• This draft proposes the use of Multiprotocol-BGP to realize the Footprint & Capabilities Advertisement component of the Request Routing Interface.
• Introduction:
  – When an upstream CDN (uCDN) receives a request from a user, it has to determine what is the downstream CDN (dCDN) to which the request is to be redirected.
  – Decision is based on MULTIPLE criteria
  – CDN’s Footprint & Capabilities are SOME of these criteria
Footprint Information
The problem...

• If the Footprint is the set of prefixes a CDN is willing to serve
  – Typically: a bunch of IP prefixes (can be quite large)
• Then, CDNs participating in the CDNI Mesh must know each other Footprint in order to select the best dCDN during Request Routing process
• If Footprint information had to be advertised between CDNs, it will result in large amount if information flooded across the CDNI Mesh
• Requiring each CDN to advertise its Footprint information to the CDNI Mesh is unpractical and un-scalable
Footprint Information
The solution...

• Footprint Information is in fact prefixes, not different (in the format) from what available in the Internet BGP table
  – In all SP networks

• A CDN Footprint is in fact a subset of the Internet BGP-4 table

• What if a Footprint can be identified by its Autonomous System membership
  – I.e.: all prefixes originated in AS-X are considered as part of Footprint X

• Footprint granularity is the Autonomous System
  – In a first stage of CDNI it will matches well the requirements

• Footprint Information becomes: set of ASs a CDN is willing to serve

• This draft proposes a set of mechanisms through which:
  – Each CDN gets a BGP4 Internet feed from its underlying SP
  – Each prefix is mapped to its Autonomous System of origin
  – Each CDN advertise its ability to serve ‘group’ of prefixes identified by their AS number

• At this stage of the draft a Footprint is identified by its AS Number

• Future revisions may include other grouping methods
Connectivity Information

- Set of Footprints the CDN is capable/willing to serve
- Advertised into the CDNI Mesh
- Low volume information
Distinction between Footprint and CDN connectivity to the Footprint

1. **CDN-C Footprint:** AS200, AS300
2. **Connectivity Advertisement:** CDN-C: AS200, AS300

**CDNI Mesh**

**Internet BGP Table**

- **AS100**
- **AS200**
- **AS300**
Capabilities Information

- CDN Capabilities are signaled using the same method SPs signal prefix capabilities and characteristics:
  - Standard Community Attribute
  - Extended Community Attribute
- Communities are already widely deployed in order to describe prefixes:
  - Location
  - Connectivity type
  - Peering point
  - ...
- Same for CDNs
  - Multiple communities can be used for a variety of capabilities
- CDN originates MP-BGP advertisement including the set of Communities describing the CDN capabilities
Multiprotocol-BGP

- BGP4 is well known, scalable, efficient, flexible, ...
- MP-BGP is an extension to BGP4 in order to carry different address families
  - Allowing isolation
- In this proposal, CDNs use MP-BGP messages to advertise their capabilities and their ability to serve given Footprints
- MP-BGP allows:
  - Advertisement of Footprint connectivity
  - Advertisement of CDN capabilities
  - Advertise how CDNs are logically inter-connected
  - Each CDN to control the policy applicable to these advertisements
Step-1: Infer Footprint from BGP-4 Database

BGP4 Feed

AS100

CDN - A

BGP/ Footprint Database
P1, AS100
P2, AS200
P3, AS300
...

CDN - C

BGP4 Feed

AS200

CDN - B

BGP/ Footprint Database
P1, AS100
P2, AS200
P3, AS300
...

CDN - D

BGP4 Feed

AS300

CDN - A

BGP/ Footprint Database
P1, AS100
P2, AS200
P3, AS300
...

CDN - C

BGP4 Feed

AS200

CDN - B

BGP/ Footprint Database
P1, AS100
P2, AS200
P3, AS300
...

CDN - D

BGP4 Feed
Step-2: Originate Connectivity Database

CDN - A

AS100

AS200

AS300

CDN - B

CDN - C

CDN - D

CDNI Mesh

BGP4 Feed

BGP/Connectivity Database

CDN-C: AS200

CDN-C: AS300

BGP/Connectivity Database

P1, AS100

P2, AS200

P3, AS300

...
Step-3: Advertise Connectivity & Capabilities

Connectivity & Cap Advertisement:
CDN-C: Cap-1, Cap-2, ...
Footprints: AS200, AS300

BGP4 Feed

CDN - A
CDN - B
CDN - C
CDN - D
CDNI Mesh

BGP/Connectivity Database
CDN-C: AS200
CDN-C: AS300

BGP/Connectivity Database
P1, AS100
P2, AS200
P3, AS300

AS100
AS200
AS300

P1
P2
P3
Partial CDNI Mesh

Connectivity Advertisement:
CDN-C: AS200, AS300
PATH: CDN-A, CDN-C

Connectivity Advertisement:
CDN-C: AS200, AS300

BGP4 Feed

BGP/Connectivity Database
CDN-C: AS200
CDN-C: AS300

BGP/Connectivity Database
P1, AS100
P2, AS200
P3, AS300
...

AS100
P1

AS200
P2

AS300
P3
Workflow

• When an upstream CDN (uCDN) receives a request from a user, it has to determine what is the downstream CDN (dCDN) to which the request is to be redirected:
  – Determine which footprint the user belongs to
    • Lookup in Footprint Database
  – Determine dCDN claiming connectivity to user
    • Lookup in Connectivity & Capabilities Database
  – Apply selection rules
To Do List

• Describe MP-BGP Message details
  – Define CDNI Address Family

• Describe scenarii where Footprint information is to be advertised
  – E.g.: when a CDN has finer granularity visibility than the one available in the BGP4 Internet table

• Define Footprint information details
  – E.g.: original AS_PATH

• Define Connectivity Information Details
  – E.g.: AS_PATH Vs. CDNI_PATH
Thank You
Footprint Information

• The right tool for the job: Multiprotocol-BGP
  – Proven over the years to be scalable and efficient
  – Multiprotocol allows separate Address Families: CDNI Address Family
  – Total separation between Internet-BGP and CDNI-BGP
  – BGP is already used for propagating connectivity _and_ capabilities: Communities