Content Delivery Network Interconnection (CDNI) Request Routing: CDNI Footprint and Capabilities Advertisement using ALTO

draft-alto-cdni-request-routing-alto-03

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Outline

• Summary of Changes
• Discussions
Summary of Changes-1

- Make Introduction section more compact and add the outline of this document (Section 1)
- Add some pointers/examples to strengthen benefits of using ALTO (Section 2.2)

- Update CDNI FCI Map response schema (Section 3.6)
  - Use the BaseAdvertisementObject defined in RFC 8008
  - Add an example to show that optimization of BaseAdvertisement objects is possible

- Add descriptions of "altonetworkmap" footprint type and dependency between CDNI FCI Map and Network Map (Section 4.1)

- Add the error handling for Filtered CDNI FCI Map (Section 5.6)
Summary of Changes-2

- Update data component's name of CDNI FCI Map to "cdni-fci-map"

- Update media type of CDNI FCI Map to "application/alto-cdnifcimap+json" (Section 3/4.2/5.7/6.2)

- Update media type of queries of CDNI FCI Map to "application/alto-cdnifcifilter+json" (Section 5.3)

- Extend Security Considerations (Section 8)

- Make descriptions of Examples more clean

- Small text edits
Revision of Introduction (Section 1)

- Change no that important lists into plain texts
- Remove unnecessary descriptions
- Add the outline of this document

The rest of this document is organized as follows. Section 2 provides non-normative background on both CDNI FCI and ALTO. Section 3 introduces the most basic service, called CDNI FCI Map, to realize CDNI FCI using ALTO. Section 4 demonstrates a key benefit of using ALTO: the ability to integrate CDNI FCI with ALTO network maps. Such integration provides a new granularity to describe footprints. Section 5 builds on filtered ALTO maps to introduce filtered CDNI FCI maps using capabilities so that a uCDN can get footprints with given capabilities instead of getting the full map which can be huge. Section 6 further shows a benefit of using ALTO: the ability to query footprint properties using ALTO unified properties. In this way, a uCDN can effectively fetch capabilities of some footprints in which it is interested. IANA and security considerations are discussed in Section 7 and Section 8 respectively.
Strengthen Benefits of using ALTO *(Section 2.2)*

1. ALTO can help a uCDN request routing
   - Add how ALTO can help a uCDN to select a proper dCDN
2. ALTO network map can be used to convey a footprint by a dCDN
   - Add a pointer to Section 4 CDNI FCI Map using ALTO Network Map
3. Security (ALTO maps can be signed)
   - Identification between uCDNs and dCDNs are extremely important
   - Add a pointer to Section 8 Security Considerations
4. RESTful-Design
   - Add a pointer to Section 3 CDNI FCI Map
5. Error-handling
   - Add a pointer to Section 5 Filtered CDNI FCI Map which includes how to use ALTO error-codes to present queries' errors
Strengthen Benefits of using ALTO (Section 2.2)

6. Filtered map service
   - Add an example that we can directly use filtered unified property map to filter on footprints

7. Server-initiated Notifications and Incremental Updates
   - Small text edits

8. Content Availability on Hosts
   - The new endpoint property for ALTO would enable to provide such information
   - Add a pointer to Section 6

9. Resource Availability on Hosts or Links
   - Add a reference to ALTO Path Vector Extension
Update CDNI FCI Map Response Schema (Section 3.6)

- Use Base Advertisement Object defined in RFC 8008 to encode CDNI FCI Map
- The original encoding of base advertisement object and footprint is remained for self-contained purpose

```json
object {
    CDNIFCIMapData cdnifi-map;
} InfoResourceCDNIFCIMap : ResponseEntityBase;

object {
    CDNIFCIOBJECT capabilities<1..*>
} CDNIFCIMapData

object {
    JSONString capability-type;
    JSONValue capability-value;
    CDNIFCIFootprint footprints<0..*>
} CDNIFCIOBJECT;

object {
    JSONString footprint-type;
    JSONString footprint-value<1..*>
} CDNIFCIFootprint
```
Update CDNI FCI Map Response Schema (Section 3.6)

- Add an example to show that optimization of BaseAdvertisement objects is possible. However, the specifics of such mechanisms are outside the scope of this document.

**Example 1**
```json
{
  "meta": {"..."},
  "cdni-fci-map": {
    "capabilities": [
      {
        "capability-type": "FCI.DeliveryProtocol",
        "capability-value": {
          "delivery-protocols": ["http/1.1"]
        }
      },
      "footprints": [<Footprint objects>]
    }
  }
}
```

**Example 2**
```json
{
  "meta": {"..."},
  "cdni-fci-map": {
    "capabilities": [
      {
        "capability-type": "FCI.DeliveryProtocol",
        "capability-value": {
          "delivery-protocols": ["https/1.1", "http/1.1"]
        }
      },
      "footprints": [<Footprint objects>]
    }
  }
}
```

- Example 1 and Example 2 are two different encodings of the same footprints with the same capabilities ([https/1.1, http/1.1] delivery protocols)
Updates of Footprint Type "altonetworkmap" (Section 4.1)

- "altonetworkmap" footprint type indicates that the corresponding footprint value is a list of PIDNames
- These PIDNames are references of PIDs in a network map
- CDNI FCI map with "altonetworkmap" footprints depends on a network map
- "dependent-vtag" field with a reference to a related network map MUST be included in the CDNI FCI map

Specifically, CDNI footprints using ALTO network maps should use a new CDNI Footprint Type called "altonetworkmap".

"altonetworkmap" footprint type indicates that the corresponding footprint value is a list of PIDNames as defined in [RFC7285]. These PIDNames are references of PIDs in a network map resource. Hence a CDNI FCI map with "altonetworkmap" footprints depends on a network map. For such a CDNI FCI map, the "dependent-vtag" field with a reference to a network map it depends on MUST be included in it (see the example in Section 4.2.3).
Error Handling of Filtered CDNI FCI Map (Section 5.6)

5.6. Response

The response MUST indicate an error, using ALTO protocol error handling specified in Section 8.5 of the ALTO protocol [RFC7285], if the request is invalid.

Specifically, a filtered CDNI FCI map request can be invalid as follows:

- The value of "capability-type" is null;
- The value of "capability-value" is null;
- The value of "capability-value" is inconsistent with "capability-type".

When the request is invalid, the ALTO server MUST return an "E_INVALID_FIELD_VALUE" error defined in Section 8.5.2 of [RFC7285], and the "value" field of the error message SHOULD indicate this CDNI FCI capability.

The ALTO server return a filtered CDNI FCI map for a valid request. The format of a filtered CDNI FCI map is the same as an unfiltered CDNI FCI map. See Section 3.6 for the format.

The returned CDNI FCI map MUST contain only BaseAdvertisementObject objects whose CDNI capability object is the superset of one of CDNI capability object in "cdni-fci-capabilities". Specifically, that a CDNI capability object A is the superset of another CDNI capability object B means that these two CDNI capability objects have the same capability type and mandatory properties in capability value of A MUST include mandatory properties in capability value of B semantically. See Section 5.7.2 for a concrete example.
Update Data Component's Name of CDNI FCI Map to "cdni-fci-map"

- Description in Section 3
- Related examples in Section 3.7/4.2/5.7/6.2

3.6. Response

If a CDNI FCI map does not depend on other resources, the "meta" field of a CDNI FCI map response MUST include the "vtag" field defined in Section 10.3 of [RFC7285], which provides the version tag of the retrieved CDNI FCI map. If a CDNI FCI map response depends on a resource such a network map, it MUST include the "dependent-vtags" field, whose value is an array to indicate the version tag of the resource used, where the resource is specified in "uses" of the IRD. The current defined dependent resource is only network map, and the usage of it is described in Section 4. The data component of an ALTO CDNI FCI map response is named "cdni-fcimap", which is a JSON object of type CDNIFCIMapData:

```
"cdni-fcimap": {
  "capabilities": [{
    "capability-type": "FCI.DeliveryProtocol",
    "capability-value": {
      "delivery-protocols": ["http/1.1"]
    }
  },
  "footprints": [<Footprint objects>]
}
```

```
"cdni-fcimap": {
  "capabilities": [{
    "capability-type": "FCI.DeliveryProtocol",
    "capability-value": {
      "delivery-protocols": ["http/1.1"]
    }
  },
  "footprints": [<Footprint objects>]
}
```
Update Media Type of CDNI FCI Map to "application/alto-cdnifcimap+json"

- Description in Section 3
- Related examples in Section 3.7/4.2/5.7/6.2
Update Media Type of Queries of Filtered CDNI FCI Map to "application/alto-cdnifcifilter+json"

• Description in Section 5.3
• Related examples in Section 5.7

5.3. Accept Input Parameters

The input parameters for a filtered CDNI FCI map are supplied in the entity body of the POST request. This document specifies input parameters with a data format indicated by the media type "application/alto-cdnifcifilter", which is a JSON object of type ReqFilteredCDNIFCIMap, where:

```json
{
    "type": "ReqFilteredCDNIFCIMap",
    "parameters": {
        "parameter1": "value1",
        "parameter2": "value2"
    }
}
```
Extend Security Considerations (Section 8)

- Despite of 5 security considerations described in RFC 7285, we must strengthen the isolation of full/filtered CDNI FCI maps for different uCDNs. Otherwise it may lead that uCDNs may redirect requests to the wrong dCDN which can not serve these requests. A potential solution of it is that we can not include all CDNI FCI maps in one IRD.
Revision of Examples' Descriptions

- Revise the descriptions in Section 3.7.1/3.7.2
- Add more descriptions in Section 3.7.3/5.7.2
  - 3.7.3 Add more explain for incremental updates response
  - 5.7.2 More descriptions on how to filter on capabilities
Discussions

- What other ALTO features may be benefit to CDNI?
  - Calendar?
  - PV?
  - ...?
Discussions

- CDNI has 4 interfaces
  - CDNI Request Routing Interface
  - CDNI Metadata Interface
  - CDNI Logging Interface
  - CDNI Contrl Interface

- If FCI uses ALTO, can other use ALTO as well? Or at least how all 4 fit together?
Next Steps

• Get comments from WG members
Backup Slides
Make CDNI FCI Map Structure Consist with Network/Cost Map

- Rename "cdni-fcimap" \(\rightarrow\) "cdni-fci-map"

Version 00

```
"cdni-fcimap": {
    "capabilities": [{
        "capability-type": "FCI.DeliveryProtocol",
        "capability-value": {
            "delivery-protocols": ["http/1.1"]
        }
    },
    "footprints": [<Footprint objects>]
}
```

Version 01

```
"cdni-fci-map": {
    "capabilities": [{
        "capability-type": "FCI.DeliveryProtocol",
        "capability-value": {
            "delivery-protocols": ["http/1.1"]
        }
    },
    "footprints": [<Footprint objects>]
}
```
Summary of Changes

• Add a new Section Protocol Error (Section 7)

• Update media type of CDNI FCI Map to "application/alto-cdnifcimap+json" (Section 3/4.2/5.7/6.2)

• Update data component's name of CDNI FCI Map to "cdni-fci-map" (Section 3/4.2/5.7/6.2)

• Update CDNI FCI Map response schema (Section 3.6)
  – Use the BaseAdvertisementObject defined in RFC 8008
Add a new Section **Protocol Error**

Only need to explain the error-handling mechanism of filtered CDNI FCI map. Others are the same as the original.

POST /cdnifcimap/filtered HTTP/1.1
HOST: alto.example.com
Content-Type: application/cdnifilter+json
Accept: application/cdni

```
{
    "cdni-fci-capabilities": [
        {
            "capability-type": "FCI.DeliveryProtocol",
            "capability-value": {
                "delivery-protocols": [
                    "http/1.1"
                ]
            }
        }
    ]
}
```

**Error handling**

- **E_Syntax**
  - Covers all cases of syntax errors of filtered CDNI FCI map queries

- **E_INVALID_FIELD_VALUE**
  - The value of "capability-type" is null
  - The value of "capability-value" is null
  - The value of "capability-value" is inconsistent with "capability-type"