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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Broadband, triple-play and advanced multimedia
services – Ubiquitous sensor network applications and
Internet of Things

Functional architecture of multimedia content delivery networks

Recommendation ITU-T H.644.3

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Recommendation ITU-T H.644.3

Functional architecture of multimedia content delivery networks

Summary

Recommendation ITU-T H.644.3 specifies the common functional architecture for multimedia content delivery networks. The functions and functional blocks within this common functional architecture and the related reference points are specified in this Recommendation for matching the requirements of various kinds of content ingestion, content distribution and content delivery within different networks and platforms. In addition, this Recommendation also provides some examples of the related service features, workflows, an implementation guide, and the security aspects in appendices.

This Recommendation is intended to provide the references for multimedia content delivery network (MCDN) providers to help them to build the common infrastructures of a multimedia content delivery network. This Recommendation is of benefit for multimedia content providers who wish to dispatch their content to different types of end-users by taking advantage of a common MCDN capability.

History

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FOREWORD

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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.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, 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 TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T H.644.3

Functional architecture of multimedia content delivery networks

1 Scope

This Recommendation specifies the common functional architecture for multimedia content delivery networks (MCDNs). The functions and functional blocks within that functional architecture and the related reference points are specified in this Recommendation for matching the requirements of various kinds of content ingestion, content distribution and content delivery within different networks and platforms. In addition, this Recommendation also provides some examples of the related service features, workflows, an implementation guide and the security aspects in the Appendices.

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.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 content [b-ITU-T H.780]: A combination of audio, still image, graphic, video, or data.

3.1.2 content delivery network (CDN) [b-ITU-T Y.2084]: A content delivery network (CDN) is a system of distributed servers that deliver content (e.g., web pages, files, videos and audios) to users based on pre-defined criteria such as the geographic locations of users, the status of the content delivery server and the IP network connection.

3.1.3 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.

NOTE – A client is a service consumer external to DSN. A peer is a node within DSN.

3.1.4 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.

NOTE – During the content distribution process, content is often sent to appropriate intermediate nodes to enable subsequent delivery.

3.1.5 data encryption [b-ITU-T J.191]: Data encryption prevents the unauthorized disclosure/access of data. Data encryption does an excellent job at providing data confidentiality and protection against theft of service. Encryption prevents making data unable to read without the correct decryption key; however, it does not validate the source/receiving entities and it does not

provide copy protection after the data have been decrypted. It also does not prevent denial of service (DoS) attacks.

3.1.6 delivery [b-ITU-T X.609]: The procedures and means employed to provide a user with the required archived material for reuse.

3.1.7 distributed service networking (DSN) [b-ITU-T Y.2206]: An overlay networking which provides distributed and manageable capabilities to support various multimedia services and applications.

3.1.8 metadata [b-ITU-T X.1255]: Structured information that pertains to the identity of users, systems, services, processes, resources, information or other entities.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 content distribution service: The service provided by content/service providers (CP/SPs) or content delivery network (CDN) vendors/providers with the capability of distributing and delivering the content from content source to the destination by using CDN facilities.

3.2.2 distribution: The unidirectional flow of information from a given point in the network to other (multiple) locations.

3.2.3 dynamic content: Content created on demand when a user uses a web application dynamically.

3.2.4 static content: Content that seldom changes and that does not change with the requests from the users.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AES	Advanced Encryption Standard
AF	Aggregation Functions
A/S-MBF	Application/Service Business Management Functions
CBR	Constant Bitrate
CD&DF	Content Distribution and Delivery Functions
CL&DF	Content Location and Distribution Functions
CDF	Content Delivery Functions
CDN	Content Delivery Network
CMS	Content Management System
CNAME	Canonical NAME
CPF	Content Provider Functions
CRF	Content Routing/Redirecting Functions
DNS	Domain Name System
DoS	Denial of Service
EPG	Electronic Programme Guide
EUF	End-user Functions
FTP	File Transfer Protocol

GSLB	Global Service Load Balance
HLS	HTTP Live Streaming
HPD	HTTP Progress Download
HTTP	Hypertext Transfer Protocol
IPTV	Internet Protocol Television
MCDN	Multimedia Content Delivery Network
NF	Network Functions
NFV	Network Functions Virtualization
NFVO	NFV Orchestrator
NGN	Next Generation Network
OTT	Over The Top
QoS	Quality of Service
RR	Request Routing
RTSP	Real-Time Streaming Protocol
SDN	Software Defined Network
SLB	Service Load Balance
SOAP	Simple Object Access Protocol
STB	Set Top Box
URL	Uniform Resource Locator
VBR	Variable Bitrate
VOD	Video On Demand
VR	Virtual Reality
XML	Extensible Markup language

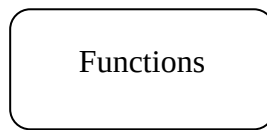
5 Conventions

In this Recommendation:

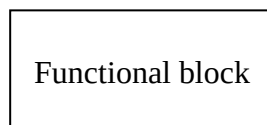
- The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.
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- The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.
- The keywords "is not recommended" indicate a requirement which is not recommended but which is not specifically prohibited. Thus, conformance with this specification can still be claimed even if this requirement is present.
- The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.



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



Functional block: In the context of MCDN architecture, 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:



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

6 Introduction

The current [ITU-T Y.2019] has defined the functional architecture of content delivery functions in next generation network (NGN). It is a general functional architecture but was built based on the Internet protocol television (IPTV) service. Currently, many additional services such as over the top (OTT) may also apply this functional architecture, but some functional blocks may need to be enhanced to support the various types of service. In order to support those services, some reference points and protocols may also need to be updated accordingly. Moreover, to provide an end-to-end content delivery service, a management and content routing system are also need to be included. Therefore, the current context in [ITU-T Y.2019] may not be sufficient to satisfy those new requirements.

A multimedia content delivery network (MCDN) as defined in this Recommendation is an integrated networking structure which is able to provide a common multimedia content distribution service to the various end-users by ignoring the difference of content type (e.g., static content, dynamic content), network and service platform, etc. Basically, the functional architecture for MCDN consists of the conventional content delivery network (CDN) functions in common, i.e., the basic functions that all types of CDN service are required to implement, e.g., content ingestion, storage and distribution, etc. However, there are many service feature differences between different types of CDN. For example, for the video service provided by streaming media CDN, a variety of streaming protocols (e.g., RTSP, HLS and Dash) should be supported but it is not required for web CDN which merely supports download protocols (e.g., HTTP and FTP). These differences can be eliminated by adopting the enhanced capability provided by MCDN functions.

Figure 6-1 provides an overview of the MCDN functional architecture.