

CDNI Working Group  
Internet-Draft  
Intended status: Standards Track  
Expires: 14 March 2022

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10 September 2021

CDNI extensions for HTTPS delegation  
draft-ietf-cdni-interfaces-https-delegation-06

## Abstract

The delivery of content over HTTPS involving multiple CDNs raises credential management issues. This document proposes extensions in CDNI Control and Metadata interfaces to setup HTTPS delegation from an Upstream CDN (uCDN) to a Downstream CDN (dCDN).

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Internet-Draft      CDNI extensions for HTTPS delegation      September 2021

## Table of Contents

<a href="#">1.</a>	Introduction . . . . .	<a href="#">2</a>
<a href="#">2.</a>	Terminology . . . . .	<a href="#">3</a>
<a href="#">3.</a>	Known delegation methods . . . . .	<a href="#">3</a>
<a href="#">4.</a>	Extension to CDNI FCI . . . . .	<a href="#">3</a>
<a href="#">5.</a>	Extending the CDNI metadata model . . . . .	<a href="#">4</a>
<a href="#">5.1.</a>	Extension to HostMetadata object . . . . .	<a href="#">4</a>
<a href="#">5.2.</a>	Extension to PathMetadata object . . . . .	<a href="#">5</a>
<a href="#">6.</a>	AcmeStarDelegationMethod object . . . . .	<a href="#">6</a>
<a href="#">7.</a>	Metadata Simple Data Type Descriptions . . . . .	<a href="#">8</a>
<a href="#">7.1.</a>	Periodicity . . . . .	<a href="#">8</a>
<a href="#">8.</a>	IANA considerations . . . . .	<a href="#">8</a>
<a href="#">8.1.</a>	CDNI MI AcmeStarDelegationMethod Payload Type . . . . .	<a href="#">9</a>
<a href="#">9.</a>	Security considerations . . . . .	<a href="#">9</a>
<a href="#">10.</a>	Comments and questions . . . . .	<a href="#">9</a>
<a href="#">11.</a>	References . . . . .	<a href="#">9</a>
<a href="#">11.1.</a>	Normative References . . . . .	<a href="#">9</a>
<a href="#">11.2.</a>	Informative References . . . . .	<a href="#">10</a>
	Authors' Addresses . . . . .	<a href="#">10</a>

## [1.](#) Introduction

Content delivery over HTTPS using one or more CDNs along the path requires credential management. This specifically applies when an entity delegates delivery of encrypted content to another trusted entity.

Several delegation methods are currently proposed within different IETF working groups. They specify different methods for provisioning HTTPS delivery credentials.

This document extends the CDNI Metadata interface to setup HTTPS delegation between an upstream CDN (uCDN) and downstream CDN (dCDN) using the Standardized delegation methods. Furthermore, it includes a proposal of IANA registry to enable adding of new methods.

[Section 2](#) is about terminology used in this document. [Section 3](#) presents delegation methods specified at the IETF. [Section 4](#) addresses the extension for handling HTTPS delegation in CDNI. [Section 5](#) describes simple data types. [Section 6](#) addresses IANA registry for delegation methods. [Section 7](#) covers the security issues. [Section 8](#) is about comments and questions.

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Internet-Draft      CDNI extensions for HTTPS delegation      September 2021

## [2.](#) Terminology

This document uses terminology from CDNI framework documents such as: CDNI framework document [[RFC7336](#)], CDNI requirements [[RFC7337](#)] and CDNI interface specifications documents: CDNI Metadata interface [[RFC8006](#)] and CDNI Control interface / Triggers [[RFC8007](#)].

## [3.](#) Known delegation methods

There are currently Internet drafts within the TLS and ACME working groups adopted to handle delegation of HTTPS delivery between entities.

This Internet Draft (I-D) proposes standardizing HTTPS delegation between the CDN entities using CDNI interfaces.

This document only considers the Short-term, Automatically-Renewed (STAR) certificates in Automated Certificate Management Environment(ACME) [[RFC8739](#)]

This document allows the extension to other delegation methods. Those methods can easily be extended to any further methods in the future.

## [4.](#) Extension to CDNI FCI

In order for CDNs to negotiate on which methods are supported, the Footprint and Capabilities interface as defined in [RFC8008](#), allows a uCDN to send a FCI capability type objects, named FCI.SupportedDelegationMethods, to dCDN.

The following example shows an exemple of the supported delegated methods capability object serialization for a CDN that supports STAR delegation method.

```
{
  "capabilities": [
    {
      "capability-type": "FCI.SupportedDelegationMethods",
      "capability-value": {
        "delegation-methods": [
          "AcmeStarDelegationDelegationMethod",
          "... Other delegation methods ..."
        ]
      }
    }
  ]
}
```

## [5.](#) Extending the CDNI metadata model

This section defines a CDNI extension to the current Metadata interface model that allows bootstrapping delegation methods between a uCDN and a delegate dCDN.

### [5.1.](#) Extension to HostMetadata object

This extension reuses HostMetadata object, as defined in [[RFC8006](#)], and adds new "Delegation methods" objects as specified in the following sections.

The existence of the delegation methods in a HostMetadata Object shall enable the use of one of this methods, chosen by the delegating entity. The delegation method will be activated for the set of Host defined in the HostMatch. See [Section 6](#) for more details about delegation methods metadata specification.

Example:

The HostMatch object can reference a host metadata that points at the delegation information. Delegation metadata are added to HostMetadata object.

Below shows both HostMatch and HostMetadata objects related to a host, for example, here is a HostMatch object referencing "video.example.com":

HostMatch:

```
{
  "host": "video.example.com",
  "host-metadata": {
    "type": "MI.HostMetadata",
    "href": "https://metadata.ucdn.example/host1234"
  }
}
```

Following the example above, the HostMetadata can be modeled for ACMEStarDelegationMethod as:

```
{
  "hostmetadata": [
    {
      "generic-metadata-type": "MI.AcmeStarDelegationMethod",
      "generic-metadata-value": {
        "star-proxy": "10.2.2.2",
        "acme-server": "10.2.3.3",
        "credentials-location-uri": "www.ucdn.com/credentials",
        "periodicity": 36000,
        "CSR-template": "Json/Text of the CSR template (see 4.2)"
      }
    }
  ]
}
```

```
    }  
  }  
}
```

This extension allows to explicitly indicate support for a given method. Therefore, the presence (or lack thereof) of an `AcmeStarDelegationMethod`, and/or further delegation methods, implies support (or lack thereof) for the given method.

## 5.2. Extension to PathMetadata object

This extension reuses PathMetadata object, as defined in [RFC8006], and adds new "Delegation methods" objects as specified in the following sections.

This allows to explicitly indicate support for a given method. Therefore, the presence (or lack thereof) of an `AcmeStarDelegationMethod`, and/or further delegation methods, implies support (or lack thereof) for the given method.

Example:

The PathMatch object can reference a path-metadata that points at the delegation information. Delegation metadata are added to PathMetaData object.

Below shows both PathMatch and PathMetaData objects related to a path, for example, here `/movies/*` located at <https://metadata.ucdn.example/video.example.com/movies>

PathMatch:

```
{  
  "path-pattern": {  
    "pattern": "/movies/*",  
    "case-sensitive": true  
  },  
  "path-metadata": {  
    "type": "MI.PathMetadata",  
    "href": "https://metadata.ucdn.example/video.example.com/movies"  
  }  
}
```

Following the example above, the PathMetadata can be modeled for ACMEStarDelegationMethod as:

```
{
  PathMetadata:
  {
    "metadata": [
      {
        "generic-metadata-type": "MI.AcmeStarDelegationMethod",
        "generic-metadata-value": {
          "star-proxy": "10.2.2.2",
          "acme-server" : "10.2.3.3",
          "credentials-location-uri": "www.ucdn.com/credentials",
          "periodicity": 36000,
          "CSR-template": Json/Text of the CSR template (see section 4.2)
        }
      }
    ]
  }
}
```

The existence of the "MI.AcmeStarDelegationMethod" object in a PathMetaData Object shall enable the use of one of the AcmeStarDelegation Methods, chosen by the delegating entity. The delegation method will be activated for the set of Path defined in the PathMatch. See [Section 6](#) for more details about delegation methods metadata specification.

## [6.](#) AcmeStarDelegationMethod object

This section defines the AcmeStarDelegationMethod object which describes metadata related to the use of ACME/STAR API presented in [\[RFC8739\]](#)

As expressed in [\[RFC8739\]](#), when an origin has set a delegation to a specific domain (i.e. dCDN), the dCDN should present to the end-user client, a short-term certificate bound to the master certificate.

dCDN	uCDN	Content Provider	CA
	ACME/STAR proxy	ACME/STAR client	ACME/STAR srv
	1. GET Metadata incl. Delegation Method object with CSR template		

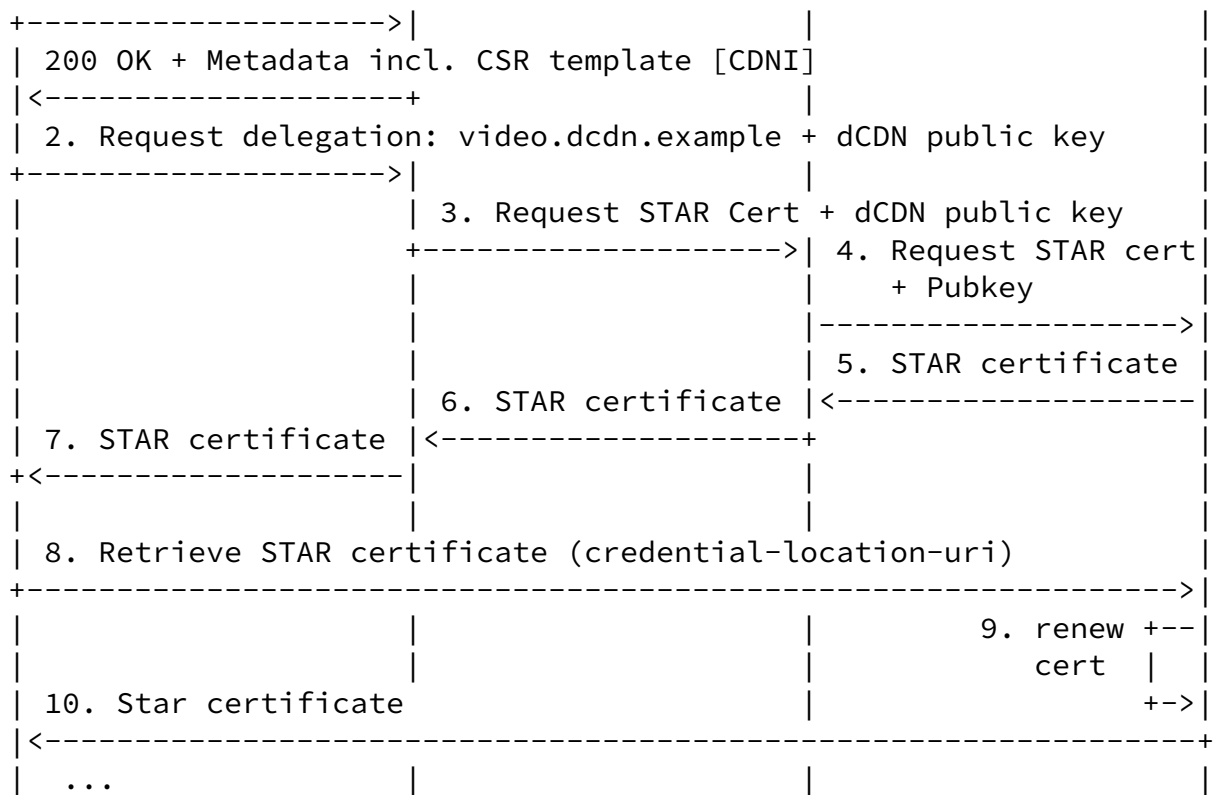


Figure 1: Example call-flow of STAR delegation in CDNI showing 2 levels of delegation

Property: star-proxy

Description: Used to advertise the STAR Proxy to the dCDN.  
 Endpoint type defined in [RFC8006, Section 4.3.3](#).

Type: Endpoint

Mandatory-to-Specify: Yes

Property: acme-server

Description: used to advertise the ACME server to the dCDN.  
 Endpoint type is defined in [RFC8006, Section 4.3.3](#).

Type: Endpoint

Mandatory-to-Specify: Yes



Property: credentials-location-uri

Description: expresses the location of the credentials to be fetched by the dCDN. Link type is as defined in [RFC8006, Section 4.3.1](#).

Type: Link

Mandatory-to-Specify: Yes

Property: periodicity

Description: expresses the credentials renewal periodicity. See [Section 7.1](#).

Type: Periodicity

Mandatory-to-Specify: Yes

Property: CSR-template

Description: The CSR template must be included in the metadata when dealing with AcmeStarDelegation Methods. It shall follow the description in [\[RFC8739\] section 3](#). It should be included in JSON/text format.

Type: JSON

Mandatory-to-Specify: Yes

## [7](#). Metadata Simple Data Type Descriptions

This section describes the simple data types that are used for properties for objects in this document.

### [7.1](#). Periodicity

A time value expressed in seconds to indicate a periodicity.

Type: Integer

## [8](#). IANA considerations

This document requests the registration of the following entries under the "CDNI Payload Types" registry hosted by IANA regarding "CDNI delegation":

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Payload Type	Specification
MI.AcmeStarDelegationMethod	RFCthis

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

### 8.1. CDNI MI AcmeStarDelegationMethod Payload Type

**Purpose:** The purpose of this Payload Type is to distinguish AcmeStarDelegationMethod MI objects (and any associated capability advertisement)

**Interface:** MI/FCI

**Encoding:** see [Section 4.2.1](#)

## 9. Security considerations

Extensions proposed here do not alter nor change Security Considerations as outlined in the CDNI Metadata and Footprint and Capabilities RFCs [[RFC8006](#)].

## 10. Comments and questions

Should dCDN be visible from the Content Provider or not? This would lead to different solutions to handle delegation towards the CP. In most cases, the dCDNs should never be visible to the CP, in order to reduce the burden of certificates generation for dCDN.

## 11. References

### 11.1. Normative References

- [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>>.

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Internet-Draft      CDNI extensions for HTTPS delegation      September 2021

- [RFC8739] Sheffer, Y., Lopez, D., Gonzalez de Dios, O., Pastor Perales, A., and T. Fossati, "Support for Short-Term, Automatically Renewed (STAR) Certificates in the Automated Certificate Management Environment (ACME)", [RFC 8739](#), DOI 10.17487/RFC8739, March 2020, <<https://www.rfc-editor.org/info/rfc8739>>.

## 11.2. Informative References

- [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>>.
- [RFC7337] Leung, K., Ed. and Y. Lee, Ed., "Content Distribution Network Interconnection (CDNI) Requirements", [RFC 7337](#), DOI 10.17487/RFC7337, August 2014, <<https://www.rfc-editor.org/info/rfc7337>>.

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Expires 14 March 2022

[Page 10]