Network Working Group
Internet-Draft
Updates: 8006,8008 (if approved)
Intended status: Standards Track
Expires: June 26, 2021

N. Sopher
Qwilt
S. Mishra
Verizon

December 23, 2020

CDNI Request Routing Extensions
draft-sopher-cdni-footprint-types-extensions-01

Abstract

Open Caching architecture is a use case of Content Delivery Networks Interconnection (CDNI) in which the commercial Content Delivery Network (CDN) is the upstream CDN (uCDN) and the ISP caching layer serves as the downstream CDN (dCDN). This document supplements to the CDNI Metadata Footprint Types defined in RFC 8006. The Footprint Types defined in this document can be used for Footprint objects as part of the Footprint & Capabilities Advertisement interface (FCI) defined in RFC 8008. The defined Footprint Types are derived from requirements raised by Open Caching but are also applicable to CDNI use cases in general.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at https://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on June 26, 2021.

Copyright Notice

Table of Contents

1. Introduction

The Streaming Video Alliance [SVA] is a global association that works to solve streaming video challenges in an effort to improve end-user experience and adoption. The Open Caching Working Group [OCWG] of the Streaming Video Alliance [SVA] is focused on the delegation of video delivery requests from commerical CDNs to a caching layer at the ISP's network. Open Caching architecture is a specific use case of CDNI where the commercial CDN is the upstream CDN (uCDN) and the ISP caching layer is the downstream CDN (dCDN). The Open Caching Request Routing Specification [OC-RR] defines the Request Routing process and the interfaces that are required for its provisioning. This document defines and registers CDNI Footprint and Capabilities objects[RFC8008] that are required for Open Caching Request Routing.

For consistency with other CDNI documents this document follows the CDNI convention of uCDN (upstream CDN) and dCDN (downstream CDN) to represent the commercial CDN and ISP caching layer respectively.

This document registers two CDNI Metadata Footprint Types (section 7.2 of [RFC8006]) for the defined objects:

- IPv4v6CIDR Footprint Type (for dCDN advertising a footprint that consists of both IPv4 and IPv6 client addresses)

- ISO3166Code Footprint Type (e.g. for dCDN advertising a footprint that is specific to a State in the USA)

1.1. Terminology

The following terms are used throughout this document:

- CDN - Content Delivery Network

Additionally, this document reuses the terminology defined in [RFC6707], [RFC7336], [RFC8006], [RFC8007], [RFC8008], and [RFC8804]. Specifically, we use the following CDNI acronyms:

- uCDN, dCDN - Upstream CDN and Downstream CDN respectively (see [RFC7336])

1.2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. CDNI Metadata Additonal Footprint Types

Section 5 of [RFC8008] describes the FCI Capability Advertisement Object, which includes an array of CDNI Footprint Objects. Each such object has a footprint-type and a footprint-value, as described in section 4.2.2.2 of [RFC8006]. This document defines additional footprint types, beyond those mentioned in CDNI metadata [RFC8006]. For consistency, this document follows the CDNI notation of uCDN for (the commercial CDN) and dCDN (the ISP caching layer).

2.1. CDNI Metadata IPv4v6CIDR Footprint Type

As described in section 5 of [RFC8008], the FCI Capability Advertisement Object includes an array of CDNI Footprint Objects. Appendix B of [RFC8008] specifies the semantics of a Footprint Objects array as a multiple, additive, footprint constraints. Meaning, the advertisement of different footprint types narrows the dCDN's candidacy cumulatively.

Sections 4.3.5 and 4.3.6 of [RFC8006] specify the "IPv4CIDR" and "IPv6CIDR" footprint types, respectively, for listing IP addresses blocks. Using Footprint Objects of these types, one can define an FCI Capability Advertisement Object footprint constraints that match IPv4 or IPv6 clients. However, the described "narrowing" semantic of the Footprint Objects array prevents the usage of these objects together in order to create a footprint constraint that matches IPv4 clients together with IPv6 clients.

Below is an example for an attempt at creating an object matching IPv4 clients of subnet "192.0.2.0/24", as well as IPv6 clients of subnet "2001:db8::/32". Such a definition results with an empty list of clients, as the constraints are additives and a client address cannot be both IPv4 and IPv6.

```
{
  "capabilities": [
    {
      "capability-type": <CDNI capability object type>,
      "capability-value": <CDNI capability object>,
      },
      "footprints": [
          {
              "footprint-type": "ipv4cidr",
              "footprint-value": ["192.0.2.0/24"]
          },
          {
              "footprint-type": "ipv6cidr",
              "footprint-value": ["2001:db8::/32"]
          }
      ]
    }
  ]
}
```

To overcome the described limitation and allow a list of footprint constraints that matches both IPv4 and IPv6 client addresses, we introduce below the "IPv4v6CIDR" simple data type as well as a derived footprint type.

2.1.1. CDNI Metadata IPv4v6CIDR Data Type

The "IPv4v6CIDR" data type specified in Section 2.1.1.1, can be either IPv4 or IPv6 address blocks. The data type is added to the list of data types described in section 4.3 of [RFC8006] that are used as properties of CDNI Metadata objects.

2.1.1.1. CDNI Metadata IPv4v6CIDR Data Type Description

Either an IPv4CIDR property or IPv6CIDR property, as described in sections 4.3.5 and 4.3.6 of [RFC8006] respectively.

Type: String

Example IPv4v6CIDRs:

"192.0.2.0/24"

"2001:db8::/32"

2.1.2. CDNI Metadata IPv4v6CIDR Footprint Type Description

The "IPv4v6CIDR" simple data type specified in Section 2.1.1, is added to the data types listed as footprint types in section 4.2.2.2 of [RFC8006].

Below is an adjustment for the example in Section 2.1.1, now embedding a footprint object of type "IPv4v6CIDR".

```
{
  "capabilities": [
    {
      "capability-type": <CDNI capability object type>,
      "capability-value": <CDNI capability object>,
      },
      "footprints": [
          {
              "footprint-type": "ipv4v6cidr",
              "footprint-value": ["192.0.2.0/24", "2001:db8::/32"]
          }
      ]
    }
  ]
}
```

2.2. CDNI Metadata ISO3166Code Footprint Type

Section 4.3.8 of [RFC8006] specifies the "Country Code" footprint type for listing [ISO3166-1] alpha-2 codes. Using Footprint Objects of this type, one can define an FCI Capability Advertisement Object footprint constraints that match a specific country. Here we define the iso3166code simple data type, as well as a footprint type allowing the dCDN to define constraints matching geographic areas

with better granularity, specifically using the [ISO3166-2] Country Subdivision codes.

2.2.1. CDNI Metadata ISO3166Code Data Type

The "ISO3166Code" data type specified in Section 2.2.1.1, can either describe a country based on an [ISO3166-1] alpha-2 code, or describe a more specific subdivision using an [ISO3166-2] code. The data type is added to the list of data types described in section 4.3 of [RFC8006] that are used as properties of CDNI Metadata objects.

2.2.1.1. CDNI Metadata ISO3166Code Data Type Description

Either an [ISO3166-1] alpha-2 code in lowercase, or such a code followed by a dash as well as a more specific subdivision [ISO3166-2] alphanumeric code in lowercase.

Type: String

Example ISO3166Codes:

"ca"

"us-ny"

2.2.2. CDNI Metadata ISO3166Code Footprint Type Description

The "ISO3166Code" simple data type specified in Section 2.2.1 , is added to the data types listed as footprint types in section 4.2.2.2 of [RFC8006] .

Below is an adjustment for the example in Section 2.2.1 , now embedding a footprint object of type "ISO3166Code". The Footprint Object in this example creates a constraints matching clients both in Canada (ISO [ISO3166-1] alpha-2 code "CA") as well as in the state of New-York (ISO [ISO3166-2] Subdivision code "NY") in the (ISO [ISO3166-1] alpha-2 code "US").

```
{
  "capabilities": [
    {
      "capability-type": <CDNI capability object type>,
      "capability-value": <CDNI capability object>,
      },
      "footprints": [
          {
              "footprint-type": "iso3166code",
              "footprint-value": ["ca", "us-ny"]
          }
      ]
    }
  ]
}
```

3. IANA Considerations

3.1. CDNI Metadata Footprint Types

As described in section 7.2 of [RFC8006] , the "CDNI Metadata Footprint Types" subregistry was created within the "Content Delivery Network Interconnection (CDNI) Parameters" registry. The created namespace defines the valid values for Footprint Object Types, and is already populated with the types described in Section 4.2.2.2 of [RFC8006] .

This document requests the registration of the two additional footprint type as defined in Section 2.1 and Section 2.2 :

Footprint Type	Description	Specification
ipv4v6cidr	IPv4/IPv6 address block	RFCthis
iso3166code	ISO 3166-1/2 Country or Subdivision Code	RFCthis

[RFC Editor: Please replace RFCthis with the published RFC number for this document.]

4. Security Considerations

This specification is in accordance with the CDNI Request Routing: Footprint and Capabilities Semantics. As such, it is subject to the

security and privacy considerations as defined in Section 8 of [RFC8006] and in Section 7 of [RFC8008] respectively.

5. Acknowledgements

The authors would like to express their gratitude to Ori Finkelman and Kevin J. Ma for their guidance and reviews throughout the development of this document.

6. References

6.1. Normative References

[ISO3166-1] ISO, "Codes for the representation of names of countries and their subdivisions -- Part 1: Country code", ISO 3166-1:2020, Edition 4, 08 2020, <https://www.iso.org/standard/72482.html>.

[ISO3166-2] ISO, "Codes for the representation of names of countries and their subdivisions -- Part 2: Country subdivision code", ISO 3166-2:2020, Edition 4, 08 2020, <https://www.iso.org/standard/72483.html>.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

[RFC8006] Niven-Jenkins, B., Murray, R., Caulfield, M., and K. Ma, "Content Delivery Network Interconnection (CDNI) Metadata", RFC 8006, DOI 10.17487/RFC8006, December 2016, <https://www.rfc-editor.org/info/rfc8006>.

[RFC8007] Murray, R. and B. Niven-Jenkins, "Content Delivery Network Interconnection (CDNI) Control Interface / Triggers", RFC 8007, DOI 10.17487/RFC8007, December 2016, <https://www.rfc-editor.org/info/rfc8007>.

[RFC8008] Seedorf, J., Peterson, J., Previdi, S., van Brandenburg, R., and K. Ma, "Content Delivery Network Interconnection (CDNI) Request Routing: Footprint and Capabilities Semantics", RFC 8008, DOI 10.17487/RFC8008, December 2016, <https://www.rfc-editor.org/info/rfc8008>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

[RFC8804] Finkelman, O. and S. Mishra, "Content Delivery Network Interconnection (CDNI) Request Routing Extensions", RFC 8804, DOI 10.17487/RFC8804, September 2020, <https://www.rfc-editor.org/info/rfc8804>.

6.2. Informative References

[OC-RR] Finkelman, O., Ed., Hofmann, J., Klein, E., Mishra, S., Ma, K., Sahar, D., and B. Zurat, "Open Caching - Request Routing Functional Specification", Version 1.1, October 2019, <https://www.streamingvideoalliance.org/books/open-cache-request-routing-functional-specification/>.

[OCWG] "Open Caching Home Page", <https://www.streamingvideoalliance.org/technical-groups/open-caching/>.

[RFC6707] Niven-Jenkins, B., Le Faucheur, F., and N. Bitar, "Content Distribution Network Interconnection (CDNI) Problem Statement", RFC 6707, DOI 10.17487/RFC6707, September 2012, <https://www.rfc-editor.org/info/rfc6707>.

[RFC7336] Peterson, L., Davie, B., and R. van Brandenburg, Ed., "Framework for Content Distribution Network Interconnection (CDNI)", RFC 7336, DOI 10.17487/RFC7336, August 2014, <https://www.rfc-editor.org/info/rfc7336>.

[SVA] "Streaming Video Alliance Home Page", <https://www.streamingvideoalliance.org>.

Authors' Addresses

Nir B. Sopher
Qwilt

6, Ha'harash

Hod HaSharon
,

4524079

Israel

Email:
nir@apache.org

Sanjay Mishra
Verizon
13100 Columbia Pike
Silver Spring, MD 20904
USA

Email: sanjay.mishra@verizon.com