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SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

Next Generation Networks – Frameworks and functional
architecture models

Content delivery functional architecture in NGN

Recommendation ITU-T Y.2019

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Recommendation ITU-T Y.2019

Content delivery functional architecture in NGN

Summary

Recommendation ITU-T Y.2019 describes the content delivery functional architecture in NGN. This detailed architecture is based on the IPTV functional architecture described in Recommendation ITU-T Y.1910. Only the NGN architecture options (IMS and non-IMS) are addressed.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Y.2019	2010-09-06	13

FOREWORD

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Introduction

The key aspects of content delivery are to locate content delivery instances in the NGN and to provide delivery of content to the end-users. Content delivery functions are described in [ITU-T Y.1910].

Content delivery functions interact with application functions, service control functions, network functions and end-user functions (e.g., functions in the home network, corporate network, etc.). Content delivery mechanisms are based on unicast and/or multicast.

This Recommendation describes the content delivery functional architecture, the related functional requirements and procedures.

In this Recommendation, only the NGN architecture options (IMS and non-IMS) are addressed.

Recommendation ITU-T Y.2019

Content delivery functional architecture in NGN

1 Scope

This Recommendation specifies the functional architecture of content delivery functions in NGN and the related procedures. This Recommendation builds upon the IPTV functional architecture described in [ITU-T Y.1910]. More specifically, this Recommendation provides:

- an overview of content delivery functions;
- a hierarchical architecture of content delivery functions and related reference points;
- requirements for content delivery;
- procedures related to content delivery functions.

2 References

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

- [ITU-T Y.1910] Recommendation ITU-T Y.1910 (2008), *IPTV functional architecture*.
- [ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.
- [ITU-T Y.2014] Recommendation ITU-T Y.2014 (2010), *Network attachment control functions in next generation networks*.
- [ITU-T Y.2111] Recommendation ITU-T Y.2111 (2008), *Resource and admission control functions in next generation networks*.
- [ITU-T Y.2701] Recommendation ITU-T Y.2701 (2007), *Security requirements for NGN release 1*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 functional architecture [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 – The functional entities can be used to describe a set of reference configurations. These reference configurations identify which reference points are visible at the boundaries of equipment implementations and between administrative domains.

3.1.2 linear TV [ITU-T Y.1910]: 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.

3.1.3 reference point [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 may correspond to one or more physical interfaces between pieces of equipment.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 cluster: Cluster is a grouping of content delivery processing entities with their related control entity. Such grouping allows the sharing of resources (e.g., storage capacity) based on provider's policy (e.g., taking into account parameters such as user location).

3.2.2 content aging: The process to delete a content and related metadata from the content delivery functions.

3.2.3 content dispatching: The process to distribute a content and related metadata within different instances of content delivery functions.

3.2.4 content ingestion: The process of acquiring a content and related metadata by content delivery functions from content preparation functions.

3.2.5 content segment: To improve the efficiency of content dispatching, a complete media content is needed to be divided into several serial media content. One piece of the divided media content is called a content segment.

NOTE – The term content segment in this Recommendation includes non-continuous portion of content as well as continuous portion of content.

3.2.6 linear TV relay: Entity which receives stream from a linear TV source and delivers it to the end-user using multicast or unicast.

3.2.7 pull mode: A content delivery mode which provides delivery of content at the request of the end-user.

3.2.8 push mode: A content delivery mode which provides delivery of content at the request of the service provider.

4 Abbreviations and acronyms

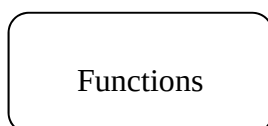
This Recommendation uses the following abbreviations and acronyms:

AF	Application Functions
CCF	Cluster Control Functions
CDCF	Content Delivery Control Functions
CDC-FE	Content Delivery Control Functional Entity
CDF	Content Delivery Functions
CDPF	Content Delivery Processing Functions
CDP-FE	Content Delivery Processing Functional Entity
CD&SF	Content Delivery & Storage Functions
CD&LCF	Content Distribution & Location Control Functions
CD&LC-FE	Content Distribution & Location Control Functional Entity
CPRF	Content Preparation Functions
FE	Functional Entity

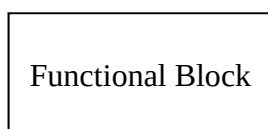
IPTV	Internet Protocol TV
IPTV AF	IPTV Application Functions
LRU	Least Recently Used
McCP-FB	Multicast Control Point Functional Block
McR-FB	Multicast Replication Functional Block
MTF	Multicast Transport Functions
NACF	Network Attachment Control Functions
NGN	Next Generation Networks
QoS	Quality of Service
RACF	Resource and Admission Control Functions
RTSP	Real Time Streaming Protocol
SCF	Service Control Functions
SCP	Service and Content Protection
UCC	User Created Content
UE	User Equipment
VoD	Video on Demand

5 Conventions

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



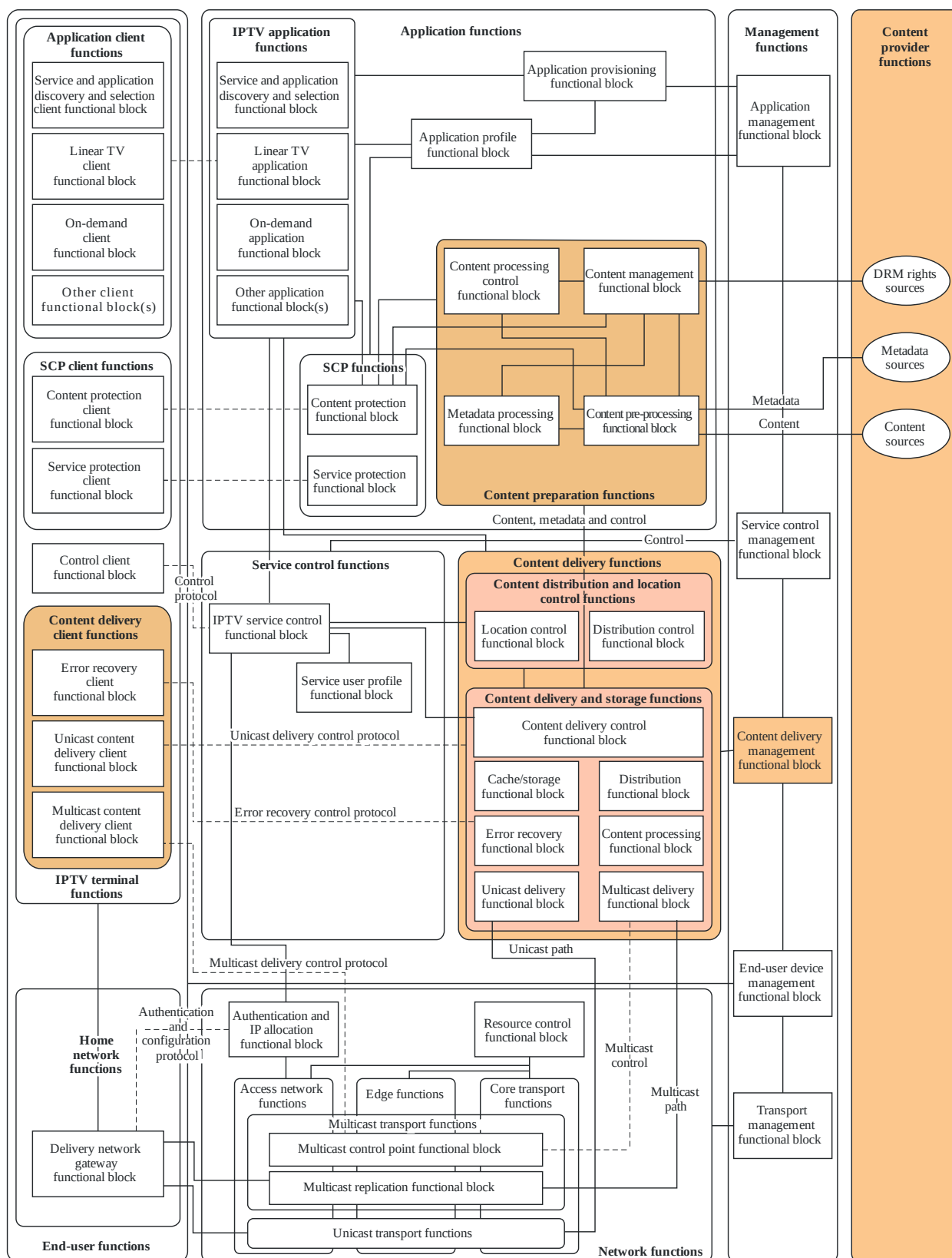
Functional block: In the context of this Recommendation, a "functional block" is defined as a group of functionalities that has not been further subdivided at the level of detail described in this Recommendation. It is represented by the following symbol:



6 Content delivery overview

6.1 Introduction

Based on Figure 10-4 of [ITU-T Y.1910], Figure 6-1 underlines the functions involved in content delivery.



Y.2019(10)_F6:

NOTE 1 – For NGN IPTV architectures "Authentication & IP allocation functional block" is replaced by "Network attachment control functions (NACF)" [ITU-T Y.2014].

NOTE 2 – For NGN IPTV architectures, "Resource control functional block" is replaced by "Resource & admission control functions (RACF)" [ITU-T Y.2111].

NOTE 3 – For NGN IMS IPTV architecture, "IPTV service control functional block" is replaced by "Core IMS functions".

NOTE 4 – For NGN IMS IPTV architecture, "Client control functional block" is replaced by "Session client functional block".

Figure 6-1 – Detailed IPTV architecture – Content delivery

Content delivery involves the following functions described in [ITU-T Y.1910]:

- Content preparation functions (CPRF):
 - content management functional block;
 - metadata processing functional block;
 - content processing control functional block;
 - content pre-processing functional block.
- Content delivery functions (CDF):
 - content distribution and location control functions;
 - content delivery and storage functions.

In [ITU-T Y.1910], the functions involved in content delivery are in relationship with the management functions and the content provider functions.

Note that in some cases the SCP functions are involved in the content delivery process (e.g., for content encryption).

Content delivery includes the following:

- content ingestion: this process loads content received from CPRF for immediate or delayed delivery;
- content dispatching: this process distributes content within different instances of content delivery functions;
- content delivery: this process supplies content to the end-user.

6.2 Content ingestion

Content ingestion handles content and related metadata received from CPRF. CPRF control the preparation and aggregation of content received from the content provider functions.

The ingestion process can optionally be based on:

- push mechanism: once prepared, the content is sent by CPRF to the content delivery functions;
- pull mechanism: the content is fetched from CPRF only when needed by the content delivery functions.

The ingestion process can optionally include recording content. In this case, the content delivery functions perform functions that record linear content, either on demand or systematically depending on the end-user and/or service needs. This recording is for immediate or delayed delivery.

6.3 Content dispatching

After ingestion, content can optionally be duplicated through the content delivery functions depending on a predefined policy.

For example, popular content can optionally be duplicated on all content delivery functions, local content can optionally reside only in certain targeted areas and rare contents are less duplicated than the latter two.

The policy for duplication can optionally be defined on a static basis or dynamically updated, e.g., based on usage statistics.

6.4 Content delivery

Content delivery supplies content to the end-user under the control of the application functions. The related procedures are detailed in Appendix I of [ITU-T Y.1910].

7 Content delivery functions

Content delivery capabilities allow IPTV end-users to select, watch and/or listen to video or audio content. Content delivery capabilities either stream content through end-user functions, allowing viewing in real time, or download it to end-user functions with storage ability (e.g., personal computer, digital video recorder or portable media player) for viewing at any time.

By using the content delivery capabilities, a service provider delivers linear TV content to the IPTV terminal device with the optional capability to record, rewind, and pause, over the network. The content delivery capabilities allow the delivery of IPTV content to IPTV end-users by responding dynamically to IPTV user's requests.

The content delivery capabilities can optionally support two delivery modes towards IPTV end-users: multicast delivery and unicast delivery.

In the content delivery architecture, either download of the content from a single storage instance or download of the content in segments from multiple storage instances is supported.

7.1 Content delivery functions in the IPTV architecture

Figure 7-1 shows the content delivery functions in the IPTV architecture and the corresponding reference points (refer to [ITU-T Y.1910] for further details).

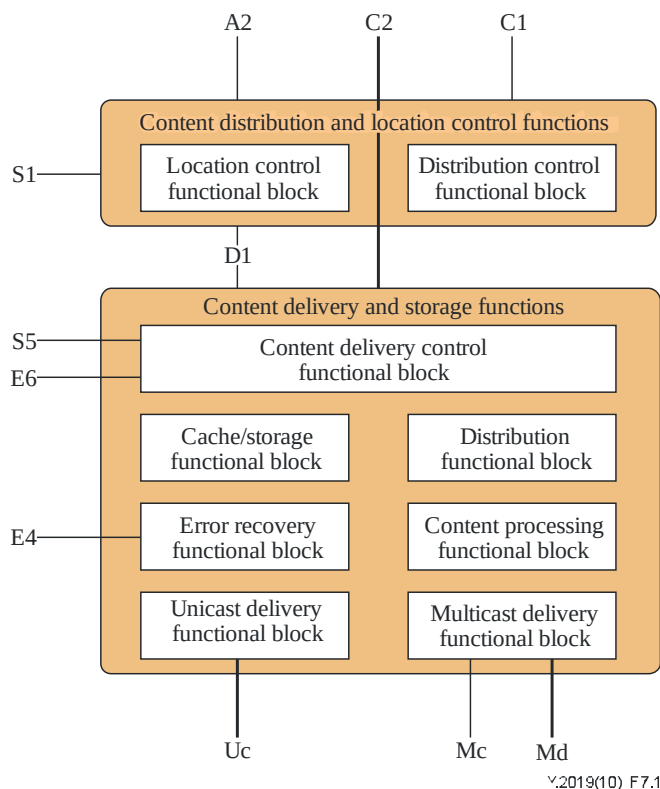


Figure 7-1 – Content delivery functions in [ITU-T Y.1910]

In [ITU-T Y.1910], the content delivery functions consist of two groups of functions:

- content distribution & location control functions (CD&LCF);
- content delivery & storage functions (CD&SF).

In the context of this Recommendation, the CD&SF, as defined in [ITU-T Y.1910], is split into two parts as shown in Figure 7-2:

- content delivery control functions (CDCF) including the following functional block:
 - content delivery control;
- content delivery processing functions (CDPF) including the following functional blocks:
 - cache/storage;
 - distribution;
 - content processing;
 - unicast delivery;
 - error recovery;
 - multicast delivery.

NOTE – Error recovery and multicast delivery functional blocks are optional.

A new reference point, i.e., the D2 reference point, is added between CDCF and CDPF.

Such functional split allows the support of the deployment scenarios described in this Recommendation.

The functional architecture shown in Figure 7-2 is compatible with the NGN functional architecture, as described in clause 9.3.4 of [ITU-T Y.2012]. More specifically:

- The CD&LCF correspond to the CD&LC-FE as per clause 9.3.4.1 of [ITU-T Y.2012];
- The CDCF correspond to the CDC-FE as per clause 9.3.4.2 of [ITU-T Y.2012];
- The CDPF correspond to the CDP-FE as per clause 9.3.4.3 of [ITU-T Y.2012].

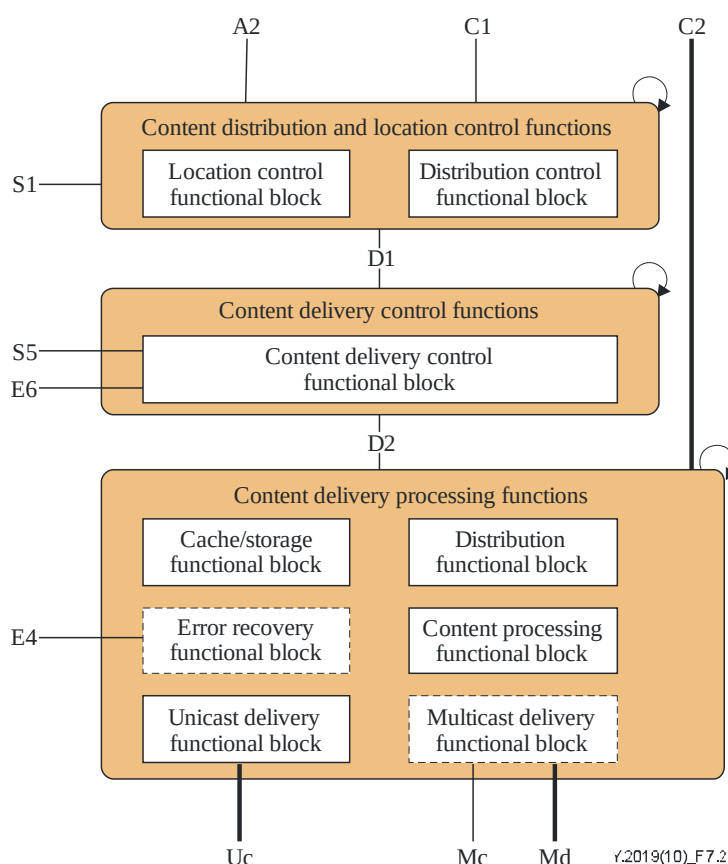


Figure 7-2 – Content delivery functional architecture