

CDNI
Internet Draft
Intended status: Informational
Expires: January 30 2013

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September 26, 2012

Best practices and Requirements for delivering Long Tail personalized content delivery over CDN Interconnections

[draft-krishnan-cdni-long-tail-03.txt](#)

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Abstract

The content desire of users is evolving from most popular to long tail personalized content. This document discusses the best practices and requirements for delivering long tail personalized content in CDN Interconnection scenarios.

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1. Introduction

Typically, the CDNI interface between CDNs is a long-haul backbone network where bandwidth is premium. For user content requests from the downstream CDN (dCDN), a cache in the dCDN addresses the CDNI bandwidth challenge by being able to serve the content from the dCDN and avoiding accessing the content from the upstream CDN (uCDN). The cache has limited storage space/processing power and relies on the fact that the same piece of content is of interest to a lot of users.

Most popular content is of interest to a lot of users; examples are latest movies, latest catch-up episodes etc. A single copy of the content is delivered across CDNI to the cache; the content is delivered to multiple users from the cache. Thus, most popular content is very amenable to caching.

Long tail personalized content is of interest to only a few users; examples are documentaries, very old movies etc. Long tail personalized content is typically not shared by many users and caching of long tail personalized content could lead to cache thrashing issues. Thus, long tail personalized content is not amenable to caching.

This document discusses the best practices and requirements for delivering long tail personalized content in CDN Interconnection scenarios.

2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

This document reuses the terminology defined in:

[I-D.ietf-cdni-problem-statement-06],

[I-D.ietf-cdni-requirements-03],

[I-D.ietf-cdni-framework-00], and

[I-D.ietf-cdni-use-cases-08].

3. No Caching in CDNs

Long tail personalized content is typically not shared by many users and not amenable to caching. Avoiding caching in the CDNs has the following benefits 1) Better cache utilization 2) Avoid unnecessary HTTP redirection.

Each CDN has a local monitoring server which monitors the end user content usage in the CDN. By monitoring the content usage, each CDN determines whether or not the content should be cached locally in the CDN. Through the CDNI interface, each dCDN propagates this information to the uCDN(s). Thus, the uCDN(s) determine the dCDNs in which the content should be cached/not cached. This results in the following CDNI metadata interface requirement and request routing interface changes which are described in this draft.

An example interconnected CDN topology is depicted in Figure 1; CDN-A and CDN-B are uCDNs which have a relationship with the Content Service Provider(CSP). CDN-C, where the end users are connected, is a dCDN and has a local monitoring server.

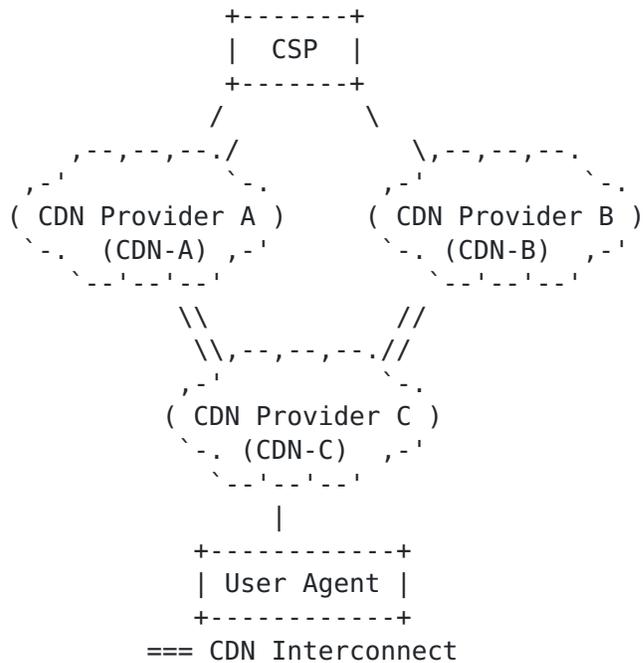


Figure 1: Interconnected CDNs with one dCDN

Metadata interface requirement

The CDNI Metadata Distribution interface shall provide indication by the dCDN to the uCDN whether the content should be cached or not cached in the dCDN. This information should be on a per URL basis. The default behavior would be to cache the content in the dCDN

Referring to the example in Fig. 2, [Section 3](#) [I-D.ietf-cdni-framework]; it shows Operator A as the uCDN and Operator B as the dCDN, where the former has a relationship with a content provider and the latter being the best CDN to deliver content to the end-user. Referring to the HTTP example in Fig. 3, [Section 3.2](#) [I-D.ietf-cdni-framework];

Request routing interface changes

Step 2: A Request Router for Operator A (which is the uCDN) processes the HTTP request. The HTTP URL metadata is looked up in a metadata database. For long tail personalized content, the metadata database lookup result indicates that the content should not be cached by the dCDN. The Request Router for Operator A recognizes that the end-user is best served by the uCDN without

any caching the in dCDN and returns a 302 redirect message with the URL of Operator A delivery node. The end-user proceeds to retrieve the data from Operator A delivery node. This is illustrated in Figure 2 below.

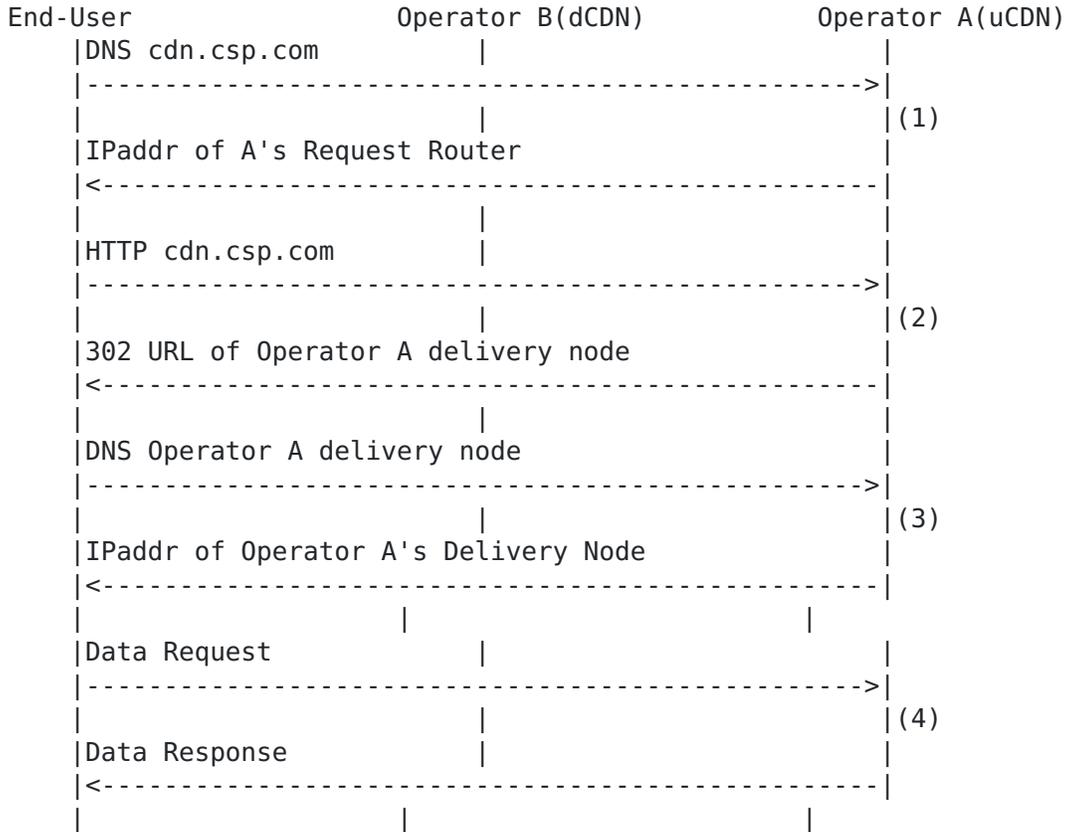


Figure 2: Request Routing interface for long tail personalized content

Logging and Auditing requirements

Work in progress

4. Benefits of HTTP Adaptive Streaming

As discussed before, long tail personalized content is not amenable to caching. Also, there is heavy asymmetric usage of the network between peak and quiet hours, where the peak hour load is much higher than the quiet hour load. These create unique bandwidth challenges across CDNI. HTTP Adaptive Streaming (HAS), which can adapt to

network congestion, is ideally suited for delivering long tail personalized content across interconnected CDNs.

5. Other techniques for delivering long tail personalized content

Approach 1

If the uCDN has a charging agreement with the dCDN that the dCDN pays fixed monthly money to uCDN (no matter how much traffic they exchange each month) and the CDN has enough storage capacity, the cache control of the long tail content is not that necessary, but let each CDN decide whether to cache the content or not locally. If the user request is redirected to dCDN but the dCDN does not cache the content, the dCDN can acquire the content from its uCDN.

Approach 2

If static control is desired for long tail content, the CSP can assign a second-level domain name for such kind of content, e.g. nocache.example.com/contentID, so that when this content is injected into CDNI system, CDN would determine whether to cache it or not according to this domain name.

Approach 3

So far, what has been discussed is streaming delivery of long tail personalized content. Caching in the end user device is another technique which can be used to address the bandwidth challenges created by streaming delivery of long tail personalized content over CDNI. This introduces a new model for long tail personalized content delivery. The various components of this model can be defined as 1)End user chooses the content to watch 2) The content is downloaded in the background and cached in the end user device 3)End user is notified of content availability. This model is typically applicable for long form content where the overhead in managing a background download is justifiable.

Caching in the end user device can have potential DRM issues which can be addressed using the following techniques 1) The content can be accessed by the end user only for playback 2) The content has a time expiry after which it destructs itself 3) In the case of end user device loss, the content destructs itself.

6. Acknowledgements

The authors would like to thank Francois Le Faucheur, Kevin Ma, Jin Weiyi and Ben Niven-Jenkins for their input.

7. References

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