

Multilateration

NETMET Lab Exercises 9

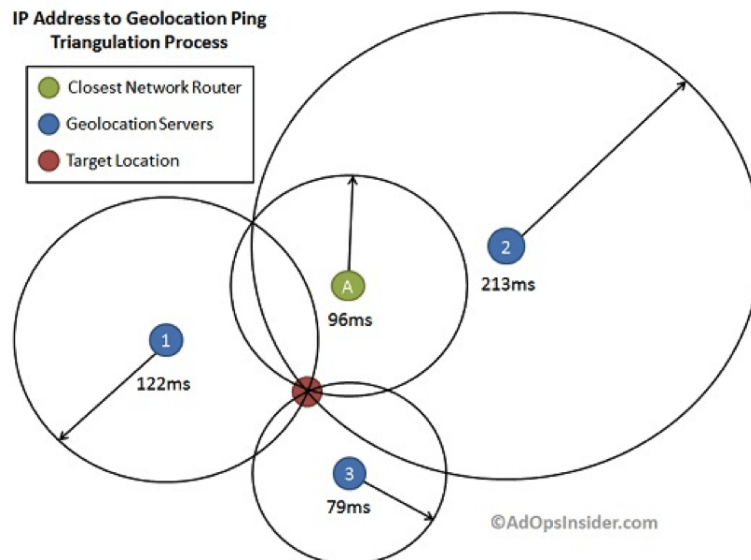
Introduction

This lab is the first one that tackle the issue of geolocating Internet routers of the Internet. In this lab, we will use EdgeNet nodes to apply one of the first (and so the least precise) techniques.

Geolocation using trilateration

Our plan:

- Let's say we want to figure out where the Internet host at *example.com* is located.
- For this we use several “vantage points” (computers at different locations in the world) and from each vantage point we measure the RTT to *example.com* using *ping*.
- Intuition: For vantage points which are far away from *example.com* RTT is very high. For vantage points which are close, RTT is low.
- Using *multilateration* (as trilateration for more than 3 locations) we can figure out approximately where *example.com* is.



How fast is the Internet actually ?

- For example if we measure 244ms from our vantage point 1 to example.com, 244ms is the round trip time (measuring the time for the packet to go there and back). So $244/2 = 122$ is the time only for one way. But how many kilometers do we cover in 122ms?

- First we have to measure **how “fast” the Internet is**. How many milliseconds does it take to go one kilometer?

Use EdgeNet nodes at different locations to perform pings between them.

```
kubectl get nodes -l edge-net.io/constraints=lip6-lab
```

Measure the speed by performing ping measurements from one node to another using

```
ping -c 20 -i 0.2 <other node name>
```

-c stands for the number of ping packets you send and -i for the interval between the packets. Of course you can also experiment with different parameters

Use the geographic distance between the nodes in kilometers (for example using <http://www.distancefromto.net>), divide it by half the measurement **minimum** RTT (the first value) in seconds ($d/(RTT_{min}/2)$)

To get the latitude/longitude of a node you can do:

```
kubectl get nodes <NODE_NAME> -o json | jq '.metadata.labels'
```

Calculate the speeds for some pairs of nodes (in km/s) and write it down. Make at least 5 measurements. You can choose any nodes you want, you should just figure out with which speed the Internet goes.

- Is the speed always the same for all node pairs or does it change? Why is it like that? What do you think limits the speed?

Geolocation using trilateration

After knowing the speed we can use trilateration to locate Internet hosts.

Let's locate the server of the website **github.com**:

- Perform delay measurements to our target from different EdgeNet nodes, in different countries and on different continents.
- Take the minimum RTT you get for the measurements from each node. Using the speed we got before, we can calculate how many kilometers away the target can be ($d = \text{speed} * (RTT_{min}/2)$).
- After you have the distances, draw a circle with the distance for each EdgeNet node from which you performed measurements. You can use for instance : <https://www.calcmaps.com/map-radius/>
- Can you accurately locate the target? Why/Why not?

Also locate “8.8.8.8” using the same method. Where do you think this Internet host is located? Do you notice something?

Geolocation made simple

- Use `tracert <target_you_want_to_locate>`. Is it possible to see the location of the target using the output of traceroute?
- Use `whois <target_you_want_to_locate>`. What is the result?

Anycast location

Have a look at <https://anycast.telecom-paristech.fr/>.

How do you think it is possible to detect that an Internet host uses anycast using the techniques we used so far ?