



b) Research scope on technical requirements

Figure 1 – Relationship between [ITU-T Y.1910] and this Recommendation

This Recommendation manages to achieve the following objectives:

– To separate data storage from business logic enabling either resource access or service functions to be expand on-demand horizontally.

– To decompose functional blocks of [ITU-T Y.1910] realizing the encapsulation in units of service capability for fast iteration and automatic deployment of new application functions.

– To discuss the definition of service capabilities considering all possible scenarios in IPTV services.

– To take into account security design and operational requirements including emergency, log, etc.

7 Layered architecture

Figure 2 provides an overview of the layered architecture of IPTV service platform. In this figure, the rectangular areas represent functional layers in IPTV service platform layered architecture. The rounded rectangular blocks represent the functional modules or particular grouping of modules, and the dotted lines represent logical associations between functional modules.

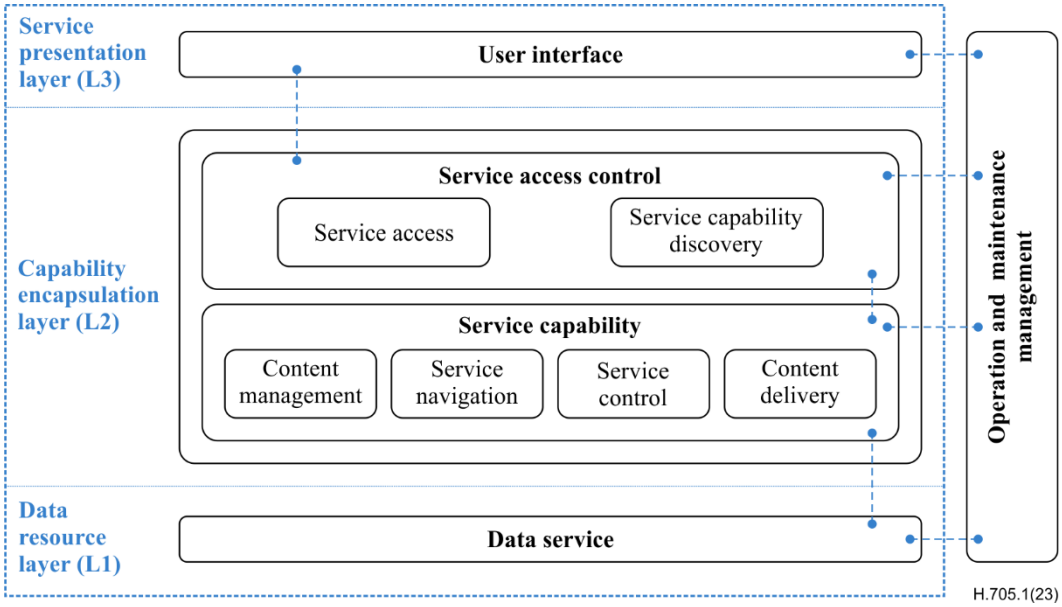


Figure 2 – Layered architecture of IPTV service platform

The following clauses give a general description of functional layers and functional modules. A detailed breakdown of modules is further illustrated in clause 8.

7.1 Service presentation layer (L3)

The service presentation layer provides graphical user interface (GUI) or presentation capability needed by GUI for all kinds of IPTV terminal devices defined in the ITU-T H.72x series of Recommendations [b-ITU-T H.72x].

This layer acquires data required by the IPTV services presentation from the service access module in the capability encapsulation layer.

7.1.1 User interface

User interface modules in this layer present organized IPTV services and contents and react to user interactions, either in web-based or application-based presentation mode.

7.2 Capability encapsulation layer (L2)

The capability encapsulation layer isolates the upper applications from the underlying resources. In this Recommendation, applications for IPTV services are split into a set of fine-grained and collaborating services. Services are mutually independent and the flexible combination of them is used to meet the various business requirements of the upper applications.

This layer acquires data required by the service offering from data resource layer (L1) and responds to all the requests for service invocation of IPTV.

7.2.1 Service access control

Service access control modules in this layer execute routing functionalities for service invocation.

7.2.1.1 Service access

Service access modules aggregate all access to the backend services and act as the single entry point into the IPTV service platform. This module is responsible for distributing requests across the available services under cooperation with the service capability discovery module. It also manages authentication, access control, load balancing and caching.

7.2.1.2 Service capability discovery

The service capability discovery module is essential for the dynamical changes of service capabilities. It is responsible for determining service availability by handling the registration/deregistration, managing the service registry containing network location information and performing health checks of service instances.

7.2.2 Service capability

Service modules in this layer are built around business capabilities of IPTV services. Each service module enables a set of distinct features or functionality by encapsulating business logic, computation, data access and other capabilities. Each service module only exposes application programming interfaces (API) to the service access module for capability invocation by any other services or application's clients.

From the implementation complexity point of view, services can be formed in two levels:

– Basic services: simple abstraction of service capabilities to enable basic functionalities of IPTV services, such as media playback functionality.

– Advanced services: complicated abstraction of service capabilities by orchestrating one or more basic services to enable extended functionalities of IPTV services, such as content ranking functionality.

From the functionality point of view, services can be divided into four categories, as shown in Figure 2.

7.2.2.1 Content management service

Content management service modules perform content aggregation, content life-cycle management, metadata processing and content pre-processing.

7.2.2.2 Service navigation service

Service navigation service modules provide metadata of IPTV services and contents required by service navigation.

7.2.2.3 Service control service

Service control service modules perform access control to network and service resources, including registration, authentication, authorization, subscription and other capabilities.

7.2.2.4 Content delivery service

Content delivery service modules provide content processing and content delivery functionalities for IPTV end users, with the aid of service control and network resource allocation.

7.3 Data resource layer (L1)

The data resource layer provides data storage and data serving capabilities for IPTV services. It supports diverse kinds of storage technology to meet different requirements of data reading and writing from the upper layer, such as database, cache, file system, etc.

This layer only expose interfaces to L2 modules for efficient and secure data service.

7.3.1 Data service

Data service modules in this layer provide data storage and data access solutions for massive data of IPTV services. IPTV data can be divided into content metadata, media, user data, operational data and so on.

7.4 Operation and maintenance management

The operation and maintenance (O&M) management module performs overall configuration and management for achieving securely operating and intelligent maintenance of IPTV services. This module does not include the functionalities that are provided by functional modules (L2) in the user plane.

8 Functional description of user interface

The user interface (UI) module provides the presentation of IPTV services and contents for all kinds of IPTV terminal devices and responds to the end user's requests for discovery, selection and consumption of services and contents.

This module is responsible for the deployment of UI templates and/or multimedia applications [ITU-T H.760] from content providers or service providers, which contain the layout and orchestration information of user interface and business logic of service presentation. It is also responsible for presenting IPTV services and contents by acquiring service-related metadata and content-related metadata from service access modules. For MAFR-based presentation mode, this module distributes multimedia application framework (MAFR) applications of IPTV services to the MAFR engines. For application-based presentation mode, this module distributes metadata as well as rules or constraints of UI framework and business logic to the application-based clients.

This module supports user interactions by means of remote controller, touch control, gesture control, voice control, etc.

9 Functional description of service access control

9.1 Service access

9.1.1 Request routing

The request routing module handles all the incoming requests for invoking service capability of IPTV service platform and routes them to the appropriate service instances. It checks the routing criteria and service monitoring data acquired from the service capability discovery module, determines the routing to a particular service instance, and directs the request to the targeted service's API. It authenticates the requests before routing and implements API mapping between the client's request and backend service, according to the API invocation rules. It performs load balancing functionality based on service monitoring data. This module provides support to simply proxy the requests to each service, it also provides support to invoke multiple service modules and aggregate the results.

9.1.2 Flow control

The flow control module controls the flow of access requests for service invocation so as to ensure IPTV service platform working in a highly secure and available way. It provides rate limiting functionality to deal with burst traffic, abnormal access or other emergencies. It also provides configuration functionality for flow control policies.

9.1.3 Communication protocol translation

The communication protocol translation module is responsible for translating the protocols between the consumers of the APIs (i.e., service modules in L2, user interface modules or external functions) and the providers of APIs (i.e., service modules in L2), which enables the clients to communicate directly with the services.

9.2 Service capability discovery

9.2.1 Service registration/deregistration

The service registration/deregistration module handles the registration or deregistration requests from fine-grained service modules in IPTV service platform and maintains the service registry. Service instance on start is required to be registered and service instance on shutdown is required to be unregistered in the service registry. This module reviews the registration request and assigns an identify for each start-up service. It is also responsible for updating the registration information in the case of service change (e.g., instance termination). The service registry is a database containing dynamic information of the available service instances, including service identify, the number of instances, and locations (i.e., IP address/port). It provides data querying capability to the service access module for service capability discovery.

9.2.2 Routing criteria configuration

The routing criteria configuration module handles the requests for the statement of capabilities from the registered services and configures the routing criteria for each service. This module acquires and reviews the information of APIs stated by the service. It configures the routing criteria concerning the service and the validated APIs. The routing criteria contains the mapping information between the service and its APIs as well as the API invocation rules between this service and other services. This configuration will be made when any one of the service, service APIs or invocation rules change and the latest configuration will be conveyed to the service access module for request routing.

9.2.3 Service monitoring

The service monitoring module performs health checks and performance monitoring to the registered service instances for the purpose of verifying whether it is able to handle requests. It supports mechanisms to periodically convey the running state of service instances to the service access module, and service registration/deregistration module.

10 Functional description of service capability

10.1 Content management service

The content management service is comprised of service modules with distinct features or functionality on content management. Figure 3 provides the modular structure of the content management service. The rectangular area in white represents content management service capabilities in basic level, and the rectangular area in grey represents content management service capabilities in advanced level. As shown in this figure, service modules across the white area and grey area have content management service capabilities in basic level and advanced level.

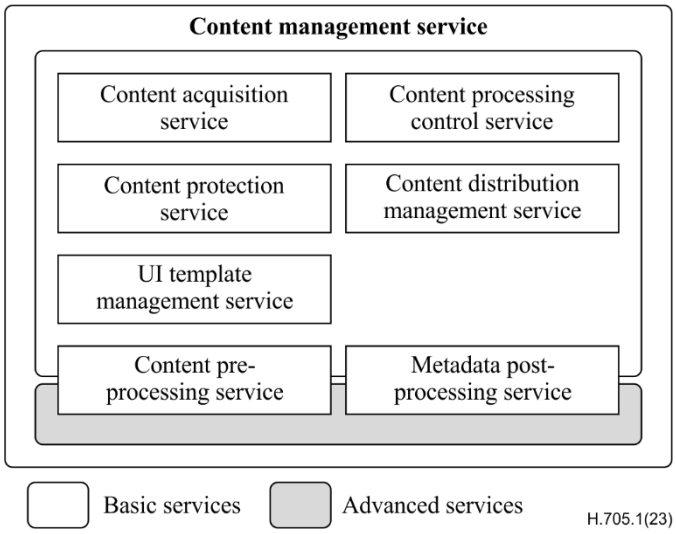


Figure 3 – Modular structure of content management service

The following clauses provide descriptive texts for fine-grained service modules of the content management service.

10.1.1 Basic services

10.1.1.1 Content acquisition service

The content acquisition service (CAS) module controls the acquisition and aggregation of content and metadata sources from content provider functions. The content and metadata sources include content sources, metadata sources, and content protection rights sources for IPTV services. This service module can optionally provide verification functionality for the contents, such as the validity of content source, normalization of source data, conformance between source content and source metadata, conformance between source content and existing content, etc. It provides the capability of content buffering before the final deployment as well as relevant metadata updates.

For detailed information on the content provisioning interface, please refer to [ITU-T H.752]. For detailed information on metadata of IPTV services, please refer to [ITU-T H.750].

10.1.1.2 Content processing control service

The content processing control service (CPCS) module controls the processing tasks of content adaptation such as transcoding, packaging, editing and other capabilities, in compliance with commercial agreements with content providers. This service module manages content pre-processing service modules within the content management service or content delivery service.

10.1.1.3 Content pre-processing service

The content pre-processing service (CPPS) module performs media content processing under the control of content processing control service modules and generates the processed content and content-related metadata. This service module provides all or some of the following capabilities:

– Content transcoding: Content transcoding performs the encoding and decoding to media content to achieve bandwidth efficiency and adaptive quality of service (QoS), such as conversions in compression format, aspect ratios, resolution, bit rate, frame rate, etc.

– Content packaging: Content packaging performs the selection and combination of multiple items of content into a specific content to achieve the provision of IPTV service on multiple terminal devices or for user preferences, such as packaging a content for diverse transport protocols (e.g., RTSP/HTTP/DASH), packaging a content with different subtitles/audio tracks, etc.

– Content editing: Content editing provides the basic capabilities of media editing for enhanced audio-visual perception, such as slicing, captioning, clipping, colour rendering, audio synthesis, advertising-insertion, logo-insertion, keyframe extraction, etc.

10.1.1.4 Content protection service

The content protection service (CPS) module controls the protection of the content in compliance with commercial agreements with content providers and generates the protected content and security-related metadata. It provides keys, performs content encryption and manages the keys for content encryption and decryption. It also provides watermark-embedding functionality for content tracing.

For detailed information on rights-related metadata, please refer to [ITU-T H.751].

10.1.1.5 Metadata post-processing service

The metadata post-processing service (MPPS) module controls the aggregation of content-related metadata, before delivering to content distribution management service modules. This service module provides all or some of the following capabilities:

– Metadata supplement: Metadata supplement complements the missing information in the original metadata (derived from CAS modules, see clause 10.1.1.1), such as the obvious information of title, genre, synopsis or cast.

– Metadata consolidation: Metadata consolidation performs metadata replacement, correlation or consolidation between the original metadata (derived from CAS modules, see clause 10.1.1.1) and the processed metadata (derived from CPCS or CPS modules).

10.1.1.6 UI template management service

The UI template management service (UITMS) module controls the acquisition, configuration and deployment of UI templates. It acquires UI templates from service providers by means of API transmission or local upload. It provides the capability of information configuration concerning the UI template, such as service provider, version, matchable user type, etc. It also controls the deployment of UI templates into user interface modules and data backup into data service modules.

10.1.1.7 Content distribution management service

The content distribution management service (CDMS) module controls the distribution and deployment of the contents. It controls the deployment of content and metadata into data service modules, in order to form the completed content repository for IPTV service. It also controls the distribution of appropriate content and metadata to service navigation service modules, service control service modules and content delivery service modules for content preparation, through pre-defined distribution policies.

The CDMS module provides configuration capability for content distribution policies. It is recommended to distribute content and metadata to content delivery service modules, service control service modules and service navigation service modules in order, so that the content presented on UI are available for end users. In order to ensure the validity and consistency of metadata among different service modules, this service module has the ability of handling exceptional cases in content distribution procedure, such as applying a retry or rollback mechanism. Further information for metadata manipulation is listed in Annex A.

10.1.2 Advanced services

10.1.2.1 Content pre-processing service

Besides the descriptions in clause 10.1.1.3, this service module further provides the following capability:

– Content editing: Content editing provides the advanced capabilities of media editing for augmented or personalized user experience, such as video frames insertion, video super-resolution, scene-based media editing, personalized trailer editing, etc., optionally by using machine learning technology.

10.1.2.2 Metadata post-processing service

Besides the descriptions in clause 10.1.1.5, this service module further provides all or some of the following capabilities:

– Label metadata optimization: Label metadata optimization generates more fine-grained labels of the contents for presentation in elaborate categories or personalized user interface, such as custom genre labels.

– Metadata backwards supplement: Metadata backwards supplement collects complementary information of content-related metadata from other service modules, such as content popularity information through audience measurement.

10.2 Service navigation service

The service navigation service is comprised of service modules with distinct features or functionality on service navigation. Figure 4 provides the modular structure of the service navigation service. The rectangular area in white represents service navigation service capabilities in basic level, and the rectangular area in grey represents service navigation service capabilities in advanced level. As shown in this figure, service modules across the white area and grey area have service navigation service capability in basic level and advanced level.

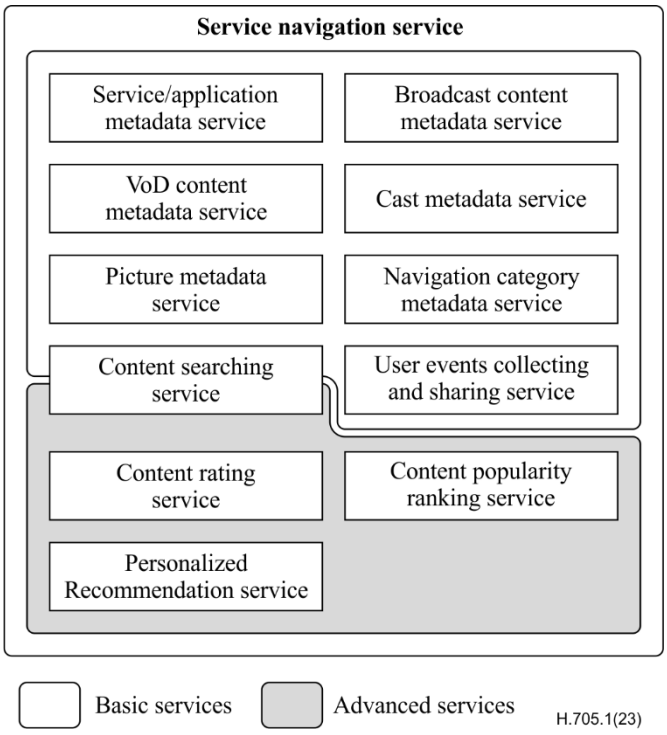


Figure 4 – Modular structure of service navigation service

The following clauses provide descriptive texts for fine-grained service modules of the service navigation service.

10.2.1 Basic services

10.2.1.1 Service/application metadata service

The service/application metadata service (SAMS) module provides service or application related metadata required by service discovery and selection. Service/application metadata contain the descriptive information on service providers, content providers, service packages, software packages, etc.

For detailed information on service discovery and selection, please refer to [ITU-T H.770].

10.2.1.2 Broadcast content metadata service

The broadcast content metadata service (BCMS) module provides content metadata required by service navigation of IPTV broadcast services. It supports various forms of broadcasting services including linear TV (with trick mode), virtual reality (VR) broadcast, live advertising, on-line learning, etc. Broadcast content metadata contain the descriptive information on linear TV channels, TV schedules, live videos, broadcast streams, etc. In response to user interface modules for content presentation, this service module is capable of providing broadcast content metadata of a particular channel/live video or a particular group of channels/live videos matching the filtering rules (e.g., linear TV channels in high-definition).

10.2.1.3 VoD content metadata service

The VoD content metadata service (VCMS) module provides content metadata required by service navigation of IPTV on-demand services. It supports various forms of on-demand services including TV programs, personal recorded videos, on-demand advertising, music videos, etc. Video content metadata contain the descriptive information on movies, TV series, videos, video streams, etc. In response to user interface modules for content presentation, this service module is capable of providing video content metadata of a particular video on demand (VoD) or a particular group of VoDs matching the filtering rules (e.g., movies in historical genre).

10.2.1.4 Cast metadata service

The cast metadata service (CMS) module provides metadata of cast members relevant to IPTV contents. Cast metadata contain the descriptive information on cast roles, personal profiles, etc. In response to user interface modules, this service module is capable of providing cast metadata of a particular individual or a particular group of cast members matching the filtering rules (e.g., the whole cast of a certain TV series).

10.2.1.5 Picture metadata service

The picture metadata service (PMS) module provides picture-related metadata required by the navigation of IPTV static pictures. It supports various types of pictures including thumbnail, poster, photos, icons, logos, background images, etc. Besides the basic information of picture files, picture metadata also contain the descriptive information on mapping relations between pictures and other metadata objects. In response to user interface modules for picture presentation, this service module is capable of providing picture content metadata of a particular picture or a particular group of pictures matching the filtering rules (e.g., movie poster in a given resolution).

10.2.1.6 Navigation category metadata service

The navigation category metadata service (NCMS) module provides navigation category metadata on the orchestration of IPTV services/contents. Besides the information of category items, navigation category metadata also contain the descriptive information on dependency relations between categories or between categories and contents. In response to user interface modules, this service module is capable of providing category metadata of a particular category item or a particular group of categories matching the filtering rules (e.g., all the categories in the second-level).

For detailed information on service and content metadata involved by the aforementioned metadata services, please refer to [ITU-T H.750] and [ITU-T H.753].

10.2.1.7 Content searching service

The content searching service (CSS) module responds to end user's content searching requests through user interface and provides content metadata that match the search keywords and search criteria. It constructs and manages the index database based on the IPTV content repository, executes the retrieval algorithms and responses the structured data of a set of sorted contents to user interface modules. This service module is capable of providing searching functionalities on channels, videos, casts, pictures, categories, service/content packages and other types of contents. It also supports multiple searching modes including full search, conditional search, accurate search, fuzzy search, etc.

10.2.1.8 User events collecting and sharing service

The user events collecting and sharing service (UECSS) module controls the collection and data read-write of user behavioural information. It performs data collection of the user's behaviour related to service navigation, content selection, content searching, content rating events, through a certain mechanism. It provides data sharing capability to other service modules or external systems, such as multiple purposes of reporting, administration and maintenance, recommendation services, etc. It also controls the storage of user events data into data service modules.

10.2.2 Advanced services

10.2.2.1 Content searching service

Besides the descriptions in clause 10.2.1.7, this service module further supports intelligent searching modes including semantic search, personalized search, etc.

10.2.2.2 Content rating service

The content rating service (CRS) module responds to end user's rating requests through user interface and provides the dynamic metadata on content rating. It collects subjective assessment information concerning IPTV contents from the end user and generates the structured metadata of content rating. It also performs data management with user's permission and controls data synchronization and data caching. For the numerical content-rating data, this service module is capable of performing calculation in real-time based on a given algorithm and synchronously conveying to metadata post-processing service (MPPS) modules so that the updated metadata can be presented on user interface in a timely manner. Content rating operations may include but are not limited to likes, shares, grading or comments.

10.2.2.3 Content popularity ranking service

The content popularity ranking service (CPRS) module provides the dynamic metadata on content ranking. It aggregates user behavioural data from user events collecting and sharing service (UECSS) (see clause 10.2.1.8) or AMS (see clause 10.4.10) modules and real-timely generates the structured metadata of ranked contents. It also performs data management and controls data read-write of content ranking information. The factors considered by content ranking may include viewing records, rating records, content release time, configuration weight, etc. Content popularity ranking service may be applied in multiple scenarios of user interface, such as recommendation category or content searching results.

10.2.2.4 Personalized recommendation service

The personalized recommendation service (PRS) module provides the personalized recommendation of IPTV services/contents for the end user with his permission. It makes correlation analysis of service/content metadata and user behavioural data and generates the dynamic metadata of recommended services/contents. It also performs data management and

controls data read-write of recommendation information. In order to meet the diversified needs of service orchestration, this service module supports configuration management of the recommendation service on the visual interface as well as the implementations of intelligent recommendation algorithms. The factors considered by personalized recommendation may include content labels, content rating, content ranking, user preference, user's favourites, viewing history, terminal attributes, etc. Personalized recommendation service may be applied in multiple scenarios, such as content recommendation, service/content package recommendation, multi-device interactive service or personalized user interface.

For detailed information on personalized IPTV service, please refer to [ITU-T H.741.5].

10.3 Service control service

Service control service is comprised of service modules with distinct features or functionality on service control. Figure 5 provides the modular structure of service control service. As shown in this figure, service control service capabilities provided by the fine-grained service modules are in basic level.

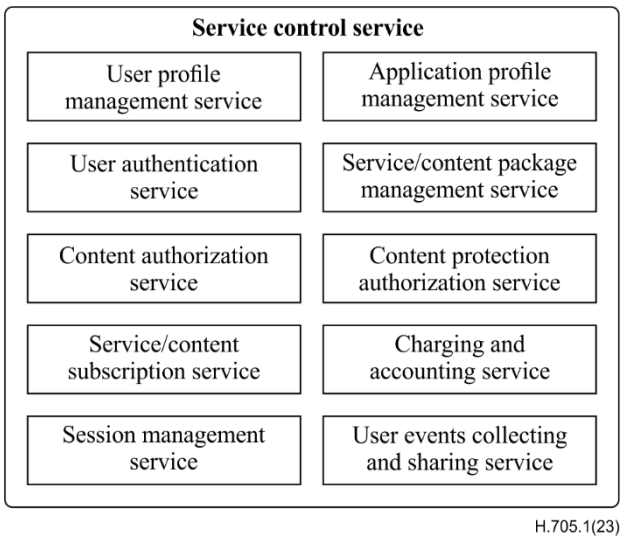


Figure 5 – Modular structure of service control service

The following clauses provide descriptive texts for fine-grained service modules of service control service.

10.3.1 User profile management service

The user profile management service (UPMS) module controls the acquisition, management and data read-write of user profile information. It acquires user information from the end user or external system such as a customer relationship management (CRM) system. It performs data aggregation, classification, correlation and other management functionalities of the user profile. It also controls data storage into data service modules as well as data sharing under permission management.

This service module manages, but is not limited to, the following user profile information:

– Service registration information, such as subscribed service package, service entry point, service provider, etc.

– Content subscription information, such as subscribed content package, valid period, etc.

– User private information, such as customer name, contact details, location, etc.

– Network information, such as network access mode, routing configuration, user IP address, etc.

– Terminal device/multiple terminal devices information, such as device identifier, terminal type, terminal capabilities, etc.
– User account information, such as user account, user type, user status, etc.
– Additional information: bonus points, coupon, etc.

10.3.2 Application profile management service

The application profile management service (APMS) module controls the acquisition, management and data read-write of application profile information. It acquires application information from the end user and performs data management functionalities. It controls data storage into data service modules as well as data sharing under permission management.

This service module manages, but is not limited to, the following application profile information:

– Application settings, such as language, parental control level, etc.
– Lists of favourite contents
– Lists of content bookmarks
– Lists of personal video recorder (PVR) contents

10.3.3 Service/content package management service

The service/content package management service (SPMS) module performs service/content packaging management and controls data read-write of service/content package information. It provides the capability of generating various service packages and content packages that end users can directly consume, which may be on premise of the packaging principle designated by content providers. It performs the life cycle management of package data. It also controls data storage into data service modules and data access from the end user or other service modules.

This service module provides the following packaging capabilities:

a) Packaging method: It supports the following packaging methods.
   i) One service/content package for one single service/content, such as live broadcast of a hockey match is packaged as one content package.
   ii) One service/content package for a combination of service/content, such as linear TV service and VoD service provided by a service provider is bundled as one combined service package of this service provider.
   iii) Multiple service/content packages for one package of services/contents, such as VoD package "new sitcoms" is re-packaged as one content package of 7 days' trial, and the other content package of 3 months' validity.
b) Pricing policy: Pricing policy can be configurable, including information on price, validity period, charge model, etc. It supports all or some of the following charge models:
   i) Charge model: It includes free-of-charge model and for-charge model. For-charge model may further be categorized into pay-per-use, pay-per-time-period model.
   ii) Pay-per-use model: It provides configuration capability of charge unit, such as usage times, network flow, elapsed time, etc. It also supports multiple charging modes, such as regular mode, capping mode, limited mode, etc.
   iii) Pay-per-time-period model: It provides configuration capability of time period, such as daily, monthly, quarterly, half yearly, annual, etc.
   iv) Discount policy: Discount policy can be configurable and applied to a for-charge model, such as promotion by time period, by user type, etc.

10.3.4 User authentication service

The user authentication service (UAS) module performs the authentication procedure of access to IPTV services by responding to end user's requests. It performs service access control by authenticating the terminal device and the user, through pre-defined business logic. Only in the case of successful authentication, this service module will provide the necessary information of service initiation.

This service module provides the following capabilities:

– The factors considered by authentication may include terminal legality, user identity, user status, purchased service package, network condition, etc.

– Service initiation information provided by this service module may include service entry point (e.g., a form of URL of a specific UI template), user license (e.g., a form of user token), resource information (e.g., network routing information, NTP resource information), audience measurement method (e.g., measurement parameters, reporting period and URL).

– In the case of service protection, this service module performs a mutual authentication procedure and then establishes the secure communication channel for IPTV service.

10.3.5 Content authorization service

The content authorization service (CAS) module performs authorization to access IPTV contents by responding to user's requests. It grants the permission for the user to consume the specific content, through pre-defined business logic. Only in the case of successful authorization, the appropriate network and system resources will be subsequently initiated and established.

This service module provides the following capabilities:

– The factors considered by authorization may include user license' legality, purchased content package, term of validity, etc. If the requested content is included in more than one purchased content package, the end user will be granted access permission as long as any one of the packages meets the authorization requirements.

– For IPTV service over multiple terminal devices or IPTV service on multiple household terminal devices, the authorization procedure depends on content sharing policy and the corresponding business logic.

10.3.6 Content protection authorization service

The content protection authorization service (CPAS) module performs authorization to access IPTV contents with digital rights protection by responding to user's requests. It manages the rights and keys and issues digital rights license containing usage conditions and decryption keys for the authorized user.

10.3.7 Service/content subscription service

The service/content subscription service (SCSS) module performs subscriptions or unsubscribe operations of the service/content package by responding to user's requests. It provides the detailed information of available service/content packages containing a given service/content and handles the whole procedure of subscriptions/unsubscribe, purchases/refund and transactions. It supports several types of prepay methods, such as balance payment, points payment, third-party payment, etc. In addition for the case of other payment methods such as post pay or advice of charge, it supports interaction with a charging and accounting service to fulfil the service/content subscription or unsubscribe operation.

10.3.8 Charging and accounting service

The charging and accounting service (CAAS) module provides charging and accounting capability for service consumption and content consumption. It generates charging information based on the subscription information, pricing policy of the consumed service/content and usage records collected from other service modules. It further generates accounting data by consolidating charging information and applying discount policy.

10.3.9 Session management service

The session management service (SMS) module manages the interaction connections between the end user and IPTV service platform during the usage of IPTV service. It performs the life cycle management of user session data, including the creation, update and deletion of session data. It controls the buffer of user sessions in a scalable and robust manner. It also provides data query capability of user presence status (e.g., online, offline).

10.3.10 User events collecting and sharing service

The user events collecting and sharing service (UECSS) module controls the collection and data read-write of user behavioural information. It performs data collection of the user's behaviour related to authentication, authorization, subscription, purchase, payment events, through a certain mechanism (e.g., message mechanism). It provides data sharing capability to other service modules, external systems or the end user under permission management, such as multiple purposes of reporting, administration and maintenance, partner settlements, recommendation services, etc. It also controls the storage of user events data into data service modules.

10.4 Content delivery service

The content delivery service is comprised of service modules with distinct features or functionality on content delivery. Figure 6 provides the modular structure of the content delivery service. As shown in this figure, content delivery service capabilities provided the fine-grained service modules are in basic level. In practical deployment, any one or a combination of the following service modules can be integrated and built as a service node or cluster of a content delivery service. In addition it supports implementation in a hierarchical architecture and distributed environment. For detailed information on the deployment model and implementation mechanisms, please refer to [ITU-T Y.2019] and [ITU-T H.644.3].

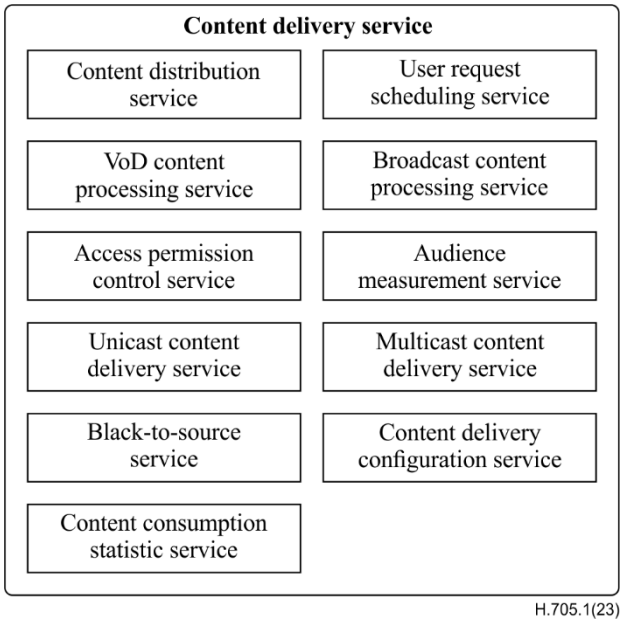


Figure 6 – Modular structure of content delivery service

The following clauses provide descriptive texts for fine-grained service modules of the content delivery service.

10.4.1 Content distribution service

The content distribution service (CDS) module handles content and related metadata from the content management service and controls the distribution and deployment of contents among multiple instances of content delivery. It performs content dispatching or content aging functionality based on a given policy. It also controls the storage of content/segment duplicates and maintains distribution information for the contents within the content delivery service.

10.4.2 VoD content processing service

The VoD content processing service (VCPS) module performs media processing for on-demand contents based on a given policy and generates the processed content and related metadata for the needs of network transmission and QoS. This service module provides the processing capabilities of content transcoding, packaging, slicing, indexing, keyframe extraction, encryption, etc.

10.4.3 Broadcast content processing service

The broadcast content processing service (BCPS) module performs content recording and media processing for live contents based on a given policy and generates the processed content and related metadata for the needs of network transmission and QoS. This service module provides the processing capabilities of content recording, transcoding, packaging, slicing, indexing, keyframe extraction, encryption, etc.

10.4.4 User request scheduling service

The user request scheduling service (URSS) module responds to user's requests for content delivery and redirects it to the appropriate service node. It is responsible for locating the appropriate instance of content delivery based on a given policy. This service module supports multiple scheduling solutions based on user's location, content routing, load balancing, etc. It also supports mechanisms to gather real time information from all the service nodes or instances within its management scope, including service capability, resource utilization, content distribution, etc. For hierarchical deployment architecture, the top-level scheduling node acts as the main entry for the content delivery service.

10.4.5 Access permission control service

The access permission control service (APCS) module performs permission control to access service resources of content delivery based on a given policy. It supports different authentication mechanisms against unauthorized using of content delivery resources, including single-point authentication, multi-point authentication, open-loop encryption/decryption, closed-loop encryption/decryption, etc. For detailed information on authentication mechanisms, please refer to [ITU-T H.644.3].

10.4.6 Unicast content delivery service

The unicast content delivery service (UCDS) module responds to the authorized requests and delivers content streams or content downloads to the end user in unicast delivery mode. It manages the content delivery session with the end user, reacts to user interaction and provides the delivery service with guaranteed QoS. When the requested content is unavailable in the local data service module, this service module supports the mode of delivering while downloading. Transmission protocols and coding schemes to be supported by this service module can be found in [ITU-T H.721], [ITU-T H.644.3]. This service module supports mechanisms to report its real-time running status, including health status, number of connections, traffic load, etc.

10.4.7 Multicast content delivery service

The multicast content delivery service (MCDS) module responds to the authorized requests and delivers content streams to the end user in multicast delivery mode. It manages the content delivery session with the end user, reacts to user interaction and provides the delivery service with guaranteed QoS. Transmission protocols and coding schemes to be supported by this service module can be found in [ITU-T H.721], [ITU-T H.644.3]. This service module supports mechanisms to report its real-time running status, including health status, number of connections, traffic load, etc.

10.4.8 Back-to-source service

The back-to-source service (BTSS) module is responsible for fetching the content when the requested content is not hit in the selected service instance at the request of the end user. It redirects to the content source based on a given policy of back-to-source service [ITU-T H.644.5] and instantly downloads and caches the content in local data service module. This service module supports mechanisms to report its real-time running status, including health status, number of connections, traffic load, etc.

10.4.9 Content delivery configuration service

The content delivery configuration service (CDCS) module performs the configuration management and the distribution of configurations and policies, in order to achieve the running in a highly efficient and flexible manner. This service module provides all or some of the following configuration capabilities:

– Service node management: It manages all the node devices of the content delivery service and configures the topology information among service nodes, such as cascade relationship, cluster relationship, etc.

– Content processing policy: It configures the content processing tasks for service nodes. It supports the processing control from content management service or the configuration in this service module.

– Content distribution policy: It configures the mechanisms of content dispatching and content aging. It supports the configuration of push mode (i.e., distributing contents from upstream nodes to downstream nodes), pull mode (i.e., fetching contents from downstream nodes to upstream nodes, usually depending on the popularity), etc.

– Content caching policy: It configures the mechanisms of content caching. It supports the configuration of caching policies based on criteria of content type, storage space, content popularity, etc.

– Access permission control: It configures the authentication mechanisms and manages the verification keys.

– User scheduling policy: It configures the scheduling mechanisms for user's requests. It supports the configuration of scheduling policies based on one or more criteria of service type, content delivery provider, end user's location, content distribution, resource utilization, service capability of nodes, etc.

– Back-to-source policy: It configures the routing mechanisms for back-to-source requests.

– QoS policy: It configures the quality control mechanisms, such as QoS level, bandwidth control algorithm, etc.

10.4.10 Audience measurement service

The audience measurement service (AMS) module controls the collection and data read-write of user behavioural information. It collects user viewership data including operation history of the audience. It provides data sharing capability to other service modules or external systems under

permission management, such as multiple purposes of reporting, recommendation services, etc. It also controls the storage of user events data into data service modules.

10.4.11 Content consumption statistic service

The content consumption statistic service (CCSS) module provides statistical data of access popularity and network flow on a content basis. It collects the user events data for a certain content from all the instances of content delivery and generates the statistical data on content consumption based on a given algorithm. It provides data sharing capability to other service modules or external systems, such as multiple purposes of content caching or aging, traffic billing, partner settlements, reporting, etc.

11 Functional description of data service

The data service module provides data storage and data reading/writing service for the IPTV service platform. According to different contents, the data of the IPTV service platform can be divided into metadata, media files, web documents, user data, operational data (e.g., statistical data, log data) and so on. This module is responsible for storing data in a database, cache system, file system or other storage type or hybrid schemes, depending on the characteristics of data change and reading/writing frequency. It is also responsible for encapsulating APIs for data reading/writing and opening to service modules and O&M management modules. It supports mechanisms to guarantee data consistency and access security, while providing data service with high reliability and scalability.

12 Functional description of O&M management

12.1 Upgrade management

The upgrade management module performs version management of application software packages and controls the upgrading/downgrading tasks for the IPTV service platform and IPTV terminal devices. This module provides the following functionalities:

– Version management: It controls the validation, deployment and release of all the application software packages. It also manages the feature information of released packages, such as version name, version number, problem-solving description, download address, etc.

– Policy configuration: It configures the upgrading/downgrading polices including the settings on initial version/target version, rollback logic, type of upgrade and so on. For IPTV terminal devices, it supports policy configuration based on one or more criteria of terminal type, user's location, hardware version, OS version, device ID, etc.

– Upgrading/downgrading management: It controls and manages the functional modules of IPTV service platform or a batch of terminal devices to upgrade or downgrade, according to the defined policies. The supported types of upgrade include hot update (i.e., dynamic update on partial codes or configuration, without rebooting system), grey scale upgrade (i.e., incremental or gradual upgrade process, usually referring to function or process), silent upgrade (i.e., automatic upgrade process, without user perception and application available), and mandatory upgrade (i.e., automatic upgrade process, application disabled until it succeeds), etc.

– Data statistic and visualization: It provides data statistic functionality as well as a visualized interface for statistical results on upgrading/downgrading tasks.

12.2 Monitoring management

The monitoring management module performs performance and QoS/QoE monitoring of IPTV functional entities and provides alarm functionality based on the configuration of alarm events. This module provides the following functionalities:

– Performance monitoring: It collects performance indicators in real-time from the functional entities in the IPTV service platform, including the server hosts, application servers and storage systems. The performance data collected by this module includes the utilization of hardware resources (e.g., CPU load, RAM/ROM usage) and application resources (e.g., number of processes, connections).

– QoS/QoE monitoring: It configures the mechanism of QoS/QoE reporting and collects data from the functional entities where the quality probes are deployed. It supports collection of data concerning quality of content, quality of interaction and quality of user experience.

– Alarm configuration: It configures various types of alarm events by setting the alarm threshold, alarm level, alerting methods and other parameters. It supports giving alarms or early warnings automatically and in a timely manner when the monitored indicators reach the preset conditions.

– Statistical analysis and visualization: It provides real-time or quasi real-time statistical analysis functionality for the aggregated monitoring data. It supports presentation of the statistical results on different dimensions and alarm messages in the forms of tables, graphs, maps, etc., on a visualized interface. The statistical analysis functionality of this module will contribute to fault prediction and fault diagnosis of IPTV end-to-end systems.

12.3 Logging management

The logging management module controls log recording and collects log data from IPTV functional entities. This module provides the following functionalities:

– Log collection: It configures the mechanism of log reporting and collects log data concerning application log, system log and operation log.

– Log data management: It performs data cleaning, structured processing and classified storage to the log data.

– Data analysis and visualization: It provides log retrieval and log analysis functionality as well as visualized interface for retrieval and analysis results. The data analysis functionality of this module will contribute to fault diagnosis of IPTV services.

– Logging output: As the output module for log files, it supports generation of log reports as required and export to external systems.

12.4 Security management

Security management module performs security related configuration and management for IPTV services, such as key management, system disaster recovery solution, and emergency plan. It also supports mechanisms to suspend or recover the service offering of IPTV in order to meet regulatory requirements.

13 Reference points

Figure 7 identifies the reference points in the IPTV service platform. In this figure, the rounded rectangular blocks of the content management service, service navigation service, service control service and content delivery service represent the combinations of all the fine-grained service modules defined in clause 10, rather than the specific modules shown in this figure. The black dash-dot lines represent direct connection interfaces between functional modules, and the blue dash lines

represent indirect connection interfaces. Line crossings do not imply connections, unless explicitly stated.

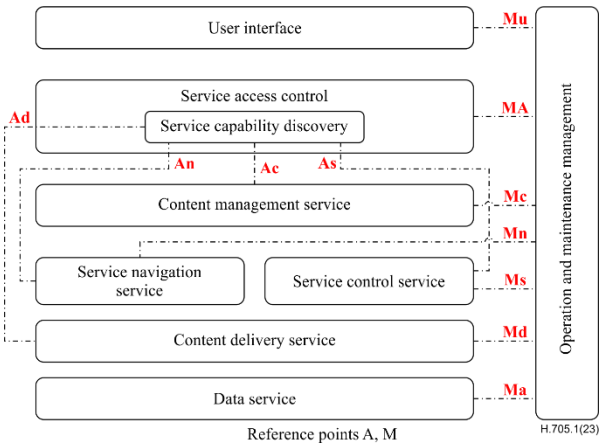


Figure 7-a – Reference points A, M

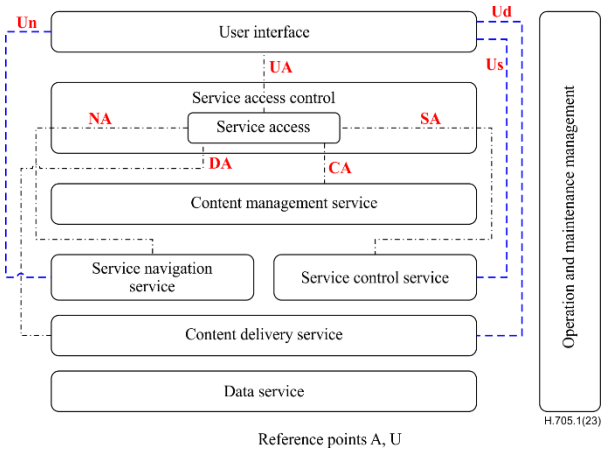


Figure 7-b – Reference points A, U

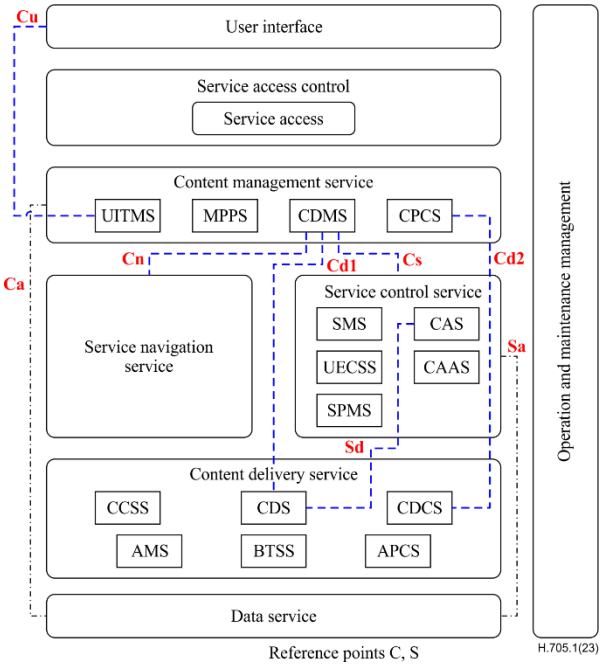


Figure 7-c – Reference points C, S

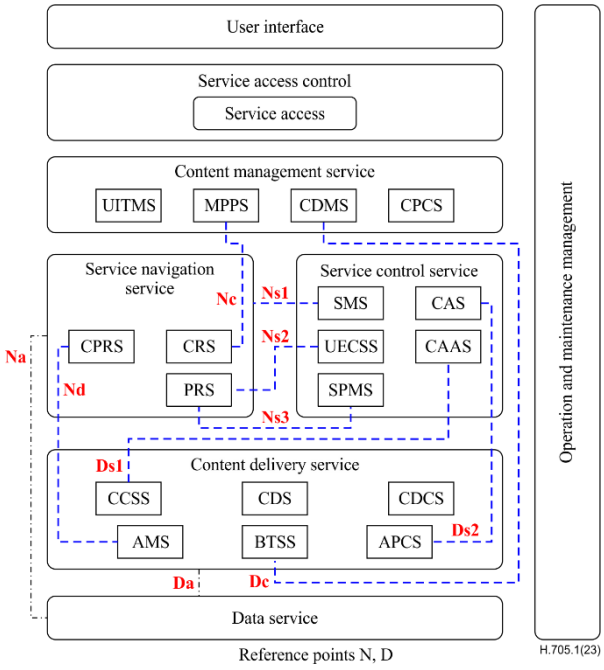


Figure 7-d – Reference points N, D

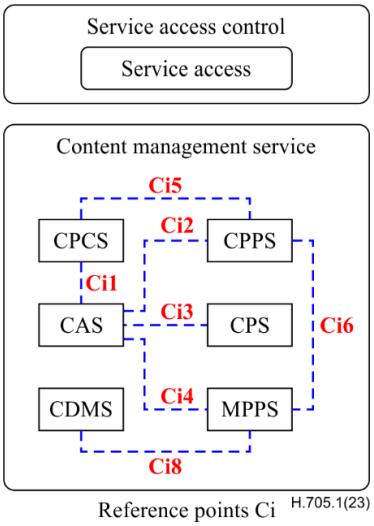


Figure 7-e – Reference points Ci

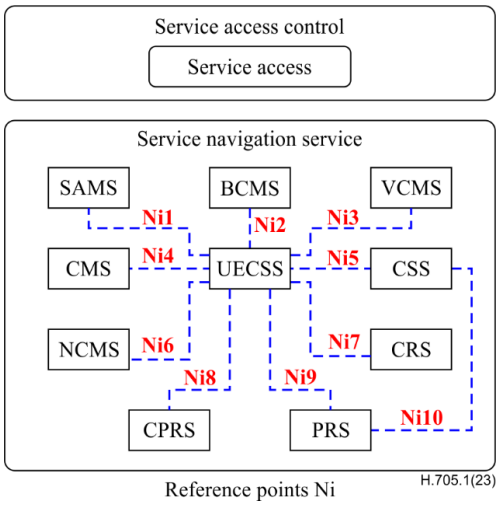


Figure 7-f – Reference points Ni

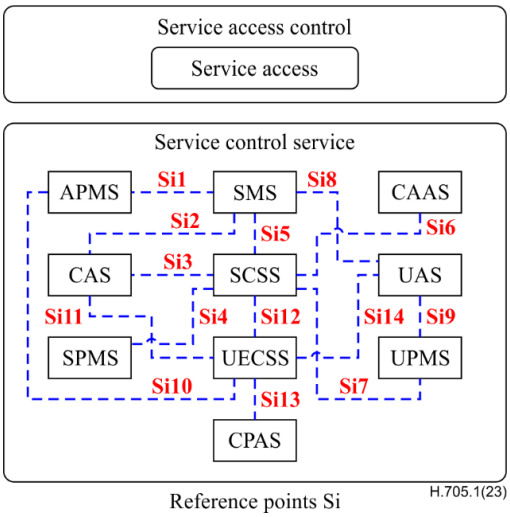


Figure 7-g – Reference points Si

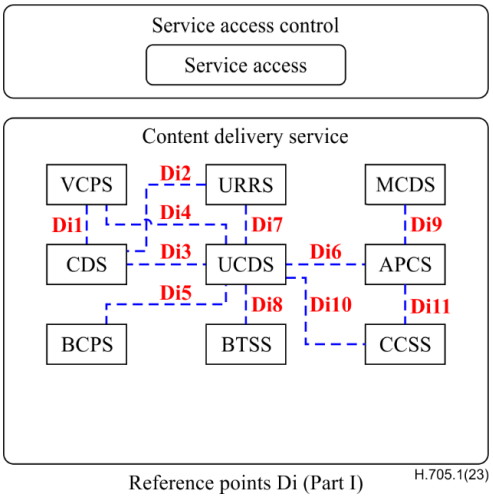


Figure 7-h – Reference points Di (part I)

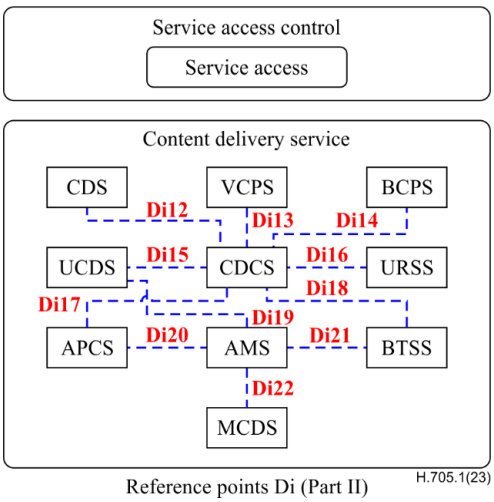


Figure 7-i – Reference points Di (part II)

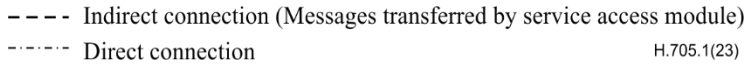


Figure 7 – Reference points of IPTV service platform layered architecture

13.1 Reference points A

The A reference points (see Figure 7-a) are used by service modules to request the service registration/deregistration, and capability statement and to convey its running data to the service access control (specific to service capability discovery) module.

13.1.1 Reference points Ac

The Ac reference point is between the service access control module (specific to service capability discovery) and the content management service module.

13.1.2 Reference points An

The An reference point is between the service access control module (specific to service capability discovery) and the service navigation service module.

13.1.3 Reference points As

The As reference point is between the service access control module (specific to service capability discovery) and the service control service module.

13.1.4 Reference points Ad

The Ad reference point is between the service access control module (specific to service capability discovery) and the control delivery service module.

13.2 Reference points for implementing service invocation

The reference points (see Figure 7-b) are used to exchange messages for service invocation, which are necessarily through the service access control (specific to service access) module. These reference points represent a general definition of direct connection interfaces between the service access module and the consumer or provider of service capability, instead of the specific definition of functional interfaces. For detailed information on functional interfaces, please refer to clauses 13.3-13.7 and clauses 13.9-13.12.

13.2.1 Reference point UA

The UA reference point is between the user interface module and the service access control module (specific to service access).

This reference point is used by the user interface to request or respond to service access for service invocation.

13.2.2 Reference point CA

The CA reference point is between the content management service module and the service access control module (specific to service access).

This reference point is used to request or respond to service invocation between content management service and service access.

13.2.3 Reference point NA

The NA reference point is between the service navigation service module and the service access control module (specific to service access).

This reference point is used to request or respond to service invocation between service navigation service and service access.

13.2.4 Reference point SA

The SA reference point is between the service control service module and the service access control module (specific to service access).

This reference point is used to request or respond to service invocation between service control service and service access.

13.2.5 Reference point DA

The DA reference point is between the content delivery service module and the service access control module (specific to service access).

This reference point is used to request or respond to service invocation between content delivery service and service access.

13.3 Reference points U

The U reference points (see Figure 7-b) are used by the user interface module to invoke the capabilities of service modules. These reference points represent functional interfaces in an indirect connection case, which are actually implemented by the particular combinations of reference points defined in clause 9.2.

13.3.1 Reference points Un

The Un reference point is between the user interface module and the service navigation service module.

This reference point is used by the user interface to acquire metadata of IPTV services and contents for end user's service/content discovery and selection. It is also used to transfer user's rating data for IPTV contents.

This functional interface is implemented by reference point UA and reference point NA (UA-NA Rp pair, for short).

13.3.2 Reference points Us

The Us reference point is between the user interface module and the service control service module.

This reference point is used by user interface to transfer user information, application information, service/content package information and exchange messages for service control functionalities.

This functional interface is implemented by UA-SA Rp pair.

13.3.3 Reference points Ud

The Ud reference point is between the user interface module and the content delivery service module.

This reference point is used by user interface to exchange messages for trick mode play functionality.

This functional interface is implemented by UA-DA Rp pair.

13.4 Reference points C

The C reference points (see Figure 7-c) are used by the content management service module to exchange messages with other functional modules. Some of these reference points represent functional interfaces in indirect connection cases.

13.4.1 Reference points Cn

The Cn reference point is between the content management service module (specific to CDMS, see clause 10.1.1.7) and the service navigation service module.

This reference point is used to distribute content metadata and service/application metadata to service navigation service.

This functional interface is implemented by CA-NA Rp pair.

13.4.2 Reference points Cs

The Cs reference point is between the content management service module (specific to CDMS, see clause 10.1.1.7) and the service control service module.

This reference point is used to distribute content metadata and service/application metadata to service control service.

This functional interface is implemented by CA-SA Rp pair.

13.4.3 Reference points Cd1

The Cd1 reference point is between the content management service module (specific to CDMS, see clause 10.1.1.7) and the content delivery service module (specific to CDS, see clause 10.4.1).

This reference point is used by CDMS to distribute contents and content metadata to CDS.

This functional interface is implemented by CA-DA Rp pair.

13.4.4 Reference points Cd2

The Cd2 reference point is between the content management service module (specific to CPCS, see clause 10.1.1.2) and the content delivery service module (specific to CDCS, see clause 10.4.9).

This reference point is used by CPCS to deliver content processing control policy to CDCS.

This functional interface is implemented by CA-DA Rp pair.

13.4.5 Reference points Cu

The Cu reference point is between content management service module (specific to UITMS, see clause 10.1.1.6) and user interface module.

This reference point is used to exchange messages for controlling the deployment of UI templates.

This functional interface is implemented by CA-UA Rp pair.

13.4.6 Reference points Ca

The Ca reference point is between the content management service module and the data service module.

This reference point is used by content management service to read and write data (i.e., contents and metadata) within its functional scope and authority.

13.5 Reference points N

The N reference points (see Figure 7-d) are used by the service navigation service module to exchange messages with other functional modules. Some of these reference points represent functional interfaces in indirect connection case.

13.5.1 Reference points Nd

The Nd reference point is between the service navigation service module (specific to CPRS, see clause 10.2.2.3) and the content delivery service module (specific to AMS, see clause 10.4.10).

This reference point is used to exchange messages for collecting user viewership data.

This functional interface is implemented by NA-DA Rp pair.

13.5.2 Reference points Ns1

The Ns1 reference point is between the service navigation service module and the service control service module (specific to SMS, see clause 10.3.9).

This reference point is used by service navigation service to acquire user information or to request update of session data.

This functional interface is implemented by NA-SA Rp pair.

13.5.3 Reference points Ns2

The Ns2 reference point is between the service navigation service module (specific to PRS, see clause 10.2.2.4) and the service control service module (specific to UECSS, see clause 10.3.10).

This reference point is used by PRS to acquire user behavioural data (e.g., PVR preferences) from UECSS for generating personalized recommendations on contents.

This functional interface is implemented by NA-SA Rp pair.

13.5.4 Reference points Ns3

The Ns3 reference point is between the service navigation service module (specific to PRS, see clause 10.2.2.4) and the service control service module (specific to SPMS, see clause 10.3.3).

This reference point is used by PRS to acquire service/content package information from SPMS for generating personalized recommendation on service/content packages.

This functional interface is implemented by NA-SA Rp pair.

13.5.5 Reference points Nc

The Nc reference point is between the service navigation service module (specific to CRS, see clause 10.2.2.2) and the content management service module (specific to MPPS, see clause 10.1.2.2).

This reference point is used to exchange messages for content rating metadata aggregation.

This functional interface is implemented by NA-CA Rp pair.

13.5.6 Reference points Na

The Na reference point is between the service navigation service module and the data service module.

This reference point is used by service navigation service to read and write data (i.e., content-related metadata) within its functional scope and authority.

13.6 Reference points S

The S reference points (see Figure 7-c) are used by the service control service module to exchange messages with other functional modules. The reference point described in clause 13.6.1 represents the functional interface in an indirect connection case.

13.6.1 Reference points Sd

The Sd reference point is between the service control service module (specific to CAS, see clause 10.3.5) and the content delivery service module (specific to CDS, see clause 10.4.1).

This reference point is used by the content acquisition service (CAS) to acquire the initial information of an accessing content delivery resource (e.g., a content playback URL pointing to URSS) for the authorized requests.

This functional interface is implemented by SA-DA Rp pair.

13.6.2 Reference points Sa

The Sa reference point is between the service control service module and the data service module.

This reference point is used by service control service to read and write data (i.e., user data and service-related metadata) within its functional scope and authority.

13.7 Reference points D

The D reference points (see Figure 7-d) are used by the content delivery service module to exchange messages with other functional modules. Some of these reference points represent functional interfaces in indirect connection cases.

13.7.1 Reference points Dc

The Dc reference point is between the content delivery service module (specific to BTSS, see clause 10.4.8) and the content management service module (specific to CDMS, see clause 10.1.1.7).

This reference point is used by BTSS to fetch the content when CDMS is configured as the content source.

This functional interface is implemented by DA-CA Rp pair.

13.7.2 Reference points Ds1

The Ds1 reference point is between the content delivery service module (specific to CCSS, see clause 10.4.11) and the service control service module (specific to CAAS, see clause 10.3.8).

This reference point is used to convey network flow data of content consumption for charging information generation.

This functional interface is implemented by DA-SA Rp pair.

13.7.3 Reference points Ds2

The Ds2 reference point is between the content delivery service module (specific to APCS, see clause 10.4.5) and the service control service module (specific to CAS, see clause 10.3.5).

This reference point is used to exchange messages for permission control when CAS is configured to perform authentication.

This functional interface is implemented by DA-SA Rp pair.

13.7.4 Reference points Da

The Da reference point is between the content delivery service module and the data service module.

This reference point is used by content delivery service to read and write data (i.e., contents and content-related metadata) within its functional scope and authority.

13.8 Reference points M

The M reference points (see Figure 7-a) are used by the O&M management module to exchange messages for configuration and management with other functional modules.

13.8.1 Reference points MA

The MA reference point is between the O&M management module and the service access control module.

This reference point is used to exchange messages for upgrade management, performance monitoring, log collection and security management (e.g., disaster recovery solution).

13.8.2 Reference points Mc

The Mc reference point is between the O&M management module and the content management service module.

This reference point is used to exchange messages for upgrade management, performance monitoring, log collection and security management (e.g., key management).

13.8.3 Reference points Ms

The Ms reference point is between the O&M management module and the service control service module.

This reference point is used to exchange messages for upgrade management, performance monitoring, log collection and security management (e.g., emergency solution).

13.8.4 Reference points Mn

The Mn reference point is between the O&M management module and the service navigation service module.

This reference point is used to exchange messages for upgrade management, performance monitoring, log collection and security management.

13.8.5 Reference points Md

The Md reference point is between the O&M management module and the content delivery service module.

This reference point is used to exchange messages for upgrade management, performance and QoS/QoE monitoring, log collection and security management.

13.8.6 Reference points Mu

The Mu reference point is between the O&M management module and the user interface module.

This reference point is used to exchange messages for upgrade management, performance and QoS/QoE monitoring, log collection and security management (e.g., emergency solution).

13.8.7 Reference points Ma

The Ma reference point is between the O&M management module and the data service module.

This reference point is used by O&M management to read and write data (i.e., monitoring data, log data, software packages and metadata) within its functional scope and authority.

13.9 Reference points Ci

The Ci reference points (see Figure 7-e) are used to exchange messages between fine-grained service modules inside the content management service module. These reference points represent functional interfaces in indirect connection cases and they are implemented by reference point CA.

13.9.1 Reference points Ci1

The Ci1 reference point is between the CAS module (see clause 10.1.1.1) and the CPCS module (see clause 10.1.1.2).

This reference point is used by CAS to query content processing policy or task for the acquired contents.

13.9.2 Reference points Ci2

The Ci2 reference point is between the CAS module (see clause 10.1.1.1) and the CPPS module (see clauses 10.1.1.3 and 10.1.2.1).

This reference point is used by CAS to deliver content metadata to CPPS for content pre-processing.

13.9.3 Reference points Ci3

The Ci3 reference point is between the CAS module (see clause 10.1.1.1) and the CPS module (see clause 10.1.1.4).

This reference point is used by CAS to deliver content metadata to CPS for content protection processing.

13.9.4 Reference points Ci4

The Ci4 reference point is between the CAS module (see clause 10.1.1.1) and the MPPS module (see clauses 10.1.1.5 and 10.1.2.2).

This reference point is used by CAS to deliver content metadata to MPPS.

13.9.5 Reference points Ci5

The Ci5 reference point is between the CPCS module (see clause 10.1.1.2) and the CPPS module (see clauses 10.1.1.3 and 10.1.2.1).

This reference point is used by CPCS to deliver control messages of content processing to CPPS.

13.9.6 Reference points Ci6

The Ci6 reference point is between the CPPS module (see clause 10.1.1.3 and 10.1.2.1) and the MPPS module (see clauses 10.1.1.5 and 10.1.2.2).

This reference point is used by CPPS to deliver processed metadata (i.e., content pre-processing) to MPPS for metadata aggregation.

13.9.7 Reference points Ci7

The Ci7 reference point is between the CPS module (see clause 10.1.1.4) and the MPPS module (see clauses 10.1.1.5 and 10.1.2.2).

This reference point is used by CPS to deliver processed metadata (i.e., content protection processing) to MPPS for metadata aggregation.

13.9.8 Reference points Ci8

The Ci8 reference point is between the MPPS module (see clauses 10.1.1.5 and 10.1.2.2) and the CDMS module (see clause 10.1.1.7).

This reference point is used by MPPS to deliver aggregated content metadata to CDMS for content distribution management.

13.10 Reference points Ni

The Ni reference points (see Figure 7-f) are used to exchange messages between fine-grained service modules inside the service navigation service module. These reference points represent functional interfaces in indirect connection case and they are implemented by reference point NA.

13.10.1 Reference points Ni1

The Ni1 reference point is between the SAMS module (see clause 10.2.1.1) and UECSS module (see clause 10.2.1.8).

This reference point is used to exchange messages for collecting user behavioural data on service discovery and selection.

13.10.2 Reference points Ni2

The Ni2 reference point is between the BCMS module (see clause 10.2.1.2) and the UECSS module (see clause 10.2.1.8).

This reference point is used to exchange messages for collecting user behavioural data on navigation of broadcast services.

13.10.3 Reference points Ni3

The Ni3 reference point is between the VCMS module (see clause 10.2.1.3) and the UECSS module (see clause 10.2.1.8).

This reference point is used to exchange messages for collecting user behavioural data on navigation of on-demand services.

13.10.4 Reference points Ni4

The Ni4 reference point is between the CMS module (see clause 10.2.1.4) and the UECSS module (see clause 10.2.1.8).

This reference point is used to exchange messages for collecting user behavioural data on navigation of cast members.

13.10.5 Reference points Ni5

The Ni5 reference point is between the CSS module (see clauses 10.2.1.7 and 10.2.2.1) and the UECSS module (see clause 10.2.1.8).

This reference point is used to exchange messages for collecting user behavioural data on content searching events.

13.10.6 Reference points Ni6

The Ni6 reference point is between the NCMS module (see clause 10.2.1.6) and the UECSS module (see clause 10.2.1.8).

This reference point is used to exchange messages for collecting user behavioural data on browsing navigation categories.

13.10.7 Reference points Ni7

The Ni7 reference point is between the CRS module (see clause 10.2.2.2) and the UECSS module (see clause 10.2.1.8).

This reference point is used to exchange messages for collecting user behavioural data on content rating events.

13.10.8 Reference points Ni8

The Ni8 reference point is between the CPRS module (see clause 10.2.2.3) and the UECSS module (see clause 10.2.1.8).

This reference point is used by CPRS to acquire aggregated data of user behaviours from UECSS for generating content popularity ranking.

13.10.9 Reference points Ni9

The Ni9 reference point is between the PRS module (see clause 10.2.2.4) and the UECSS module (see clause 10.2.1.8).

This reference point is used by PRS to acquire aggregated data of user behaviours from UECSS for generating personalized recommendations.

13.10.10 Reference points Ni10

The Ni10 reference point is between the CSS module (see clauses 10.2.1.7 and 10.2.2.1) and the PRS module (see clause 10.2.2.4).

This reference point is used by CSS to acquire personalized recommendations from PRS for generating personalized search results.

13.11 Reference points Si

The Si reference points (see Figure 7-g) are used to exchange messages between fine-grained service modules inside the service control service module. These reference points represent functional interfaces in indirect connection cases and they are implemented by reference point SA.

13.11.1 Reference points Si1

The Si1 reference point is between the APMS module (see clause 10.3.2) and the SMS module (see clause 10.3.9).

This reference point is used by APMS to acquire user information or request to update session data for application settings or operations.

13.11.2 Reference points Si2

The Si2 reference point is between the CAS module (see clause 10.3.5) and the SMS module (see clause 10.3.9).

This reference point is used by CAS to acquire user information or request to update session data for authorization.

13.11.3 Reference points Si3

The Si3 reference point is between the CAS module (see clause 10.3.5) and the SCSS module (see clause 10.3.7).

This reference point is used to deliver user's subscribed content packages for content authorization.

13.11.4 Reference points Si4

The Si4 reference point is between the SPMS module (see clause 10.3.3) and the SCSS module (see clause 10.3.7).

This reference point is used to deliver the information of service/content packages for subscription processing.

13.11.5 Reference points Si5

The Si5 reference point is between the SCSS module (see clause 10.3.7) and the SMS module (see clause 10.3.9).

This reference point is used by SCSS to acquire user information or request to update session data for subscription.

13.11.6 Reference points Si6

The Si6 reference point is between the SCSS module (see clause 10.3.7) and the CAAS module (see clause 10.3.8).

This reference point is used by SCSS to deliver subscription/unsubscribe information and service/content package information to CAAS for charging and accounting.

13.11.7 Reference points Si7

The Si7 reference point is between the SCSS module (see clause 10.3.7) and the UPMS module (see clause 10.3.1).

This reference point is used by SCSS to deliver user's subscription/unsubscribe information to UPMS.

13.11.8 Reference points Si8

The Si8 reference point is between the UAS module (see clause 10.3.4) and the SMS module (see clause 10.3.9).

This reference point is used by UAS to request to create user session for the successful authentication.

13.11.9 Reference points Si9

The Si9 reference point is between the UAS module (see clause 10.3.4) and the UPMS module (see clause 10.3.1).

This reference point is used by UAS to acquire user information from UPMS for user authentication.

13.11.10 Reference points Si10

The Si10 reference point is between the APMS module (see clause 10.3.2) and the UECSS module (see clause 10.3.10).

This reference point is used to exchange messages for collecting user behavioural data on recording content bookmarks or favourites.

13.11.11 Reference points Si11

The Si11 reference point is between the CAS module (see clause 10.3.5) and the UECSS module (see clause 10.3.10).

This reference point is used to exchange messages for collecting user behavioural data on authorization events.

13.11.12 Reference points Si12

The Si12 reference point is between the SCSS module (see clause 10.3.7) and the UECSS module (see clause 10.3.10).

This reference point is used to exchange messages for collecting user behavioural data on subscription events.

13.11.13 Reference points Si13

The Si13 reference point is between the CPAS module (see clause 10.3.6) and the UECSS module (see clause 10.3.10).

This reference point is used to exchange messages for collecting user behavioural data on content protection authorization.

13.11.14 Reference points Si14

The Si14 reference point is between the UAS module (see clause 10.3.4) and the UECSS module (see clause 10.3.10).

This reference point is used to exchange messages for collecting user behavioural data on authentication events.

13.12 Reference points Di

The Di reference points (see Figure 7-h and 7-i) are used to exchange messages between fine-grained service modules inside the content delivery service module. These reference points represent functional interfaces in indirect connection cases and they are implemented by reference point DA.

13.12.1 Reference points Di1

The Di1 reference point is between the CDS module (see clause 10.4.1) and the VCPS module (see clause 10.4.2).

This reference point is used by CDS to deliver content metadata to VCPS for VoD content processing (e.g., keyframe extraction).

13.12.2 Reference points Di2

The Di2 reference point is between the CDS module (see clause 10.4.1) and the URSS module (see clause 10.4.4).

This reference point is used to deliver content distribution information for the basis of scheduling decisions.

13.12.3 Reference points Di3

The Di3 reference point is between the CDS module (see clause 10.4.1) and the UCDS module (see clause 10.4.6).

This reference point is used by CDS to distribute content and related metadata to UCDS for content deployment.

13.12.4 Reference points Di4

The Di4 reference point is between the UCDS module (see clause 10.4.6) and the VCPS module (see clause 10.4.2).

This reference point is used by UCDS to deliver content metadata to VCPS for VoD content pre-processing (e.g., transcoding).

13.12.5 Reference points Di5

The Di5 reference point is between the UCDS module (see clause 10.4.6) and the BCPS module (see clause 10.4.3).

This reference point is used by UCDS to deliver content metadata to BCPS for broadcast content processing.

13.12.6 Reference points Di6

The Di6 reference point is between the UCDS module (see clause 10.4.6) and the APCS module (see clause 10.4.5).

This reference point is used by UCDS to request access permission control from APCS for unicast delivery service.

13.12.7 Reference points Di7

The Di7 reference point is between the UCDS module (see clause 10.4.6) and the URSS module (see clause 10.4.4).

This reference point is used to exchange messages for collecting load data of UCDS.

13.12.8 Reference points Di8

The Di8 reference point is between the UCDS module (see clause 10.4.6) and the BTSS module (see clause 10.4.8).

This reference point is used to exchange messages for fetching contents based on back-to-source policy.

13.12.9 Reference points Di9

The Di9 reference point is between the MCDS module (see clause 10.4.7) and the APCS module (see clause 10.4.5).

This reference point is used by MCDS to request access permission control from APCS for multicast delivery service.

13.12.10 Reference points Di10

The Di10 reference point is between the CCSS module (see clause 10.4.11) and the UCDS module (see clause 10.4.6).

This reference point is used by CCSS to collect network flow data of content consumptions from UCDS.

13.12.11 Reference points Di11

The Di11 reference point is between the CCSS module (see clause 10.4.11) and the APCS module (see clause 10.4.5).

This reference point is used by CCSS to acquire user information from APCS for network flow statistic.

13.12.12 Reference points Di12

The Di12 reference point is between the CDCS module (see clause 10.4.9) and the CDS module (see clause 10.4.1).

This reference point is used to deliver content distribution policy.

13.12.13 Reference points Di13

The Di13 reference point is between the CDCS module (see clause 10.4.9) and the VCPS module (see clause 10.4.2).

This reference point is used to deliver VoD content processing policy.

13.12.14 Reference points Di14

The Di14 reference point is between the CDCS module (see clause 10.4.9) and the BCPS module (see clause 10.4.3).

This reference point is used to deliver broadcast content processing policy.

13.12.15 Reference points Di15

The Di15 reference point is between the CDCS module (see clause 10.4.9) and the UCDS module (see clause 10.4.6).

This reference point is used to deliver QoS and content caching policy.

13.12.16 Reference points Di16

The Di16 reference point is between the CDCS module (see clause 10.4.9) and the URSS module (see clause 10.4.4).

This reference point is used to deliver user scheduling policy.

13.12.17 Reference points Di17

The Di17 reference point is between the CDCS module (see clause 10.4.9) and the APCS module (see clause 10.4.5).

This reference point is used to deliver the authentication mechanism and key.

13.12.18 Reference points Di18

The Di18 reference point is between the CDCS module (see clause 10.4.9) and the BTSS module (see clause 10.4.8).

This reference point is used to deliver back-to-source policy.

13.12.19 Reference points Di19

The Di19 reference point is between the UCDS module (see clause 10.4.6) and the AMS module (see clause 10.4.10).

This reference point is used to exchange messages for collecting user behavioural data on unicast delivery service.

13.12.20 Reference points Di20

The Di120 reference point is between the APCS module (see clause 10.4.5) and the AMS module (see clause 10.4.10).

This reference point is used by AMS to acquire user information from APCS for the creation of audience measurement report.

13.12.21 Reference points Di21

The Di21 reference point is between the BTSS module (see clause 10.4.8) and the AMS module (see clause 10.4.10).

This reference point is used to exchange messages for collecting user behavioural data on back-to-source service.

13.12.22 Reference points Di22

The Di22 reference point is between the MCDS module (see clause 10.4.7) and the AMS module (see clause 10.4.10).

This reference point is used to exchange messages for collecting user behavioural data on multicast delivery service.

Annex A

Metadata information relating to content distribution

(This annex forms an integral part of this Recommendation.)

This annex describes the information of exchanged metadata between the content management service and service navigation service, service control service or content delivery service during the content distribution procedure.

Table A.1 lists the minimum recommended subset of content metadata and is not intended to be exhaustive or restrictive for practical implementation. All the elements and attributes of metadata shown in this table refer to the definitions in [ITU-T H.750].

Table A.1 – **Elements or attributes information of content metadata**

Distribution direction	Distributed metadata
content management service → service navigation service	Elements for content: includes all the defined attributes in clause 8.1 of [ITU-T H.750] except: – Rights or Copyright information – Codec or format – Acquisition or delivery schedule, protocol and address – File format, file size
	Elements for collective content: includes all the defined attributes in clause 8.1 of [ITU-T H.750] except: – Price and conditions of availability of collective content
	Elements for group of segment: includes all the defined attributes in clause 8.1 of [ITU-T H.750].
	Elements for service (or channel): includes all the defined attributes in clause 8.1 of [ITU-T H.750].
	Elements for content adaptation: includes all the defined attributes in clause 8.1 of [ITU-T H.750] except: – Targeting – Interstitials replacement, replacement rules
	Elements for usage restrictions, usage rules: – Validity period – Output control – Trick mode enabled or not – Maximum buffering size or duration – Schedule (timeslots) for pay-per view – Restricted area – Expiration date or deletion management information – Recordable or not
content management service → service control service	Elements for content: – Identifier – Title/name – Rights or Copyright information (for more details, see Appendix V of [ITU-T H.751]) – Name of content provider, service provider – Type of content

Table A.1 – **Elements or attributes information of content metadata**

Distribution direction	Distributed metadata
	– Encrypted or not – Content expiration date
	Elements for collective content: – Total number of sub-contents – IDs for sub-contents – IDs for other collections of which this collection is a member
	Elements for content adaptation: – Consumption control parameter
	Elements for usage restrictions, usage rules: – Validity period – DRM type, clearing house or pricing server URL, license identification – Restricted area – Expiration date or deletion management information
content management service → content delivery service	Elements for content: – Identifier – Name of content provider, service provider – Codec or format – Aspect ratios, resolution, bit rate, frame rate for video – Mono, stereo, multi-channel indication for audio – Acquisition or delivery schedule, protocol and address – File format, file size – Duration
	Elements for collective content: – IDs for sub-contents
	Elements for describing delivery modes: includes all the defined attributes in clause 8.1 of [ITU-T H.750].

Appendix I

Procedural flows relating to IPTV services

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

I.1 Content preparation flows

This appendix describes some typical scenarios and the corresponding procedural flows of content preparation. The flows show how service capabilities are invoked in order to complete the preparation process of content and metadata.

I.1.1 Content preparation without additional processing

Scenario

Content and metadata source derived from content provider functions can be directly used to deliver to end user functions. In this scenario, a minimum set of content management service capabilities is required to be adopted.

Sequence

Figure I.1 illustrates the simplest sequence of content preparation. In this figure, the dotted lines represent logical associations instead of direct interaction between functional modules.

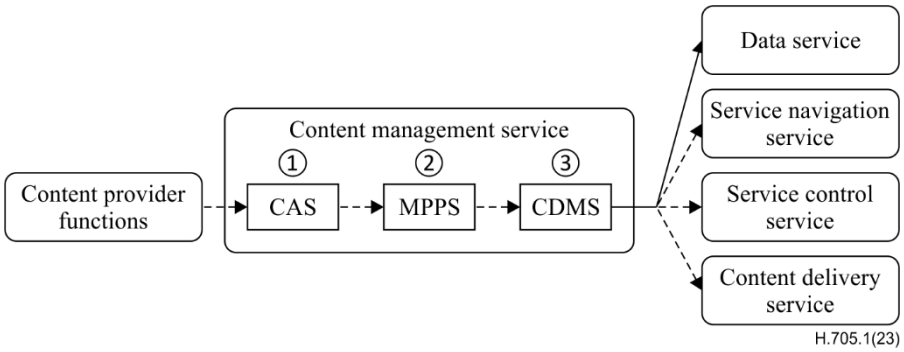


Figure I.1 – Sequence diagram for content preparation without additional processing

1) CAS (see clause 10.1.1.1) acquires content and metadata from the content provider, checks data integrity and validity, downloads and buffers the content.
2) MPPS (see clauses 10.1.1.5 and 10.1.2.2) checks and supplements metadata information, and conveys data to CDMS.
3) CDMS (see clause 10.1.1.7) deploys the content and metadata into data service and then distribute metadata needed for service presentation to service navigation service, metadata needed for service management to service control service, content and metadata needed for delivery to content delivery service, respectively.

I.1.2 Content preparation with additional processing

Scenario

Content and metadata source derived from content provider functions is used to offer IPTV services on one kind of IPTV terminal device (TD) (e.g., TD Type1). These contents are also authorized by the content provider to another kind of IPTV TD (e.g., TD Type2). In this scenario, content processing service capabilities are required to be adopted.

Sequence

Figure I.2 illustrates the entire sequence of content preparation. In this figure, the dotted lines represent logical associations instead of direct interaction between functional modules.

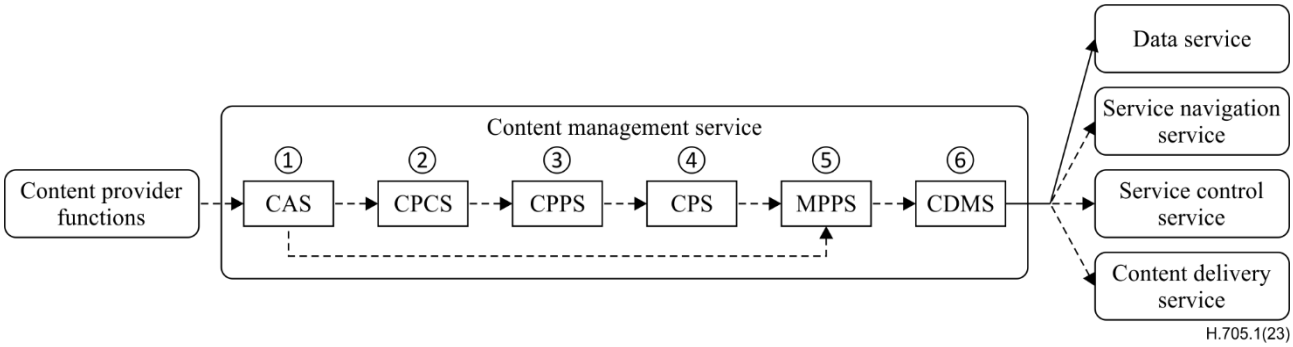


Figure I.2 – Sequence diagram for content preparation with additional processing

1) CAS (see clause 10.1.1.1) acquires content and metadata source (of TD Type1) from the content provider, checks data integrity and validity, downloads and buffers the content, and conveys data to CPCS and MPPS.
2) CPCS (see clause 10.1.1.2) generates the processing tasks for the contents and conveys tasks to CPPS. In this scenario, processing tasks may include media transcoding task (e.g., to lower bit rate) and media packaging task (e.g., DASH format for transmission).
3) CPPS (see clauses 10.1.1.3 and 10.1.2.1) executes media content processing based on the assigned tasks, generates new content and metadata for TD Type2, buffers the new content, and conveys the data to CPS.
4) CPS (see clause 10.1.1.4) executes content encryption based on digital rights information, generates the protected content and security-related metadata, buffers the protected content, and conveys the data to MPPS.
5) MPPS (see clauses 10.1.1.5 and 10.1.2.2) performs metadata aggregation of the original contents and processed contents and then conveys data to CDMS. In this scenario, the generated metadata for multiple TD will be correlated with the original metadata.
6) CDMS (see clause 10.1.1.7) deploys the content and metadata into data service and then distribute content and metadata to service navigation service, service control service and content delivery service, respectively.

I.2 Service/content presentation flow

This appendix describes the procedural flow of service/content presentation.

Scenario

The end user is a new user for IPTV services and selects to subscribe a service package. IPTV service and contents are presented in MAFR-based presentation mode [ITU-T H.760].

Sequence

Figure I.3 illustrates how service capabilities are invoked in order to complete the presentation process of IPTV services and contents on user interface. In this figure, the dotted lines represent logical associations instead of direct interaction between functional modules, which is actually implemented via service access control.

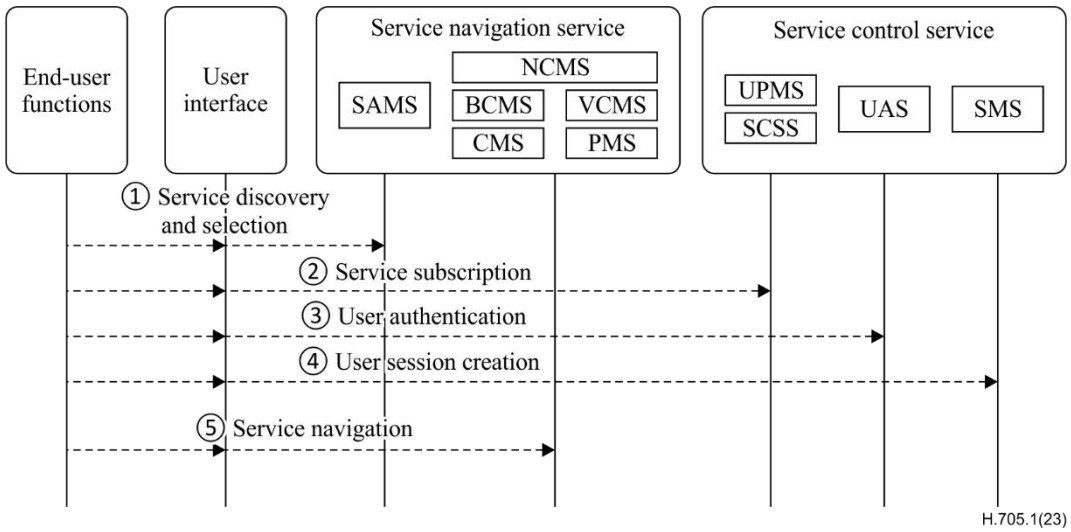


Figure I.3 – Sequence diagram for service/content presentation

1) When the end user accesses to IPTV services through user interface for the first time, SAMS (see clause 10.2.1.1) provides service related metadata required by SP service discovery and selection.

2) When the end user selects to subscribe a desired IPTV service, UPMS (see clause 10.3.1) acquires user information, terminal device information from the end user for service registration, while acquiring network information of the user and other necessary information from external system. SCSS (see clause 10.3.7) provides the details of service packages and fulfils the subscription of a service provider's package. Then UPMS completes the configuration of service registration information, and user account information for the end user.

3) When the end user requests to access the subscribed IPTV service, UAS (see clause 10.3.4) performs user authentication and returns service initiation information to the end user.

4) SMS (see clause 10.3.9) creates the user session and manages the session data during the usage of IPTV service of the end user.

5) The end user connects to the portal of the IPTV service, then NCMS/BCMS/VCMS/CMS/PMS (see clauses 10.2.1.6, 10.2.1.2, 10.2.1.3, 10.2.1.4 and 10.2.1.5) are invoked as required for the presentation of IPTV contents.

I.3 Content consumption flow

This appendix describes the procedural flows of content consumption.

Scenario

The end user searches a VoD content of interest on a user interface and subscribes to a content package in which the charging is based on network flow. He requests for content delivery service and it is offered in unicast delivery mode and by back-to-source means.

Sequence

Figure I.4 illustrates how service capabilities are invoked in order to complete the content delivery and charging process of a particular VoD content. In this figure, the dotted lines represent logical associations instead of direct interaction between functional modules, which is actually implemented via service access control.

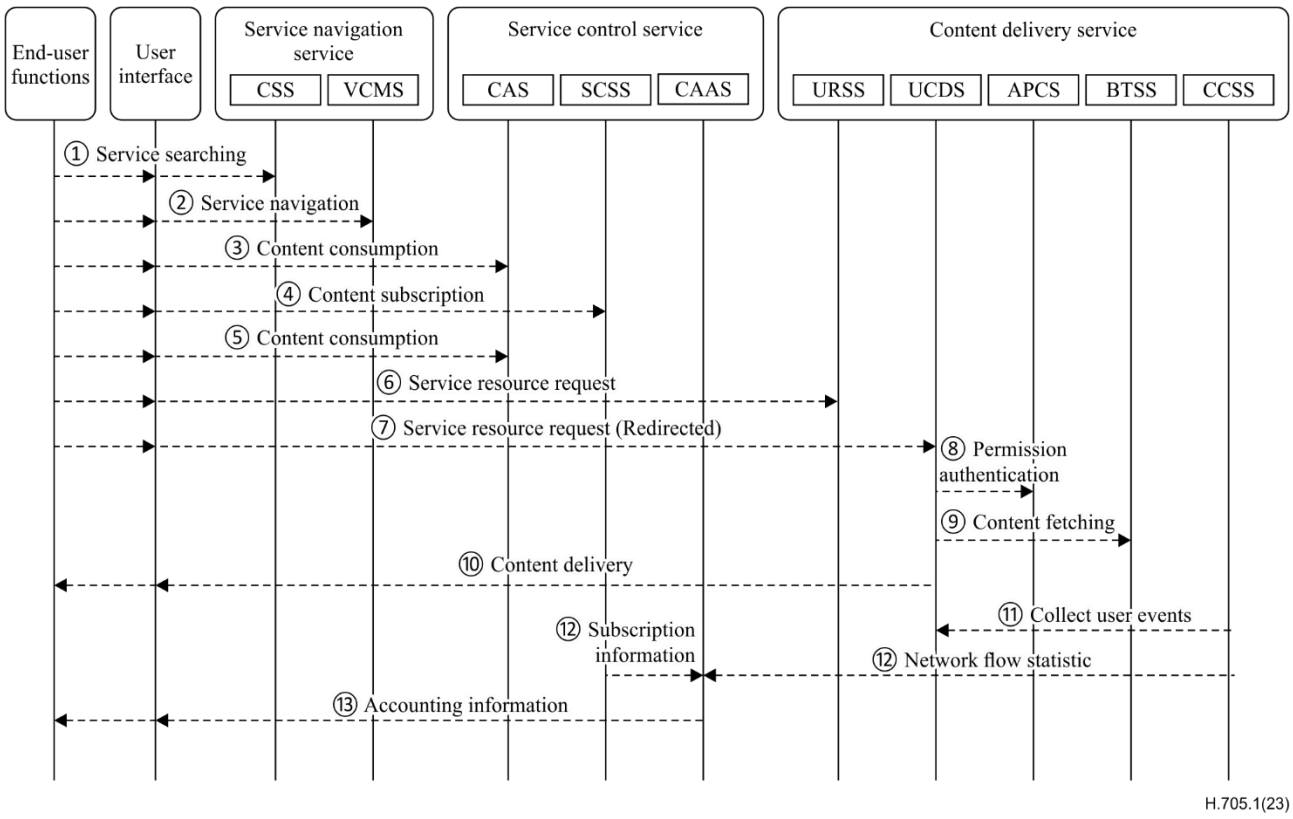


Figure I.4 – Sequence diagram for content consumption

1) The end user searches for a desired VoD content on user the interface, CSS (see clauses 10.2.1.7 and 10.2.2.1) provides the search result containing this content.

2) When the end user selects to browse the details of this VoD, VCMS (see clause 10.2.1.3) provides content related metadata for content presentation on the user interface.

3) When the end user requests to consume the content, CAS (see clause 10.3.5) verifies the user license and purchased content package, and returns the failure result of content authorization.

4) When the end user selects to subscribe content packages, SCSS (see clause 10.3.7) provides the detailed information of the content packages and fulfils the purchase and payment.

5) When the end user requests to consume the content again, CAS (see clause 10.3.5) grants the permission for the user and returns the initiated network/service resource.

6) When the end user is routed to the main entry of the content delivery service, URSS (see clause 10.4.4) selects the appropriate service resource based on a scheduling policy.

7) The end user is redirected to UCDS (see clause 10.4.6) for the content delivery in unicast mode.

8) APCS (see clause 10.4.5) is invoked to perform the permission control and returns the authentication result to UCDS.

9) When UCDS finds the requested content is unavailable in the local data service module, it requests BTSS (see clause 10.4.8) to fetch the content.

10) UCDS downloads the content from BTSS while delivering it to the end user. It also responds to the user's playback control (e.g., trick mode operations) and provides high-quality streaming service.

11) CCSS (see clause 10.4.11) collects user event data from UCDS and generates statistical data on the network flow of consuming of this content.

12) CAAS (see clause 10.3.8) receives the content subscription information from SCSS and the network flow data from CCSS, and generates the charging information concerning this content consumption.

13) CAAS conveys the accounting information to the end user.

Appendix II

Mapping relationship of functional modules between [ITU-T Y.1910] and this Recommendation

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

This appendix describes the mapping relationship between the defined functions and functional blocks of [ITU-T Y.1910] and the defined modules and fine-grained modules of this Recommendation. It provides a reference for upgrading the conventional IPTV service platform to an open platform.

Table II.1 lists the minimum set of modules and fine-grained modules (in the right two columns) defined in this Recommendation that can match the functionalities supported by functions and functional blocks (in the left two columns) in [ITU-T Y.1910], by referring to the descriptions in clause 9 and clause 10.3 of [ITU-T Y.1910]. Correspondingly, this Recommendation can cover all the technical requirements of [ITU-T Y.1910] and further offer more enhanced functions than [ITU-T Y.1910].

Table II.1 – Mapping relationship between [ITU-T Y.1910] and this Recommendation

Functions/functional block [ITU-T Y.1910]		**Module/fine-grained module (this Recommendation)**	
Application functions	IPTV application functions	Service control service	User authentication service Content authorization service Service/content subscription service Session management service
		Service navigation service	Service/application metadata service Broadcast content metadata service VoD content metadata service Cast metadata service Picture metadata service Navigation category metadata service
		User interface	
		Data service	
	Application profile functional block	Service control service	Application profile management service User profile management service
		Data service	
	Content preparation functions	Content management service	Content acquisition service Content processing control service Content pre-processing service Content protection service Metadata post-processing service
		Data service	
	Service and content protection functions	Content management service	Content protection service

Table II.1 – Mapping relationship between [ITU-T Y.1910] and this Recommendation

Functions/functional block [ITU-T Y.1910]		**Module/fine-grained module (this Recommendation)**	
		Service control service	Content protection authorization service User authentication service
		Data service	
Service control functions	IPTV service control functional block	Service control service	User authentication service Content authorization service Charging and accounting service
		Data service	
	Service user profile functional block	Service control service	User profile management service Session management service
		Data service	
Content delivery functions	Content distribution and location control functions	Content delivery service	Content distribution service User request scheduling service Content delivery configuration service
		Data service	
	Content delivery and storage functions	Content delivery service	Access permission control service Unicast content delivery service Multicast content delivery service VoD content processing service Broadcast content processing service Content consumption statistic service
		Data service	
		User interface	
Management functions	Application management functional block Content delivery management functional block Service control management functional block	Operation and maintenance management	Upgrade management Monitoring management Logging management Security management
		Data service	

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