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SERIES F: NON-TELEPHONE TELECOMMUNICATION SERVICES

Multimedia services

Use cases and requirements for a multimedia content delivery network

Recommendation ITU-T F.743.9

ITU-T F-SERIES RECOMMENDATIONS

NON-TELEPHONE TELECOMMUNICATION SERVICES

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Recommendation ITU-T F.743.9

Use cases and requirements for a multimedia content delivery network

Summary

Recommendation ITU-T F.743.9 illustrates a content delivery network (CDN), and defines use cases for a multimedia CDN in two categories: content delivery and capability, as well as the requirements for a CDN.

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FOREWORD

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Use cases and requirements for a multimedia content delivery network

1   Scope

This Recommendation specifies a content delivery network (CDN), and describes use cases for multimedia CDN in two categories: content delivery and capability use cases, as well as the requirements for multimedia CDN.

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.743.5]   Recommendation ITU-T F.743.5 (2018), *Framework and interfaces for multimedia content delivery network.*

3   Definitions

3.1   Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

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

3.1.2   content delivery network [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   dynamic content [ITU-T F.743.5]: Contents created on demand while a user dynamically operates a web application.

3.1.4   static content [ITU-T F.743.5]: Content that changes infrequently. This type of content is not changed with the requests of users.

3.2   Terms defined in this Recommendation

None.

4   Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CDN   Content Delivery Network

IP   Internet Protocol

QoE   Quality of Experience

QoS   Quality of Service

5   Convention

In this Recommendation:

The keywords 'is required to' indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords 'is prohibited from' indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords 'is recommended' indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

The 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.
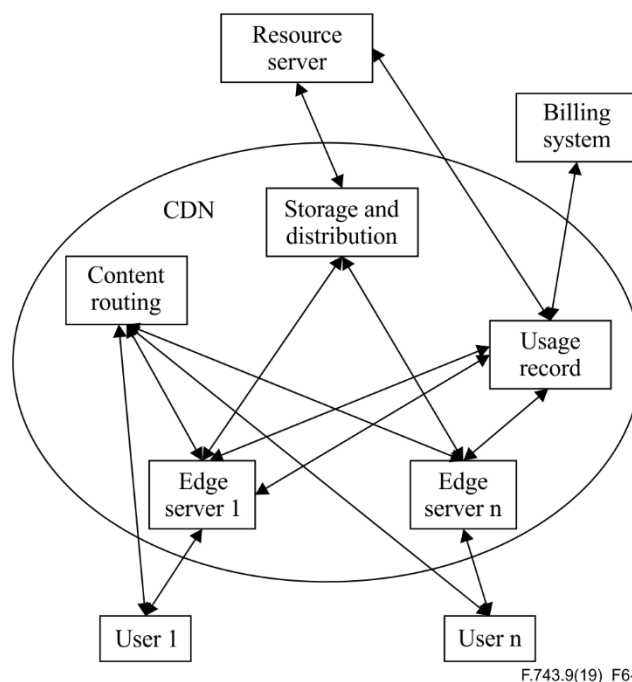
The keywords 'can optionally' indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6   Background

Nowadays, the Internet has become an important network infrastructure for delivering content. Because of the best effort nature of the Internet, quality of service (QoS) and quality of experience (QoE) provided by content services are not able to meet consumers' content quality expections, which is aggravated by the rapid growth of the number of Internet users and Internet content providers. Both content consumers and content providers seek content service QoS and QoE improvements. Meanwhile, traffic related to content services will meet its bandwidth bottleneck of backbone networks and investment in information technology infrastructure by content providers will become greater and greater. Therefore, CDN technology is the most appropriate solution for wide adoption in the current market.

Typically, a CDN consists of functions for content distribution and control, content delivery, content routing and redirection and management. For the high-level framework of multimedia CDN, see clause 8.2 of [ITU-T F.743.5].

A networking sketch of a CDN is shown in Figure 6-1.

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Figure 6-1 – Illustration of content delivery network

Basically, the original content provided by a content provider on the resource server should be ingested into the storage and distribution system first and then be pushed to the edge servers, according to the CDN operator strategy. While an end-user requests specific content, that request would be redirected by the content routing server to a CDN edge server that is close to that end-user and is able to provide a content consumption service. When the content is consumed on the edge server, content usage information will be collected by the usage record server and then transferred to both the billing system handled by the CDN operator and the resource server handled by the content provider.

A CDN can provide services for a single or several content providers. The types of content delivered by a CDN may be static content, dynamic content or a mixture of the two, based on requirements.

7   Use cases

7.1   Content delivery use cases

7.1.1   Static content delivery

7.1.1.1   Static web page browsing, file downloading and audio/video on demand

In these use cases, a CDN distributes static content from the original server to its edge nodes based on the distribution policy between the content provider and the CDN service provider. When an end-user requests relevant content, the content routing server of a CDN redirects the request to an edge node close to that end-user based on pre-defined strategies and the edge node delivers the content to the end-user.

These use cases are suitable for:

–   browsing static content, such as images, words, animations and audio/video content;

–   downloading files, such as articles, electronic books, application software and system software;

–   audio/video on demand, such as movies, TV programmes, music and songs.

7.1.1.2   Content upload

In this use case, end-users in different locations can upload their own content to the resource servers of one content provider via the nearest edge node selected by the CDN. This use case can accelerate user-generated content upload and distribution.

7.1.2   Dynamic content delivery

7.1.2.1   Dynamic web content delivery

In this use case, a CDN chooses the most appropriate transmission path to deliver dynamic content, which is created during the use of an application.

This use case is suitable for, but not limited to, delivery of dynamic content created by a certain application, such as active server pages, hypertext preprocessor pages, Java server pages and Java pages.

7.1.2.2   Live content distribution

In this use case, live content can be distributed to multiple edge nodes by a CDN, then delivered to a large number of end-users to save the bandwidths of backbone networks and provide better QoE when the multicast network is not available.

This use case is suitable for, but not limited to, movie or music broadcast, live and advertisement broadcast and live text content distribution services.

7.1.3   Mixed content distribution

The CDN can also provide a distribution service for a mixture of static and dynamic contents. In this case, static content can be distributed and stored in the CDN edge nodes as normal. Dynamic content can be retrieved from its original source by choosing an optimal routing path based on relevant strategies. The CDN the synchronizes dynamic and relevant static contents, displaying them on end-user terminals.

7.1.4   Virtual private content delivery network

Some content providers or companies may have special requirements for their content distribution, using a private CDN solution within a specific area over a given period of time. They want control and management of the private CDN themselves, without their own CDN solutions.

In this use case, CDN providers can provide virtual private CDNs to their customers by creating certain logical CDN partitions from the entire CDN resource, e.g., a combination of certain CDN hardware and software resources, with sufficient capabilities based on customer demand.

7.1.5   Authentication acceleration

For security issues, authentication, such as that for a user identifier, needs to be processed by the original resource server, which increases the pressures of processing on that server and backbone networks.

In this use case, relevant authentication can be processed in a CDN, instead of the original resource server, subject to agreement between the CDN and content providers. This solution can accelerate authentication and reduce access pressure on the original resource.

This use case is suitable for, but not limited to, hypertext transfer protocol secure services.

7.1.6   Services across different networks

In this use case, services provided by a content provider can be accessed by end-users from a CDN across different networks, such as a fixed or mobile network, or the CDNs provided by different CDN operators.

7.2 Capability use cases

7.2.1 Content processing

In this use case, content processing services, such as image reformation, audio-visual content transcoding, popular content updating and small file converging, are provided by redundant data-processing capabilities within a CDN.

7.2.2 Statistic or monitoring service

In this use case, a CDN can provide statistical results of content access and report possible safety threats within a period of time by analysing end user access log data, according to content provider requirements. A CDN can also provide report network traffic status to network operators by analysing the network traffic data of their carrier networks, which is collected when it provides content delivery services.

7.2.3 Resource rental services

In this use case, a CDN is able to store or cache user digital resources in their CDN nodes based on user requirements by using redundant storage resources. This use case includes, but is not limited to, content storage or caching services and pre-located storage or caching services.

8 Requirements

8.1 General requirements

8.1.1 Requirements for delivering various types of content

GR01: A CDN is recommended to have the capabilities of delivering various types of content, such as text, picture, audio-video and cartoon.

GR02: A CDN is recommended to have the capability of delivering static, dynamic or mixed content.

8.1.2 Requirements for accessing by multiple types of device

GR03: A CDN is recommended to have access capabilities by multiple types of device, e.g., personal computer, intelligent mobile device, personal assistant device and television with set top box.

8.1.3 Requirements for supporting multiple protocols

GR04: A CDN is recommended to have capabilities to support multiple protocols.

8.1.4 Requirements for content delivery network service, and node management and maintenance

GR05: A CDN is recommended to have capabilities to maintain and manage the relevant status of services or nodes, e.g., connection quality and node status.

8.1.5 Requirements for probing the carrier networks

GR06: A CDN is optionally to have capabilities of probing carrier network performance to improve service quality.

8.1.6 Requirements for content cache or storage

GR07: A CDN is required to have capabilities to store or cache content within its service coverage area based on a pre-defined storage or cache policy.

8.1.7 Requirements for request routing

GR08: A CDN is recommended to have capabilities to redirect requests to edge nodes nearby end-users.

CR09: A CDN is recommended to have capabilities to select the most appropriate routing path, such as the best connection quality and shortest path.

8.2 Service-oriented requirements

8.2.1 Requirements for synchronization of mixed content delivery

SOR01: A CDN is recommended to have capabilities to keep static and dynamic contents synchronous.

8.2.2 Requirements for providing virtual private content delivery network

SOR02: A CDN can optionally have capabilities to insulate a logical partition from CDN resources and to provide a virtual private CDN independently.

8.2.3 Requirements for original authentication acceleration

SOR03: A CDN can optionally have capabilities to provide an original authentication proxy granted by the original content source based on relevant agreements between the CDN and original content providers.

8.2.4 Requirements for providing services across different networks

SOR04: A CDN can optionally connect to different networks, such as the fixed and mobile networks, or the CDNs provided by different CDN operators.

8.2.5 Requirements for content processing services

SOR05: A CDN can optionally have capabilities to transfer the content format from one content processing service to another, e.g., different content coding, size and resolution.

SOR06: A CDN can optionally have capabilities to encrypt content based on content provider demand.

8.2.6 Requirements for statistical analysis services

SOR07: A CDN can optionally have capabilities to analyse statistically services provided by content providers.

8.2.7 Requirements for the reporting of network performances

SOR08: A CDN can optionally have capabilities to analyse network performance and to provide statistical performance reports about the networks.

8.2.8 Requirements for providing resource rental services

SOR09: A CDN can optionally have capability to provide its data storage or caching spaces to consumers.

8.3 Requirement for security

8.3.1 Security requirements for contents

SR01: A CDN is required to provide measures to guarantee consistency of content data when content is delivered from the content resource to the user.

SR02: A CDN is required to provide measures to prevent unauthorized access to the content delivered.

SR03: A CDN can optionally provide a digital rights management service when needed.

8.3.2 Security requirements for components of multimedia content delivery network

SR04: A CDN is recommended to provide measures to prevent its components from attacking and invading.

SR05: A CDN is recommended to configure redundancy to maintain services if certain components become unanvailable.

8.3.3 Security and privacy requirements for user information

SR06: A CDN is required to provide measures to prevent private user and service provider information of, such as username, password and content consumed, from unauthorized exposure.

Bibliography

[b-ITU-T H.780]   Recommendation ITU-T H.780 (2012), *Digital signage: Service requirements and IPTV-based architecture*.

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

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