Sorbonne University

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Graphs and Networks - Lab 1

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Using the UI

Step 1 : Go to the UI and navigate to the measurement endpoint (on the left scroll bar).

Step 2 : In the search bar enter the measurement id : 83506365.

Q-1

What type is the measurement ? (Explain briefly how this measurement works)

A

The measurement type is **ping**. It works by sending ICMP Echo Request packets to the target IP and measuring the time it takes to receive Echo Replies,

Q-2

What kind of information can you retrieve with this type of measurement ?

A

A ping measurement provides information about **RTT** (Round-Trip Time) which is the time it takes for a packet to travel from the probe to the target and back.

Q-3

Which IP addresses are targeted ?

A

Target IP Address : 142.251.227.120

Q-4

When was it created ? Finished ?

A

System Creation Time : `2024-12-01 21:08:02`
System Stop Time : `2024-12-01 21:15:02`

Q-5

What information can you find from the measurement description ?

A

Description : Active Geolocation of 142.251.227.120
Family and Type : IPv4 ping
Target : 142.251.227.120
Resolved on Probe : false *(name should be resolved (using DNS) on the probe)*
Periodic : false *(This is a one-off measurement, not a recurring one)*
Public : true *(The results are available publicly)*

Q-6

How many vantage points were requested ?

A

Vantage points Requested : 50

Q-7

How many vantage points participated ?

A

Vantage points participated : 45

Q-8

How many packets were sent per vantage point ?

A

Packets sent per vantage point : 3

9- Check the “results” entry of the measurement page :

Q-a

Where is located the vantage point with the lowest latency ?

A

The vantage point with the lowest latency is located in : US

Q-b

What is its public IP address ? IP prefix ? AS number ?

A

Public IP address : 43.130.64.187
IP prefix : 43.130.64.0/18
AS number : 132203

Q-c

There exists a correlation between the geographic distance and the measured latency, can you infer the location of the IP address ?

A

Yes, there is a clear correlation between geographic distance and latency. From the RTT values, we can infer that the target IP 142.251.227.120 is likely hosted on the east coast of

the United States (near where the probes with the lowest latencies are located).

Step 3 : In your terminal, run the following command (replacing the IP address with the one of the measurement) :

```
whois <ip_addr>
```

Q-1

What is whois ? (briefly)

A

whois is a tool used to query databases that store information about Internet resources (like IP address blocks, domain names, and AS numbers).

Q-2

What is the prefix of this IP address

A

Prefix (CIDR) : 142.250.0.0/15

Q-3

Who owns this prefix ?

A

Owner : Google LLC

Without answering all the previous questions, check the measurement **82979479**. Where is the measured IP address located ? What does it say about this CDN infrastructure ?

A

The measured IP address 142.251.251.3 is located in Japan. This demonstrates that Google's CDN infrastructure is geographically distributed, with servers placed worldwide to serve users locally, ensuring low latency and high performance.

Using the API

Step 1 : Open the notebook `lab1.ipynb`. In it, you will find the default structure for executing measurement and retrieve the data. Follow the steps described in the notebook, complete the exercise and answer the question using the retrieved results.

Exercise 1 :

Q-1

Get the measurement information

Q-2

Answer the same question of the previous section (creation time, number of probes, etc.)

Q-3

Get the measurement results

Q-4

For each participating probe, print : 'source_addr' ; 'from' ; 'prb_id' ; 'dst_addr' ; rtts ; min_rtt where min_rtt is the minimum rtt over all the packet sent.

A

The answers to the questions 1,2,3,4 can be retrieved from `lab1.ipynb` file

Q-a

What is problematic with the field 'src_addr' ?

A

The field src_addr is problematic because it often shows private or local IPs (e.g., 192.168.x.x, 10.x.x.x) instead of the probe's real public IP, so it cannot be used reliably for geolocation or AS identification.

Q-b

For a few vantage points, use the RIPE Atlas probe UI and get their network information. What is the 'from' parameter ?

A

The 'from' parameter represents the public source IP address that the probe actually used to send the ping measurement.

Q-5

Order the vantage point measurements per increasing min_rtt and find the vantage point with the lowest latency. Where is it located ?

A

The vantage point with the lowest latency is probe 6858, located in Germany, with a minimum RTT of 0.523793 ms.

Q-6

Knowing that the maximum speed of a packet through the Internet is $\frac{2}{3}$ of the speed of light (speed of a packet in optic fiber), estimate the distance between the vantage point with the lowest latency and the target IP address. Geographically speaking, what is the shape of the "area of presence" of the target around the VP ?

A

$$\text{Speed in fiber} = \frac{2}{3} \cdot c \approx 2 \times 10^8 \,\text{m/s}$$

$$\text{RTT} = 0.523793\,\text{ms}$$

$$\text{One-way time} = \frac{\text{RTT}}{2} = \frac{0.523793}{2}\,\text{ms} = 0.2618965\,\text{ms} = 0.2618965 \times 10^{-3}\,\text{s}$$

$$\text{Distance} = \text{Speed in fiber} \times \text{Time} = 2 \times 10^8 \cdot 0.2618965 \times 10^{-3} = 52.379\,\text{km}$$

Area of presence is a circle centered on the VP with 52 km radius (the target is likely somewhere within that circle).

Q-7

What are the limitations of geolocating an IP address with this technique ? Why is it often imprecise ?

A

RTT reflects a mix of physical distance and network effects (Routing, Queuing, Congestion...), the estimated distance is only a rough lower bound. In practice, the inferred "area of presence" can be hundreds of km wide.

Exercise 2 :

Q-8

Perform a ping measurement to IP address 142.250.201.36 (this time using a POST request, example given in the notebook).

Q-9

Get the measurement results

Q-10

For each VP, get the min_rtt (as previous)

A

The answers to the questions 8,9,10 can be retrieved from `lab1.ipynb` file

Q-11

Check the two VPs location, compare the measured latencies. Why is a VP experiencing a much higher latency ?

A

The target IP (142.250.201.36) is in Marseille, France. VP1 (192.134.1.25, Paris) is geographically close, so it measures a low RTT (11 ms). VP2 (23.148.232.6, New Jersey, US) is across the Atlantic, so it sees a much higher RTT (88 ms) due to long-distance routing.

Exercise 3 :

Q-1

Do the same but for IP address : 104.16.124.96

A

The answer to the question 1 can be retrieved from `lab1.ipynb` file

Q-2

Do you observe a difference with the previous latency measurement ?

A

Although IPinfo shows 104.16.124.96 registered in California, Cloudflare uses Anycast, meaning this IP is advertised from many datacenters worldwide. Traffic from Paris is routed to the nearest Cloudflare PoP in Europe, while traffic from New Jersey is routed to a local US PoP. As a result, both VPs see very low and similar RTTs (1–2 ms) instead of high transatlantic delays.

Exercise 4 :

Q-1

Run Traceroute measurements from the same VPs targeting the two IP addresses and print the IP level path between the destination (the VP) and the target IP address (either 1 or 2).

Q-2

In your opinion, do you think these measurements reflect the reality a user could experience while requesting services to those CDNs ?

A

I'd say traceroute gives a good approximation of what a user might experience since it shows the main network domains (local ISP, backbone, CDN). But in reality, it's not always exact because CDNs use anycast, load balancing, and routing tricks, so the actual path for user traffic can differ.