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

draft-alto-cdni-request-routing-alto-00
replace draft-seedorf-cdni-request-routing-alto-10

J. Seedorf, Y. Richard Yang, Kevin Ma, J. Peterson

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Context

- CDNI WG has defined [RFC8008], which has defined precisely the semantics of Footprint & Capability advertisement Interface (FCI) and provided guidelines on the FCI protocol, but the exact protocol is explicitly outside the scope [RFC8008]
- ALTO charter item: define an FCI protocol based on ALTO
  - Consider FCI as a new ALTO service
  - Specification of transport of FCI JSON objects using ALTO
  - Investigate possibility to take advantage of both the ALTO base protocol [RFC 7285] and additional capabilities such as ALTO incremental updates (draft-ietf-alto-incr-update-sse-07)
Design Constraint: What are Fixed

- ALTO [RFC7285] + finishing items such as incremental updates
- FCI
  - Semantics
    - [RFC8008] integrates footprint and capabilities with an approach of "capabilities with footprint restrictions"
    - ...
  - Syntax
    - [RFC7336] CDNI media type: application/cdni
    - [RFC8008] Capability-type, value, footprints restrictions structure:
      - capability-type:, capability-value:, footprints: []
    - [RFC8006] Footprint
      - type + value structure
        - list of ISO country codes,
        - list of AS numbers,
        - set of IP-prefixes,

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

```json
{  "footprint-type": "countrycode",  "footprint-value": ["us"] }
```

```json
{  "footprint-type": "ipv4cidr",  "footprint-value": ["192.0.2.0/24, "198.51.100.0/24"] }
```
Basic Design

- **Approach:** ALTO as a generic information resource distribution framework, with FCI (cdni objects more generally) as an example
  - Information resource is largely opaque
- **Why leverage ALTO?**
  - Service discovery
    - Information resource directory
  - Information transport: transport envelop, version tag, and error handling
  - Information resource update: incremental updates
Basic Design: Information Resource Directory

RFC 7285:
   9.1. Information Resource Attributes . . . . . . . . . . . . . 27
      9.1.1. Resource ID . . . . . . . . . . . . . . . . . . 27
      9.1.2. Media Type . . . . . . . . . . . . . . . . . . . 27
      9.1.3. Capabilities . . . . . . . . . . . . . . . . . . . 28
      9.1.4. Accepts Input Parameters . . . . . . . . . . . 28
      9.1.5. Dependent Resources . . . . . . . . . . . . . . 28
   9.2. Information Resource Directory (IRD) . . . . . . . . . . 28
      9.2.1. Media Type . . . . . . . . . . . . . . . . . . . 29
      9.2.2. Encoding . . . . . . . . . . . . . . . . . . . . 29
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      9.2.4. Delegation Using IRD . . . . . . . . . . . . . . 34
      9.2.5. Considerations of Using IRD . . . . . . . . . . . 36

Announce FCI information resources:
HTTP/1.1 200 OK
Content-Length: ####
Content-Type: application/alto-directory+json

```json
{
    "meta": {},
    "resources": {
        "my-fci-map": {
            "uri": "http://fcialto.example.com/fcimap",
            "media-type": "application/cdni",
            "capabilities": { // announce FCI capabilities?? }
            "accepts": { // if allow filtering of FCI info? }
            "uses": [ "my-mapping-from-countrycode-to-ip-addresses" ]
        },
        ...
    }
}
```
Basic Design: Information Resource Transport

FCI object envelop:
GET /fcimap HTTP/1.1
Host: fcialto.example.com
Accept: application/cdni,application/alto-error+json

HTTP/1.1 200 OK
Content-Length: ####
Content-Type: application/cdni
{
  "meta": {
    "vtag": {
      "resource-id": "my-fci-map",
      "tag": "da65eca2eb7a10ce8b059740b0b2e3f8eb1d4785"
    }
  },
  "cdni": { // ← need to agree on the name of this envelop
    "capabilities": [
      {
        "capability-type": "FCI.DeliveryProtocol",
        "capability-value": {
          "delivery-protocols": [
            "http/1.1",
          ],
        },
        "footprints": [
          <Footprint objects>
        ]
      }
    ]
  } // it could carry other cdni objects
} // end of capabilities
**Basic Design: Transport Error Handling**

<table>
<thead>
<tr>
<th>ALTO Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E_SYNTAX</td>
<td>Parsing error in request (including identifiers)</td>
</tr>
<tr>
<td>E_MISSING_FIELD</td>
<td>A required JSON field is missing</td>
</tr>
<tr>
<td>E_INVALID_FIELD_TYPE</td>
<td>The type of the value of a JSON field is invalid</td>
</tr>
<tr>
<td>E_INVALID_FIELD_VALUE</td>
<td>The value of a JSON field is invalid</td>
</tr>
</tbody>
</table>

- Design decision: The error codes look to be still enough, although we plan to add more text on error information for cdni objects
Basic Design: Incremental Updates

POST /updates/fci HTTP/1.1
Host: fcialtoupdate.example.com
Accept: text/event-stream,application/alto-error+json
Content-Type: application/alto-updatestreamparams+json
Content-Length: ###
{
  "add": {
    "my-fci-stream": {
      "resource-id": "my-fci-map"
    }
  }
}

HTTP/1.1 200 OK
Connection: keep-alive
Content-Type: text/event-stream
event: application/alto-updatestreamcontrol+json
data: {"control-uri": "http://fcialtocu.example.com/updates/streams/3141592653589"}

event: application/cdni,my-fci-stream
data: { ... full cdni message ... }

event: application/merge-patch+json,my-fci-stream
data: { ... Merge patch update of cdni objects ... }

event: application/json-patch+json,my-fci-stream
data: { ... JSON patch update of cdni objects, e.g., footprints entries ... }
Advanced Design

• Directions
  – Introduce filtering of FCI info
  – Integrate ALTO information resources w/ FCI information resources, e.g.,
    • Utilize ALTO network map to provide input to FCI footprint
    • Query capabilities of ALTO endpoints (inverted index of FCI objects)
    • ...

Status and Planning

- Current draft focuses on Basic Design

Planning
  - Aug. 4: initial version w/ details reflecting agreed items during WG meeting
  - Aug. 18: feedback from solicited reviewers
  - Aug. 30: update according to feedback, upload -01
Backup Slides
FCI Examples

```
{
  "capabilities": [
    {
      "capability-type": "FCI.RedirectionMode",
      "capability-value": {
        "redirection-modes": [
          "DNS-I",
          "HTTP-I"
        ]
      }
    },
    {
      "footprints": [
        {<Footprint objects>}
      ]
    }
  ]
}
```

Example Footprint object describing a footprint covering the IP address ranges 192.0.2.0/24 and 198.51.100.0/24:

```
{
  "footprint-type": "ipv4cidr",
  "footprint-value": ["192.0.2.0/24", "198.51.100.0/24"]
}
```