GaN Network Lab 2

Introduction

Follow up of the first lab, introducing CDNs' client redirection with DNS and Traceroute.

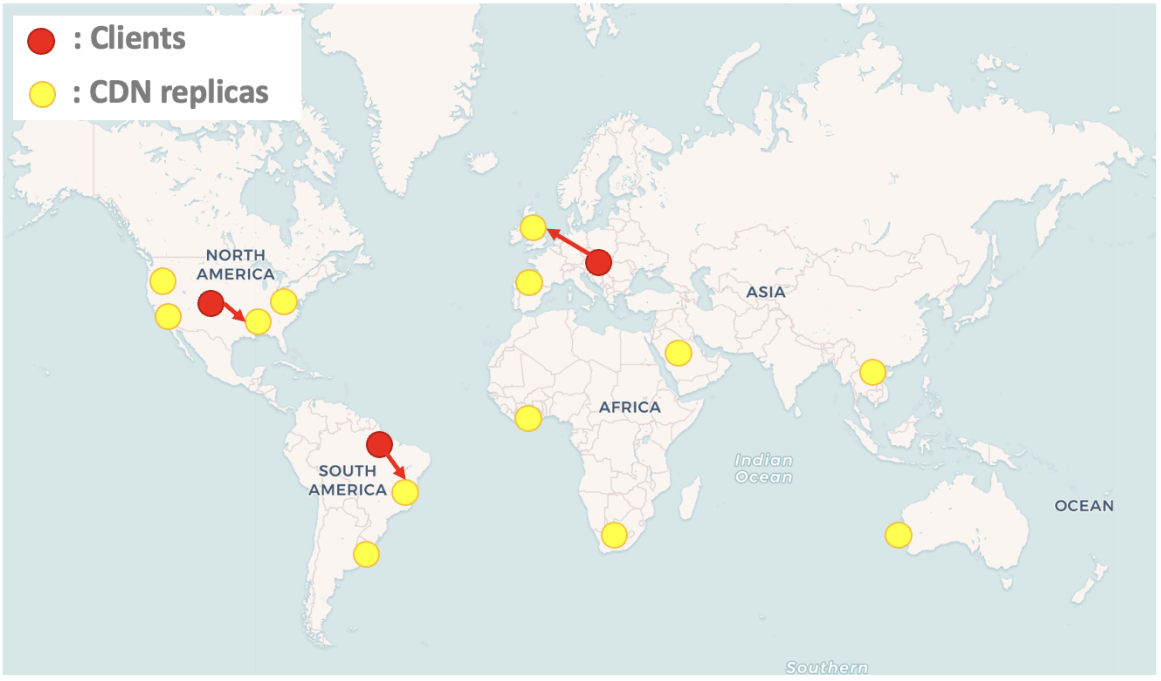
Learning objectives:

- Precise understanding of client to web-service redirection
- DNS measurement on RIPE Atlas
- Build IP level path between VPs and CDNs
- Build AS level path between between VPs and CDNs
- Perform Anycast detection based on latency measurements

Content:

- DNS measurement with RIPE Atlas API
- Traceroute measurements with RIPE Atlas API
- IP to AS translation with RIPE RIS

CDNs client redirection



Clients' redirection illustration

As covered in the previous lab, CDNs are geographically diverse network infrastructures serving content to users all over the world. In such a context, finding the right entry point for each user requesting access to a service hosted in a CDN is challenging. For example, we saw in the previous lab that there exists a correlation between the geographic distance and the measured latency.

Intuitively, it does not make much sense to redirect a European client to a frontend server located in the US and vice versa…

Even if the geographic location of a user plays an important role in the redirection decision process, it is not the only parameter considered by CDNs. Depending on the load present on each of its servers, a CDN can also perform load balancing to spread the incoming traffic, it has to react to network outages (caused by a natural catastrophe for example) or cyber-attacks on its infrastructure.

CDNs have to deal with a wide variety of constraints and challenges ranging from efficient server deployment, maintenance and security while guaranteeing high performance and availability. For this lab, we will measure the *result of the redirection* between a series of RIPE Atlas vantage points and the two CDNs we introduced during the first lab and infer on the hidden process of client to server redirection.

Client redirection generalities

A user wants to get access to a video on Youtube. After opening its favorite navigator, this user enters youtube's **domain name** in the search bar and loads the corresponding web page. Our goal with this lab is to understand all the steps and entities implicated between the moment this user requests access to a service and when the page is finally rendered on its screen.

DNS: getting access to the redirection

Step 1: Additionally, answer the following question:

1. Explain the different steps involved between a user requesting access to a web service with DNS and the moment it can access to the server.
    a. Give the name, the function and the a short description of each implicated entities
    b. On a schema, provide the chronological steps between each entities

Step 2: Open lab2.ipynb and follow the different coding exercise, starting with a DNS measurement from the two VPs we used in the previous lab.

2. Perform DNS measurement
3. Check the location of a few IP addresses using IPinfo. What can you say about the geographic relationship between the returned IP address and the VP?
4. How many IP addresses are returned by CloudFlare? Google?
5. How many /24 prefixes?
6. Do you spot any difference between the redirection of VP1 and VP2 for CloudFlare?
7. Do you think the two VPs are returned to the same CloudFlare's front-end server?
8. What can we say about the role of DNS in the redirection process of Google? CloudFlare?

Step 3: Perform meshed Traceroute measurement from each VP:

- Store the DNS IP address returned for each pair (VP; hostname)
- Select on IP address per returned /24 prefixes
- Perform meshed Traceroute measurements:
    - VP1: Traceroute to IP addresses returned by DNS VP1 and DNS returned for VP2
    - VP2: Traceroute to IP addresses returned by DNS VP2 and DNS returned for VP1

- Obtain the IP level path between the VPs and the CDNs frontend server.
- Obtain the AS level path between the VPs and the CDNs frontend server.

CloudFlare is known for relying on an Anycast infrastructure for redirecting their clients to the optimal front-end server:

9. Explain what an Anycast IP address is.
10. Based on your knowledge of BGP, Explain how two clients in different regions in the world can experience the same latency.
11. Knowing that we are interacting with Anycast IP addresses, are you able to explain the results of your measurement? Draw a figure of the situation.

As shown in this lab's measurement, Google and CloudFlare adopted two very different strategies of redirection. Using your answers to the previous question, explain briefly their respective strategies. Provide the inconvenient and advantages of both strategies (think in terms of redirection control, availability, security, costs, etc.)

Bibliography:

RIPE Atlas:

- UI
- API
- RIPE RIS
- RIPE NCC
- RIPE Atlas survey
- RIPE Atlas IP address geolocation

CDNs:

- CDNs resiliency paper
- CloudFlare CDN
- Google CDN
- The Best of Both Worlds (CDN redirection paper)

Others:

- IPInfo
- PeeringDB

Anycast:

- CloudFlare Anycast
- Manycast (Anycast detection paper)