ITUPublications
Recommendations

International Telecommunication Union
Standardization Sector

Recommendation

# ITU-T H.644.6 (09/2023)

SERIES H: Audiovisual and multimedia systems

Broadband, triple-play and advanced multimedia services – Content delivery and ubiquitous sensor network applications

---

# Architecture for video distribution systems

ITU-T H-SERIES RECOMMENDATIONS

**Audiovisual and multimedia systems**

| | |
|---|---|
| CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS | H.100-H.199 |
| INFRASTRUCTURE OF AUDIOVISUAL SERVICES | H.200-H.499 |
| MOBILITY AND COLLABORATION PROCEDURES | H.500-H.549 |
| VEHICULAR GATEWAYS AND INTELLIGENT TRANSPORTATION SYSTEMS (ITS) | H.550-H.599 |
| BROADBAND, TRIPLE-PLAY AND ADVANCED MULTIMEDIA SERVICES | H.600-H.699 |
| Broadband multimedia services over VDSL | H.610-H.619 |
| Advanced multimedia services and applications | H.620-H.629 |
| **Content delivery and ubiquitous sensor network applications** | **H.640-H.649** |
| IPTV MULTIMEDIA SERVICES AND APPLICATIONS FOR IPTV | H.700-H.799 |
| E-HEALTH MULTIMEDIA SYSTEMS, SERVICES AND APPLICATIONS | H.800-H.899 |

*For further details, please refer to the list of ITU-T Recommendations.*

# Recommendation ITU-T H.644.6

## Architecture for video distribution systems


### Summary

Recommendation ITU-T H.644.6 specifies the architecture for video distribution systems. The video distribution system described in this Recommendation is an over-the-top (OTT) video application system, which has the capabilities of video access, distribution, transcoding, processing, management, and presentation, and can provide live video streaming service, video on demand service, and other related value-added services to users on the Internet. Users can directly use the video distribution functions through the system without complex system development, deployment and maintenance processes.



### History *

| Edition | Recommendation | Approval | Study Group | Unique ID |
|---|---|---|---|---|
| 1.0 | ITU-T H.644.6 | 2023-09-13 | 16 | 11.1002/1000/15631 |

### Keywords

Architecture, live video streaming, video distribution, video on demand.


* To access the Recommendation, type the URL https://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID.

## FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

## NOTE

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

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

## INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

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

## Table of Contents

# Recommendation ITU-T H.644.6

## Architecture for video distribution systems

### 1 Scope

This Recommendation specifies the architecture and reference points of the video distribution system, which meets the video distribution system requirements defined in [ITU-T F.743.14].

### 2 References

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

[ITU-T F.743.14] Recommendation ITU-T F.743.14 (2022), *Requirements for video distribution systems.*

### 3 Definitions

#### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

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

NOTE – This definition is taken from [b-ITU-T Y.2012] and therefore relates to NGN. However, it is also valid for other networks and systems, e.g., a video distribution system.

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

**3.1.3 live streaming** [b-ITU-T Y.2084]: A video service in which a continuous stream flows in real time from the service provider to the terminal device and the user cannot control the temporal order in which content is played.

**3.1.4 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.

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

**3.1.6 video distribution system (VDS)** [ITU-T F.743.14]: An Internet application system that is built based on the video delivery networking platform such as CDN, and which can provide the video collection, distribution and viewing functions for Internet users without any system development.

**3.1.7 video on demand (VoD)** [b-ITU-T Y.1910]: A service in which the end user can, on demand, select and view 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:

AF Audience Functions

AMF Account Management Functions

CMF Centre Management Functions

DSF Data Storage Functions

MDF Media Delivery Functions

MMF Media Management Functions

MPF Media Producer Functions

SMF System Management Functions

VD Video Distribution

VDS Video Distribution System

VoD Video on Demand

## 5 Conventions

**Functions**: In the context of VDS architecture, "functions" are defined as a collection of functionalities. It is represented by the following symbol:


**Functional block**: In the context of VDS architecture, a "functional block" is defined as a group of functionalities that have not been further subdivided at the level of detail described in this Recommendation. It is represented by the following symbol:


## 6 Overall architecture for video distribution system

This clause specifies the overall functional architecture for the video distribution system (VDS).

[ITU-T F.743.14] describes the requirements and application scenarios for video distribution systems. This Recommendation defines a standardized video distribution system architecture, which has the capabilities of media access, coding, distribution, storage, management, processing,

playback, and other related service management functions such as authentication, authorization, billing, and channel management, and can provide live video streaming services, video-on-demand (VoD) services and other related value-added services to users on the Internet. Users can directly use the video distribution (VD) functions through the system without complex system development, deployment and maintenance processes.

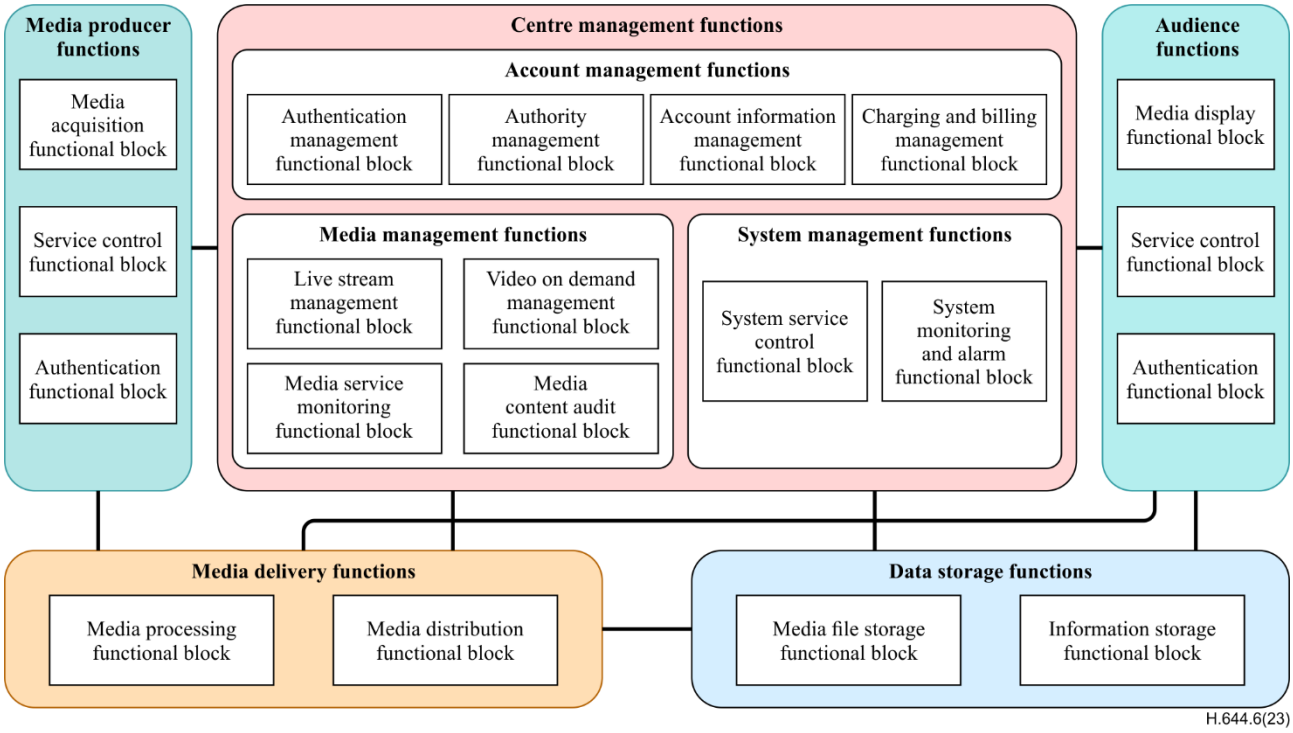


**Figure 6-1 – Functional architecture of video distribution system**

As shown in Figure 6-1, the functional architecture of the VDS includes five functional groups:

– Media producer functions
– Centre management functions
– Media delivery functions
– Data storage functions
– Audience functions

The functional group can be divided into several sub-functional groups and functional blocks. The media producer functions (MPF) consist of the media acquisition functional block, service control functional block and authentication functional block. The audience functions (AF) consist of the media display functional block, service control functional block and authentication functional block. The media delivery functions (MDF) consist of the media processing functional block and media distribution functional block. The data storage functions (DSF) consist of the media file storage functional block and information storage functional block. As the core management role of the VDS, the centre management functions (CMF) can be subdivided into account management functions (AMF), media management functions (MMF) and system management functions (SMF). Among them, the account management functions consist of the authentication management functional block, authority management functional block, account information management functional block and charging and billing management functional block. The media management functions consist of the live stream management functional block, video on demand management functional block, media service monitoring functional block and media content audit functional block. The system management functions consist of the system service control functional block and system monitoring and alarm functional block.

# 7 Functions for video distribution system

This clause defines the specific functions and functional blocks of the VDS architecture.

## 7.1 Media producer functions (MPF)

The MPF are responsible for the media producer authentication, handling the interaction, and obtaining the media resources, including the live video streams for the channels created in the VDS and the VoD files uploaded by the users. The detailed functions consist of the following functional blocks:

– **Media acquisition functional block**

  - The media acquisition functional block acquires the live video streams for the channels created in the VDS.
  - The media acquisition functional block acquires the VoD resources uploaded by the users.
  - The media acquisition functional block encodes the multimedia data including video and audio.
  - The media acquisition functional block transmits the acquired live video streams and VoD resources to the MDF.

– **Service control functional block**

  - The service control functional block provides the live video related service control functions, including live stream control, related configuration of live video distribution, interactive operations of live video channels, etc.
  - The service control functional block provides the VoD related service control functions, including VoD resource upload control, related configuration of VoD, interactive operations of VoD, etc.

– **Authentication functional block**

  - The authentication functional block provides the registration/deregistration and login/logout services for media producers.
  - The authentication functional block authenticates the media producers when they use the VDS to verify their identity and ensure the security of the VDS.

## 7.2 Centre management functions (CMF)

The CMF are responsible for managing the basic information of the VDS, coordinating the service access and usage, and managing accounts, the VDS and media services. The CMF is subdivided into account management functions (AMF), media management functions (MMF) and system management functions (SMF).

### 7.2.1 Account management functions (AMF)

The AMF are responsible for performing the authentication function for the media producers and the audiences, managing the basic information and authority of the account, and managing the corresponding charging and billing of the account. The detailed functions consist of the following functional blocks:

– **Authentication management functional block**

  - The authentication management functional block performs the authentication service for the MPF and audience functions (AF) users.

– **Authority management functional block**

  - The authority management functional block grants the different levels of users' authority to manage different services with fine granularity.

– **Account information management functional block**

  • The account information management functional block manages the account and related authority information of the MPF and AF users.

– **Charging and billing management functional block**

  • The charging and billing management functional block monitors the media service usage of different users for billing services.

  • The charging and billing management functional block obtains the account information from the account information management functional block and performs the charging function.

### 7.2.2 Media management functions (MMF)

The MMF are responsible for managing the live stream and VoD services, monitoring the media services and auditing the media content. The detailed functions consist of the following functional blocks:

– **Live stream management functional block**

  • The live stream management functional block manages the live video stream channels. The user can add, delete, modify, and search the live channels. In addition, the user can also configure the related information and control parameters of the live channels, including the name and introduction of the live channels, the supported viewer scale, and the viewing permissions of the live channels, etc.

– **Video on demand management functional block**

  • The video on demand management functional block manages the VoD resources. The user can upload, add, delete, modify, search, and preview the VoD resources. In addition, the administrator can also configure the related information and control parameters of the VoD resources, including the name and introduction of the VoD resources, the supported viewer scale, and the viewing permissions of the VoD resources, etc.

– **Media service monitoring functional block**

  • The media service monitoring functional block monitors the real-time status of media services.

  • The media service monitoring functional block stores and displays the status of the media services, including the live video monitoring, the number of the online viewers, the number of the VoD resources, etc.

– **Media content audit functional block**

  • The media content audit functional block audits the media content, and bans and processes the harmful content in the live video content, VoD content and user interaction information.

### 7.2.3 System management functions (SMF)

The SMF are responsible for the management and control of the system services, the real-time system monitoring and alarm. The detailed functions consist of the following functional blocks:

– **System service control functional block**

  • The system service control functional block manages and controls the services provided by the VDS, and coordinates the operations with other functional groups and functional blocks.

  • The system service control functional block manages the system data and related management information of the VDS.

– **System monitoring and alarm functional block**
  - The system monitoring and alarm functional block monitors the service status of the VDS in real time.
  - The system monitoring and alarm functional block detects the outlier status and events of the system and produces the related alarm messages.

### 7.3 Audience functions (AF)

The AF are responsible for the audience authentication, handling the interaction, and displaying the media content, including the live video streams and VoD resources. The detailed functions consist of the following functional blocks.

– **Media display functional block**
  - The media display functional block receives the live video streams and VoD resources from the MDF.
  - The media display functional block decodes the multimedia data including video and audio.
  - The media display functional block displays the live video streams and VoD resources.

– **Service control functional block**
  - The service control functional block provides the live video related service control functions, including live stream control, related configuration of live video distribution, interactive operations of live video channels, etc.
  - The service control functional block provides the VoD related service control functions, including VoD control, VoD viewing settings, interactive operations of VoD, etc.

– **Authentication functional block**
  - The authentication functional block provides the registration/deregistration and login/logout services for audience.
  - The authentication functional block authenticates the audience when they use the VDS to verify their identity and ensure the security of the VDS.

### 7.4 Media distribution functions (MDF)

The MDF are responsible for the processing and distribution of live video streams and VoD resources. The detailed functions consist of the following functional blocks.

– **Media processing functional block**
  - The media processing functional block is responsible to transcode and watermark the live video streams.
  - The media processing functional block is responsible to transcode and watermark the VoD resources.
  - The media processing functional block sends the processed live streams and VoD resources to the media distribution functional block.

– **Media distribution functional block**
  - The media distribution functional block transmits the processed live streams, VoD resources and related media information data to the AF.
  - The media distribution functional block supports the third-party forwarding of live streams and VoD resources.

## 7.5 Data storage functions (DSF)

The DSF are responsible for storing the media resources, media information, account information and system information. The detailed functions consist of the following functional blocks.

– **Media file storage functional block**

- The media file storage functional block supports the storage of live videos.
- The media file storage functional block supports the storage of VoD resource files uploaded by the users.
- The media file storage functional block supports the transmission of the stored videos to the MDF on demand.

– **Information storage functional block**

- The information storage functional block supports the storage of the related information of media content, accounts and the VDS.
- The information storage functional block supports the transmission of the stored information of media content, accounts and the VDS to the MMF on demand.

# 8 Reference points for video distribution systems

Figure 6-1 shows the functional architecture of the VDS. Considering the functional requirements of the VDS and the interaction between the functional groups, this Recommendation defines the reference points for the functional architecture in Figure 8-1, and the functions of the reference points are described in detail in clauses 8.1 to 8.7.

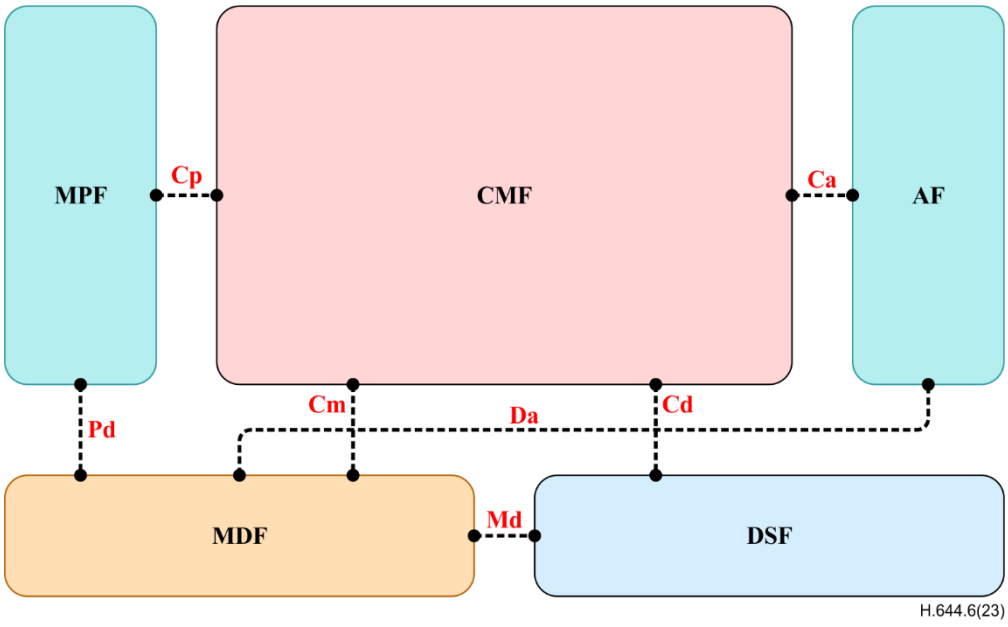


**Figure 8-1 – Reference points for VDS architecture**

## 8.1 Reference point Cp: CMF-MPF

The reference point Cp is located between the CMF and the MPF. It is used to send media producer information from MPF to CMF, and help MPF receive control signalling such as service management information, account information and authentication information from CMF. At the same time, Cp reference point is responsible for exchanging system information between CMF and MPF and helps CMF realize system service management and monitoring more effectively.

## 8.2 Reference point Ca: CMF-AF

The reference point Ca is located between the CMF and the AF. It is used to send audience information from AF to CMF, and helps AF receive control signalling such as service management information, account information and authentication information from CMF. At the same time, Ca reference point is responsible for exchanging system information between CMF and AF and helps CMF realize system service management and monitoring more effectively.

## 8.3 Reference point Cm: CMF-MDF

The reference point Cm is located between the CMF and the MDF. It is used to exchange information related to media distribution and transmission between MDF and CMF, as well as control signalling such as traffic monitoring and media processing. At the same time, Cm reference point is responsible for exchanging system information between CMF and MDF and helps CMF realize system service management and monitoring more effectively.

## 8.4 Reference point Cd: CMF-DSF

The reference point Cd is located between the CMF and the DSF. It is used to exchange information related to media, accounts and the VDS between DSF and CMF, as well as control signalling such as live streaming playback, media storage, information storage and management. At the same time, Cd reference point is responsible for helping CMF realize monitoring more effectively.

## 8.5 Reference point Pd: MPF-MDF

The reference point Pd is located between the MPF and the MDF. It is used to send the live streaming and VoD resources and related media resource information data obtained from MPF to MDF for subsequent forwarding to AF or a third party.

## 8.6 Reference point Da: MDF-AF

The reference point Da is located between the MDF and the AF. It is used to send live streaming and VoD resources and related media resource information data to AF, so as to realize media presentation and related service control of AF.

## 8.7 Reference point Md: MDF-DSF

The reference point Md is located between the MDF and the DSF. On the one hand, it is used to send the live playback and VoD resources from MDF to DSF. On the other hand, it is responsible for sending the media resources stored in DSF to MDF for subsequent forwarding to AF or a third party.

# Bibliography


[b-ITU-T Y.101] Recommendation ITU-T Y.101 (2000), *Global Information Infrastructure terminology: Terms and definitions*.

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

[b-ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of the NGN release 1*.

[b-ITU-T Y.2084] Recommendation ITU-T Y.2084 (2015), *Distributed service networking content distribution functions*.

# SERIES OF ITU-T RECOMMENDATIONS

| | |
|---|---|
| Series A | Organization of the work of ITU-T |
| Series D | Tariff and accounting principles and international telecommunication/ICT economic and policy issues |
| Series E | Overall network operation, telephone service, service operation and human factors |
| Series F | Non-telephone telecommunication services |
| Series G | Transmission systems and media, digital systems and networks |
| **Series H** | **Audiovisual and multimedia systems** |
| Series I | Integrated services digital network |
| Series J | Cable networks and transmission of television, sound programme and other multimedia signals |
| Series K | Protection against interference |
| Series L | Environment and ICTs, climate change, e-waste, energy efficiency; construction, installation and protection of cables and other elements of outside plant |
| Series M | Telecommunication management, including TMN and network maintenance |
| Series N | Maintenance: international sound programme and television transmission circuits |
| Series O | Specifications of measuring equipment |
| Series P | Telephone transmission quality, telephone installations, local line networks |
| Series Q | Switching and signalling, and associated measurements and tests |
| Series R | Telegraph transmission |
| Series S | Telegraph services terminal equipment |
| Series T | Terminals for telematic services |
| Series U | Telegraph switching |
| Series V | Data communication over the telephone network |
| Series X | Data networks, open system communications and security |
| Series Y | Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities |
| Series Z | Languages and general software aspects for telecommunication systems |

Published in Switzerland
Geneva, 2023