CDNI Request Routing Extensions
draft-ietf-cdni-request-routing-extensions-02

Abstract

   The Open Caching working group of the Streaming Video Alliance is
   focused on the delegation of video delivery requests from commercial
   CDNs to a caching layer at the ISP. In that aspect, Open Caching 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 extensions specified in this document to the CDNI Metadata and
   FCI interfaces are derived from requirements raised by Open Caching
   but are applicable to CDNI use cases in general.

Requirements Language

   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].

Status of This Memo

Table of Contents

1. Introduction

   This document defines objects needed for Open Caching request
   routing. For that purpose it extends CDNI metadata [RFC8006] and
   CDNI Footprint and Capabilities [RFC8008]. For consistency, this
   document follows the CDNI notation of uCDN (the commercial CDN) and
   dCDN (the ISP caching layer).

   This document also registers CDNI Payload Types [RFC7736] for the
   defined objects:

   o Redirect Target Capability (for dCDN advertising redirect target
      address)

   o Fallback Target Metadata (for uCDN configuring fallback target
      address)

1.1. Terminology

   This document reuses the terminology defined in [RFC6707], [RFC8006],
   [RFC8007], and [RFC8008].

   Additionally, the following terms are used throughout this document
   and are defined as follows:

   o RR - Request Router

   o CP - Content Provider

2. Redirect Target Address Capability Object

   Iterative request redirect as defined in section 1.1 of [RFC7336]
   requries the provisioning of a redirect target address to be used by
   the uCDN in order to redirect to the dCDN. Redirect target addresses
   can vary between different footprints, for example between different
   regions, and they may also change over time, for example due to
   scaling issues a dCDN may need to split different regions over
   multiple targets, or due to network problems the dCDN may have to
   change the target address. Due to this variable and dynamic nature
   of the redirect target, it may not be suitable to advertise it during
   bootstrap, and a more dynamic, and footprint oriented interface is
   required. Therefore, we have chosen to use the CDNI Footprint and
   Capabilities interface for redirect target advertisement.

   Use cases

   o Footprint: The dCDN may want to have a different target per
      footprint. Note that a dCDN may spread across multiple
      geographies. This makes it easier to route client requests to a
      nearby request router. Though this can be achieved using a single
      canonical name and Geo DNS, that approach has limitations; for
      example a client may be using third party DNS resolver, making it
      impossible for the redirector to detect where the client is
      located, or Geo DNS granularity may be too rough for the
      requirement of the application.

   o Scaling: The dCDN may choose to scale its request routing service
      by deploying more request routers in new locations and advertise
      them via an updatable interface like the FCI.

   The Redirect Target capability object is used to indicate the target
   address the uCDN should use in order to redirect a client to the

dCDN. A target may be attached to a specific uCDN host, a list of
uCDN hosts, or it can be set globally for all the hosts of the uCDN.

When dCDN is attaching the redirect target to a specific uCDN host or
a list of uCDN hosts, the dCDN MUST advertise the hosts within the
Redirect Target Capability object as "redirecting-hosts". In that
case, the uCDN can redirect to that dCDN address, only if the request
was directed to one of these uCDN hosts.

A redirect target for DNS redirection is an IP address used as an A
record response or a FQDN used as an alias in a CNAME record response
(see [RFC1034]) of the uCDN DNS router. Note that DNS routers take
routing decisions based on either the DNS resolver's IP address or
the client IP address when EDNS0 client-subnet is used (see
[RFC7871]). The dCDN may choose to advertise redirect targets and
footprints to cover both cases. A uCDN DNS router implemenation
SHOULD prefer routing based on client IP address when it is
available.

A redirect target for HTTP redirection is the URI to be used as a
value of the Location header of a HTTP redirect 3xx response,
typically a 302 (Found) (see section 7.1.2 of [RFC7231] and section
6.4 of [RFC7231]).

   Property: redirecting-hosts

      Description: One or more uCDN hosts to which this redirect
      target is attached. A redirecting host SHOULD be a host that
      was published in a HostMatch object by the uCDN as defined in
      section 4.1.2 of [RFC8006].

      Type: A list of Endpoint objects (see section 4.3.3 of
      [RFC8006])

      Mandatory-to-Specify: No. If not present, or empty, the
      redirect target applies to all hosts of the redirecting uCDN.

   Property: dns-target

      Description: Target address for DNS A record or CNAME record.

      Type: DnsTarget object (see Section 2.1)

      Mandatory-to-Specify: No. but at least one of "dns-target" or
      "http-target" MUST be present and non empty.

   Property: http-target

Description: Target URI for HTTP redirect.

Type: HttpTarget object (see [Section 2.2](#))

Mandatory-to-Specify: No. but at least one of "dns-target" or "http-target" MUST be present and non empty.

Example of Redirect Target Capability object that advertises a dCDN target address that is attached to a specific list of uCDN "redirecting-hosts". A uCDN host that is included in that list can redirect to the advertised dCDN redirect target.

```
{
  "capabilities": [
    {
      "capability-type": "FCI.RedirectTarget",
      "capability-value": {
          "redirecting-hosts": [
             "a.service123.ucdn.example.com",
             "b.service123.ucdn.example.com"
          ]
          "dns-target": {
             "host": "service123.ucdn.example.dcdn.com"
          }
          "http-target": {
             <Properties of an HttpTarget object>
          }
      },
      "footprints": [
          <Footprint objects>
      ]
    }
  ]
}
```

2.1. DnsTarget

The DnsTarget object gives the instructions to construct the target address for the DNS response for delegation from the uCDN to the dCDN.

Property: host

Description: The host property is a hostname or an IP address, without a port number.

Type: Endpoint object as defined in [section 4.3.3 of [RFC8006]](#) with the limitation that it MUST NOT include a port number.

         Mandatory-to-Specify: Yes.

   Example of DnsTarget object:

    {
       "host": "service123.ucdn.example.dcdn.com"
    }

   Example of a DNS query for uCDN address
   "a.service123.ucdn.example.com" and the corresponding CNAME
   redirection response:

    Query:
    a.service123.ucdn.example.com:
    type A, class IN

    Response:
    a.service123.ucdn.example.com:
    type CNAME, class IN, cname service123.ucdn.example.dcdn.com

2.2. HttpTarget

   The HttpTarget object gives the instructions to construct the target
   Location URI for http redirection from the uCDN to the dCDN.

      Property: host

         Description: Hostname or IP address and an optional port, i.e.,
         the host and port of the authority component of the URI as
         described in section 3.2 of [RFC3986].

         Type: Endpoint object as defined in section 4.3.3 of [RFC8006].

         Mandatory-to-Specify: Yes.

      Property: path-prefix

         Description: A path prefix for the HTTP redirect Location
         header. The original path is appended after this prefix.

         Type: A prefix of a path-absolute as defined in section 3.3 of
         [RFC3986]. The prefix MUST end with a trailing slash, to
         indicate the end of the last path segment in the prefix.

         Mandatory-to-Specify: No. If this property is absent or empty,
         the uCDN MUST NOT prepend a path prefix to the original content
         path, i.e. the original path MUST appear in the location URI
         right after the authority component.

      Property: include-redirecting-host

         Description: A flag indicating whether or not to include the
         redirecting host as the first path segment after the path-
         prefix. In case this flag is true and a "path-prefix" is used,
         the uCDN redirecting host MUST be added as a separate path
         segment after the path-prefix and before the original URL path.
         In case this flag is true and there is no path-prefix, the uCDN
         redirecting host MUST be prepended as the first path segment in
         the redirect URL.

         Type: Boolean.

         Mandatory-to-Specify: No. Default value is False.

   Example of HttpTarget object with a path-prefix and include-
   redirecting-host:

   {
      "host": "us-east1.dcdn.com",
      "path-prefix": "/cache/1/",
      "include-redirecting-host": true
   }

   Example of a HTTP request for content at uCDN host
   "a.service123.ucdn.example.com" and the corresponding HTTP response
   with Location header used for redirecting the client to the dCDN
   using the the http-target in the above example:

    Request:
    GET /vod/1/movie.mp4 HTTP/1.1
    Host: a.service123.ucdn.example.com

    Response:
    HTTP/1.1 302 Found
    Location: http://us-east1.dcdn.com/cache/1/
    a.service123.ucdn.example.com/vod/1/movie.mp4

3. Fallback Target Address Metadata

   Open Caching requires that the uCDN should provide fallback target
   server to the dCDN to be used in cases where the dCDN cannot properly
   handle the request. To avoid redirect loops, the fallback target
   server's address at the uCDN MUST be differnet than the original
   address at the uCDN from which the client was redirected to the dCDN.
   The uCDN MUST avoid further redirection when receiving the client
   request at the fallback target. The fallback target is defined as a
   generic metadata object (see section 3.2 of [RFC8006])

Use cases

o Failover: A dCDN request router receives a request but has no
   caches to which it can route the request. This can happen in the
   case of failures or temporary network overload.

o No coverage: A dCDN request router receives a request from a
   client located in an area inside the footprint but not covered by
   the dCDN caches, or a client located outside the dCDN footprint
   coverage. In such cases, the router may choose to redirect the
   request back to the uCDN fallback address.

o Error: A cache may receive a request that it cannot properly
   serve, for example, some of the metadata objects for that service
   were not properly acquired. In this case, the cache may resolve
   to redirect back to uCDN.

The Fallback target metadata object is used to indicate the target
address the dCDN should use in order to redirect a client back to the
uCDN. Fallback target is represented as endpoint objects as defined
in section 4.3.3 of [RFC8006].

The uCDN fallback target address may be used as a DNS A record or
CNAME record in case of DNS redirection mode or a host name for HTTP
redirect.

When using HTTP redirect to route a client request back to the uCDN,
it is the dCDN's responsibility to use the original URL path as the
client would have used for the original uCDN request, stripping, if
needed, the dCDN path-prefix and the uCDN host name from the redirect
URL that may have been used to request the content from the dCDN.

   Property: host

      Description: Target address to which the dCDN can redirect the
      client.

      Type: Endpoint object as defined in section 4.3.3 of [RFC8006]
      with the limitation that in case of DNS delegation, it MUST NOT
      include a port number.

      Mandatory-to-Specify: Yes.

Example of a MI.FallbackTarget Metadata object that designates the
host address the dCDN should use as fallback address to redirect back
to the uCDN.

```
   {
      "generic-metadata-type": "MI.FallbackTarget",
      "generic-metadata-value":
       {
          "host": "fallback-a.service123.ucdn.example"
       }
   }
```

4. IANA Considerations

4.1. CDNI Payload Types

   This document requests the registration of the following CDNI Payload
   Types under the IANA CDNI Payload Type registry defined in [RFC7736]:

```
              +--------------------+---------------+
              | Payload Type       | Specification |
              +--------------------+---------------+
              | FCI.RedirectTarget | RFCthis       |
              | MI.FallbackTarget  | RFCthis       |
              +--------------------+---------------+
```

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

4.1.1. CDNI FCI RedirectTarget Payload Type

   Purpose: The purpose of this payload type is to distinguish
   RedirectTarget FCI objects

   Interface: FCI

   Encoding: see Section 2

4.1.2. CDNI MI FallbackTarget Payload Type

   Purpose: The purpose of this payload type is to distinguish
   FallbackTarget MI objects (and any associated capability
   advertisement)

   Interface: MI/FCI

   Encoding: see Section 3

5. Security Considerations

This specification is in accordance with the CDNI Metadata Interface
and the CDNI Request Routing: Footprint and Capabilities Semantics.
As such, it is subject to the security considerations as defined in
[RFC8006] and [RFC8008] respectively.

6. Acknowledgements

TBD.

7. Contributors

TBD.

8. References

8.1. Normative References

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Authors' Addresses

   Ori Finkelman
   Qwilt
   6, Ha'harash
   Hod HaSharon 4524079
   Israel

   Phone: +972-72-2221647
   Email: ori.finkelman.ietf@gmail.com

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

   Email: sanjay.mishra@verizon.com