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**Capability Information Advertising for CDN Interconnection
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Abstract

This document describes protocol for Capability Information Advertising which is

used to communicate capability information among interconnected Content Delivery

Networks(CDNs).

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[1. Introduction](#)

Some discussion happened on request routing interface of CDNI among the CDNI working group, consensus has been achieved that the request routing interface comprises two main parts and these two parts should be addressed in different documents to progress separately:

* the asynchronous advertisement of footprint and capabilities by a dCDN that allows a uCDN to decide whether to redirect particular user requests to that dCDN; and

* The synchronous operation of actually redirecting a user request.

This document hence focuses on defining the Capability Information Advertising

Protocol for CDNI, which is one of the main building blocks of request routing interface.

1.1. Terminology

This document reuses the terminology defined in [I-D.[draft-cdni-problem-statement](#)].

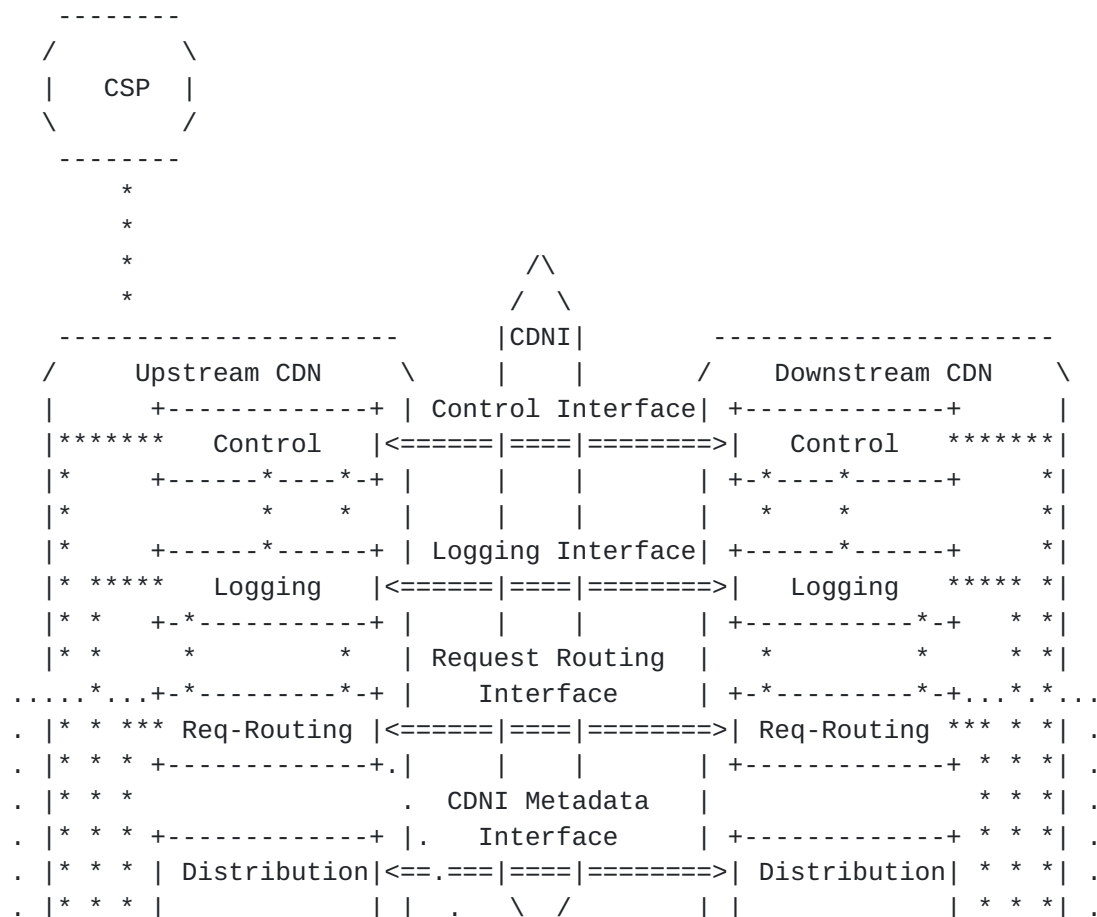
1.2. Reference Model

Figure 1 from [I-D.[draft-cdni-problem-statement](#)] illustrating the CDNI model and the CDNI interfaces are replicated below.

The Capability Information Advertising Protocol is not explicitly shown in figure

1. Although that might be changed later upon the working group's decision, but now

it is thought that capability advertisement is part of the function of the Request Routing interface.

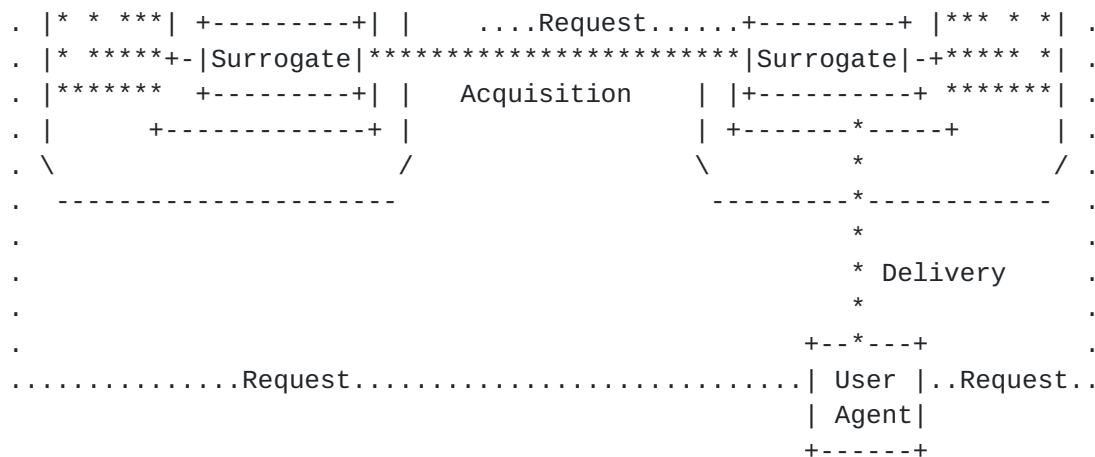


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<==> interfaces inside the scope of CDNI
 ***** interfaces outside the scope of CDNI
 interfaces outside the scope of CDNI

Figure 1: CDNI Model

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](#)].

3. Capability information description

The Capability Information Advertising Protocol allows the Downstream CDN to provide the Upstream CDN with information (e.g. resources, footprint, load) to

facilitate selection of the Downstream CDN by the Upstream CDN request routing

system when processing subsequent content requests from User Agents.

From the perspective of an Upstream CDN, to make a routing decision from multiple

Downstream CDNs which will meet the local policy or requirement of the CP, the

information needed may includes:

- 0 Status of each CDN, e.g. in service or out of service;

- 0 Resource status of each Downstream CDN, e.g. usage percentage of acquisition

bandwidth, usage percentage of delivery bandwidth, available acquisition bandwidth,

available delivery bandwidth etc.;

0 Footprint of each Downstream CDN;

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- 0 Delivery protocol supported by each Downstream CDN;
- 0 Cost information of each Downstream CDN;
- 0 Authentication type to end user supported by each of the Downstream CDNs (Optional)

4. Protocol Function and Operation Overview

CDN capability is information coupling with a specified application (CDNI), it should be conveyed via an application layer protocol rather than any other underlying layer protocol e.g. IP layer which should de-coupling with any application. In this document HTTP/1.1 protocol [[RFC2616](#)] is used for capability

information advertising. The CDNs which have contracted for providing interconnection service to each other send capability advertisement messages to

their interconnected peers. The detailed capability information description and

message definition is described in [section 5](#) of this document.

The Capability Information Advertising Protocol takes two modes. One is report

mode, where the Downstream CDN advertises its capability information to the Upstream CDN during at a periodic interval, e.g. every 5 minutes. The other one is

query mode, where the Upstream CDN acquires the capability information from the

Downstream CDN periodically, e.g. every 5 minutes. The Upstream CDN utilizes the

capability information to makes its routing decision upon receiving a content request from an end user.

To enable the communications over the Capability Information Advertising Protocol,

the two interconnected CDNs need to know each other's contact address. The contact

address may be statically pre-configured, dynamically discovered via control interface, or other means. However, they are not specified in this document, as

this is considered not in the scope of the CDNI Capability Information Advertising Protocol.

5. Protocol Specification

This section describes the details of the Capability Information Advertising

Protocol.

5.1. Capability information description

The Downstream CDN exposes its capability information to an Upstream CDN to facilitate CDN selection among other functions. The exposure should be of appropriate granularity to ensure the self-administrative nature of Downstream CDN.

The following information in Table 2 is considered for capability exchange.

+-----+-----+-----+-----+-----+					+-----+	
Name	Type	Value	Cat.	Description		
+-----+-----+-----+-----+-----+					+-----+	

IPVersion	ENUM,4 byte	1:IPv4;2:IPv6 3:IPv4&IPv6	M	IP address version of which a CDN can serve for end users	
+-----+-----+-----+-----+-----+					
Service- Status	ENUM,4 byte	1:in-service; 2:out-of-service	M	CDNI service status	
+-----+-----+-----+-----+-----+					
maxDelive- ryBW	UNIT32	Integer starts from zero Unit:Mbps	M	Maximum bandwidth commit- ted for content delivery	
+-----+-----+-----+-----+-----+					
 DeliveryBW Usage	UNIT8	Integer starts from zero to 100	M	Current usage percentage of bandwidth for content delivery	
+-----+-----+-----+-----+-----+					
maxConnec- tion	UNIT32	Integer starts from zero	M	Maximum number of simult- aneous HTTP connections committed for content delivery	
+-----+-----+-----+-----+-----+					
usedConne- ction	UNIT32	Integer starts from zero	M	Number of HTTP connection for content delivery	
+-----+-----+-----+-----+-----+					
Delivery- Protocol	List	A list of protoc- ols,e.g.HTTP,RTSP	M	Supported delivery protocols	
+-----+-----+-----+-----+-----+					
Coverage 	List	Coverage represe- nted by ASN or Contry,State,City combination of the covered region	M	CDN coverage	
+-----+-----+-----+-----+-----+					
Cost 	Object	A Currency and a Price subelement	M	CDN Cost	
+-----+-----+-----+-----+-----+					
Currency	String	USD,CNY, EUR etc.	M	CDN Currency	
+-----+-----+-----+-----+-----+					
Price 	UNIT32	Integer starts From zero	M	CDN Price for per GB data delivery	
+-----+-----+-----+-----+-----+					
UserAuth 	ENUM,4 byte	1:urlSigning; 2:urlToken	0	Authentication type to end user supported byCDN	
+-----+-----+-----+-----+-----+					

Note: The value of "maxDeliveryBW" and "DeliveryBWUsage" may be an absolute value taking only the physical bandwidth of the CDN into account or it may be a normalized value which may also consider the disk I/O capacity and CPU usage as a whole. This depends on the CDN specific

implementation

and is out of scope of CDNI.

Table 2 capability information description

5.2. Message description

The HTTP/1.1 protocol is used for capability advertising.

The HTTP request is HTTP POST for Report mode and HTTP GET for Query mode respectively.

The request URI in both modes conforms to [\[RFC3986\]](#). The URI format in this document is as follows: HTTP://<host>/<url-path>, where the <host> specifies

a destination, and the <url-path> conveys the message name.

The message body representation specified in this document is JavaScript Object Notation(JSON).

5.2.1. Report mode

The Downstream CDN issues an HTTP POST message to the Upstream CDN to report its capability information.

The message name in the request URI is "CdniCapReport".

The Content-Type header field is "application/json".

The message body includes capability information.

Upon successful receipt of the POST request, the Upstream CDN responds with a 200 OK message.

5.2.2. Query mode

The Upstream CDN issues a HTTP GET message to a Downstream CDN to query its capability information.

The message name in the request URI is "CdniCapQuery".

Upon successful receipt of the GET request, the Downstream CDN responds a 200 OK message with its capability information.

The Content-Type header field for the response is "application/json".

5.3. Message examples

This section gives some message examples for Capability Information Advertising Protocol.

5.3.1. Report mode

The POST request and corresponding response are illustrated as below.

Request example (Downstream CDN to Upstream CDN):

POST <http://contact-address.ucdn.example/CdniCapReport> HTTP/1.1
Content-Type: application/json
Content-Length: 350

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```
{
  "IPVersion":1,
  "ServiceStatus":1,
  "maxDeliveryBW":5000,
  "DeliveryBWUsage":40,
  "maxConnection": 2000,
  "usedConnection": 600,
  "DeliveryProtocol":["HTTP", "RSTP"],
  "Cost":
  {"Currency":USD,
   "Price":200,
  },
  "Coverage":
  [
    {
      "ASN":1000
    },
    {
      "ASN":2000
    }
  ]
}
```

Response example:

HTTP/1.1 200 OK

5.3.2. Query mode

The GET request and corresponding response are illustrated as below.

Request example (Upstream CDN to Downstream CDN):

GET <http://contact-address.dcdn.example/CdniCapQuery> HTTP/1.1

Response example:

HTTP/1.1 200 OK

Content-Type: application/json

Content-Length: 350

The content of message body is the same as that of POST message illustrated in [section 4.3.1](#).

6. Security Considerations

Capability advertising is a main function which will affect the final routing decision of an upstream CDN, security threats on it

include that any identity spoofing of the downstream CDN or changing of the capability advertising message with malicious intent which would cause the upstream CDN redirect an end user request to an inappropriate downstream CDN which possible cannot provide service to the end user.

It is mentioned in [section 8](#) of the requirement draft [I-D.[draft-cdni-requirements](#)], all the CDNI interface shall support secure operation over unsecured IP connectivity (e.g. The Internet). This includes authentication, confidentiality, integrity protection as well as protection against spoofing and replay. As this security requirement applies to all the CDNI interfaces and it is recommended that the working group addresses this issue and considers a consistent solution in another separate document later.

7. IANA Considerations

If the approach described in this document is adopted, we would request that IANA allocate the message name "CdniCapReport" and CdniCapQuery" in the HTTP Parameters registry.

8. References

8.1. Normative References

[[RFC2119](#)] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

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9. Acknowledgments

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