

A Traceroute Program for Hops Count, RTT and Geographical Information

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1. Task Description

Implement an ICMP based traceroute program to measure counts of hops to get to a host, as well as RTT , distance and other local information like:

- Location (latitude and longitude)
- City, State, Country
- Postcode
- Geographical Distance

2 .Methodology

u Internet Control Message Protocol (ICMP)

- Error Reporting (ICMP Message)

- ICMP Message:

1. Type and code field
2. Header and first 8 bytes of IP datagram
3. ICMP warning message includes the name of the router and its IP address

ICMP Type	Code	Description
0	0	echo reply (to ping)
3	0	destination network unreachable
3	1	destination host unreachable
3	2	destination protocol unreachable
3	3	destination port unreachable
3	6	destination network unknown
3	7	destination host unknown
4	0	source quench (congestion control)
8	0	echo request
9	0	router advertisement
10	0	router discovery
11	0	TTL expired
12	0	IP header bad

Figure 4.23 ♦ ICMP message types

2 .Methodology

Two ways of UDP/ICMP based Traceroute:

Type I. Constant TTL, Available port number, Limited hops

Type II. Increasing TTLs, Unused port number

2 .Methodology

- Time To Live(TTL)
 - Each IP packet has a field called TTL
 - The maximum number of hops that a packet can travel through across the internet, before its discarded
 - When IP packet arrives at a route, TTL reduced by 1
 - TTL exceeded messages are only send by the router that receives a packet with TTL of 1.

2 .Methodology

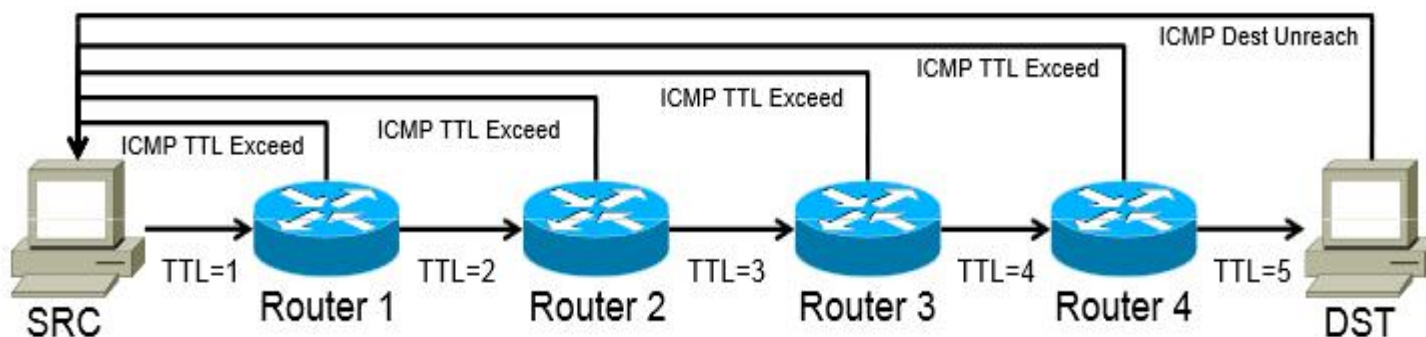
- Type I Traceroute
 - The UDP package contains:
 1. My source address
 2. Destination address
 3. A destination UDP port number (available)
 - Initial TTL = Constant Number (30)

Drawback: If hops need $>$ TTL, TTL expired before reaching the destination

2 .Methodology

u Type II Traceroute

- Every UDP package contains:
 1. My source address
 2. Destination address
 3. A destination UDP port number (unused, 33434 to 33534)
- First datagram has TTL = 1, second has TTL=2,..., Nth has TTL=N
- Before arrival, sender always got ICMP warning (type11, code0)
- When arrival, sender received port unreachable (type3, code3)



3. Experiment Result

Type I Traceroute:

Destination:



```
('Sending packet to', '216.58.219.196')
('Time start is:', 1524152568.150843)
(('216.58.219.196', 0), 'showed')
('The number of hops to this IP is: ', 13, ' hops')
('The RTT of the packet is: ', 0.012083053588867188, ' ms')
('The number of bytes from the original datagram is:', 28, ' bytes\n')

('Sending packet to', '104.244.42.193')
('Time start is:', 1524152568.165447)
(('104.244.42.193', 0), 'showed')
('The number of hops to this IP is: ', 11, ' hops')
('The RTT of the packet is: ', 0.03062891960144043, ' ms')
('The number of bytes from the original datagram is:', 28, ' bytes\n')

('Sending packet to', '172.217.12.206')
('Time start is:', 1524152568.199054)
(('172.217.12.206', 0), 'showed')
('The number of hops to this IP is: ', 13, ' hops')
('The RTT of the packet is: ', 0.01305389404296875, ' ms')
('The number of bytes from the original datagram is:', 28, ' bytes\n')
```


3. Experiment Result

Type II Traceroute :
Destination: Google.com



```
(yazhou) cisa@cisa-All-Series:~/Desktop$ sudo python python_traceroute.py
1  0.003821  172.20.0.2 (172.20.0.2)
2  0.003659  10.240.128.154 (10.240.128.154)
3  0.003433  131.128.72.2 (131.128.72.2)
4  0.004883  131.128.19.50 (131.128.19.50)
5  * * *
6  0.00627   131.109.192.45 (131.109.192.45)
7  0.007472  rtr1.osh300bent.mgmt.oshean.org (198.7.224.105)
8  0.007629  nox300gw1-oshean-cps.nox.org (207.210.142.137)
9  0.012752  et-7-3-0.120.rtsw.newy32aoa.net.internet2.edu (198.71.47.57)
10 0.012202  lo-0.8.rtsw.newy2.net.internet2.edu (64.57.20.215)
11 0.012096  162.252.69.199 (162.252.69.199)
12 0.031578  108.170.248.65 (108.170.248.65)
13 0.027384  72.14.234.23 (72.14.234.23)
14 0.012134  lga25s60-in-f14.1e100.net (172.217.11.14)
```

3. Experiment Result

Type II Traceroute :

Destination: Google.com

Implemented by Jupyter Notebook

```
IP: 131.128.73.7   Latitude: 41.4773   Longitude: -71.5208
Location: 2350, Kingstown Road, South Kingstown, Washington, Rhode Island, 02881, United States of America
Distance(miles): 0.6087773354955203
```

This IP is not trackable!

```
IP: 131.128.72.2   Latitude: 41.4773   Longitude: -71.5208
Location: 2350, Kingstown Road, South Kingstown, Washington, Rhode Island, 02881, United States of America
Distance(miles): 0.6087773354955203
```

```
IP: 131.128.19.50  Latitude: 41.4773   Longitude: -71.5208
Location: 2350, Kingstown Road, South Kingstown, Washington, Rhode Island, 02881, United States of America
Distance(miles): 0.6087773354955203
```

```
IP: 131.109.192.45 Latitude: 42.0858   Longitude: -70.9999
Location: East Junior High Playground, Centre Street, Brockton, Plymouth County, Massachusetts, 02302, United States of America
Distance(miles): 49.689365502601206
```

```
IP: 198.7.224.105  Latitude: 41.839   Longitude: -71.4373
Location: 10, Arbor Drive, Providence, Rhode Island, 02908, United States of America
Distance(miles): 24.939157064516408
```

```
IP: 207.210.142.137 Latitude: 41.7686   Longitude: -72.6745
Location: 1 Commercial Plaza, 280, Trumbull Street, Hartford, Hartford County, Connecticut, 06103, United States of America
Distance(miles): 62.517128484796864
```

3. Experiment Result

Type II Traceroute :
Destination: Google.com

IP: 198.71.47.57 Latitude: 42.2167 Longitude: -83.7406
Location: Fairfield Court, Pittsfield Charter Township, Washtenaw County, Michigan, 48108, United States of America
Distance(miles): 631.6560623291473

IP: 64.57.20.215 Latitude: 42.2167 Longitude: -83.7406
Location: Fairfield Court, Pittsfield Charter Township, Washtenaw County, Michigan, 48108, United States of America
Distance(miles): 631.6560623291473

IP: 162.252.69.199 Latitude: 37.751 Longitude: -97.822
Location: Reno County, Kansas, United States of America
Distance(miles): 1420.6467122540096

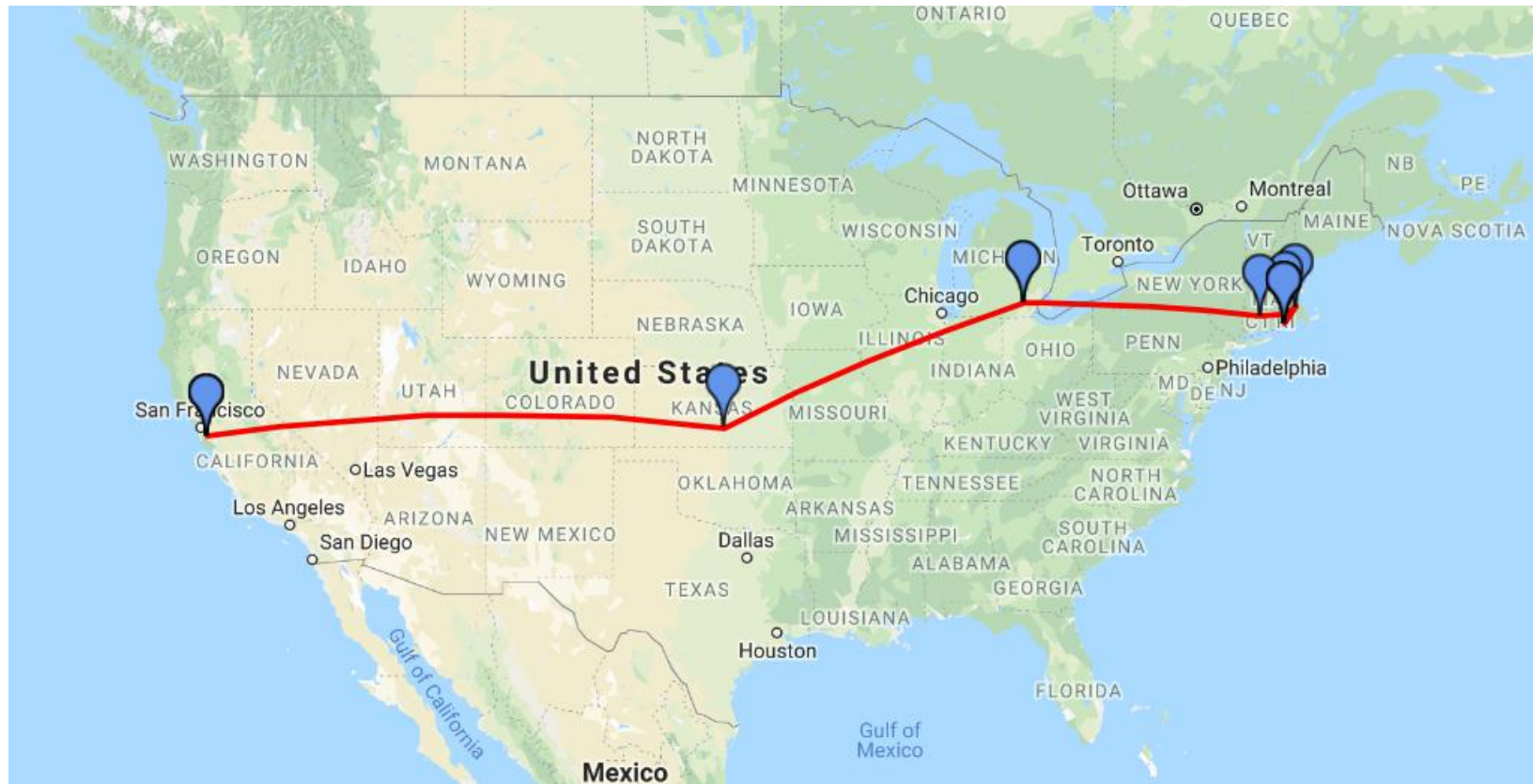
IP: 108.170.248.65 Latitude: 37.419200000000004 Longitude: -122.0574
Location: N-144, Severyns Road, ARC, Mountain View, Santa Clara County, California, 94086, United States of America
Distance(miles): 2678.525941719761

IP: 72.14.234.23 Latitude: 37.419200000000004 Longitude: -122.0574
Location: N-144, Severyns Road, ARC, Mountain View, Santa Clara County, California, 94086, United States of America
Distance(miles): 2678.525941719761

IP: 172.217.11.14 Latitude: 37.419200000000004 Longitude: -122.0574
Location: N-144, Severyns Road, ARC, Mountain View, Santa Clara County, California, 94086, United States of America
Distance(miles): 2678.525941719761

3. Experiment Result

Type II Traceroute :
Destination: Google.com



3. Experiment Result

Type II Traceroute :
Destination: sina.com



```
(yazhou) cisa@cisa-All-Series:~/Desktop$ sudo python python_traceroute.py
[sudo] password for cisa:
1  0.01131  172.20.0.2 (172.20.0.2)
2  0.003924  10.240.128.154 (10.240.128.154)
3  * * *
4  * * *
5  * * *
6  0.006391  131.109.192.45 (131.109.192.45)
7  0.008276  host-198-7-224-105.oshean.org (198.7.224.105)
8  0.006917  5-1-4.bear1.Boston1.Level3.net (4.53.54.21)
9  0.080914  ae-2-3605.ear1.LosAngeles1.Level3.net (4.69.210.37)
10 0.080837  CHINA-TELEC.ear1.LosAngeles1.Level3.net (4.35.156.14)
11 0.080758  202.97.90.113 (202.97.90.113)
12 0.132189  202.97.49.206 (202.97.49.206)
13 0.129363  203.14.186.38 (203.14.186.38)
14 0.126289  218.30.41.245 (218.30.41.245)
15 0.137442  218.30.41.234 (218.30.41.234)
16 0.133392  66.102.251.33 (66.102.251.33)
```

3. Experiment Result

Type II Traceroute :

Destination: Sina.com

Implemented by Jupyter Notebook

IP: 131.128.73.7 Latitude: 41.4773 Longitude: -71.5208
Location: 2350, Kingstown Road, South Kingstown, Washington, Rhode Island, 02881, United States of America
Distance(miles): 0.6087773354955203

This IP is not trackable!

IP: 131.109.192.45 Latitude: 42.0858 Longitude: -70.9999
Location: East Junior High Playground, Centre Street, Brockton, Plymouth County, Massachusetts, 02302, United States of America
Distance(miles): 49.689365502601206

IP: 198.7.224.105 Latitude: 41.839 Longitude: -71.4373
Location: 10, Arbor Drive, Providence, Rhode Island, 02908, United States of America
Distance(miles): 24.939157064516408

IP: 4.53.54.21 Latitude: 43.179 Longitude: -77.555
Location: 84, Kiniry Drive, Glen Haven, Irondequoit Town, Monroe County, New York, 14609, United States of America
Distance(miles): 329.977233329676

IP: 4.69.210.37 Latitude: 37.751 Longitude: -97.822
Location: Reno County, Kansas, United States of America
Distance(miles): 1420.6467122540096

IP: 4.35.156.14 Latitude: 34.0291 Longitude: -118.3993
Location: 5, Santa Monica Freeway, Palms, LA, Los Angeles County, California, 90293, United States of America
Distance(miles): 2585.0798838073647

3. Experiment Result

Type II Traceroute :

Destination: Sina.com

IP: 202.97.90.113 Latitude: 34.7725 Longitude: 113.7266

Location: 商务内环路, 管城回族区, 金水区 (Jinshui), 郑州市 / Zhengzhou, 河南省, 450000, 中国

Distance(miles): 7172.655222279005

IP: 202.97.49.206 Latitude: 34.7725 Longitude: 113.7266

Location: 商务内环路, 管城回族区, 金水区 (Jinshui), 郑州市 / Zhengzhou, 河南省, 450000, 中国

Distance(miles): 7172.655222279005

IP: 203.14.186.38 Latitude: 22.2833 Longitude: 114.15

Location: international, 堅道 Caine Road, 金鐘 Admiralty, 半山區 Mid-levels, 香港 Hong Kong, 中西區 Central and Western District, 香港島 Hong Kong Island, HK, 1F, 中国

Distance(miles): 8028.304506483064

IP: 218.30.41.245 Latitude: 37.4997 Longitude: 110.2539

Location: 绥德县, 绥德县 (Suide), 榆林市 (Yulin), 陕西省, 中国

Distance(miles): 6994.0021917742915

IP: 218.30.41.234 Latitude: 37.4997 Longitude: 110.2539

Location: 绥德县, 绥德县 (Suide), 榆林市 (Yulin), 陕西省, 中国

Distance(miles): 6994.0021917742915

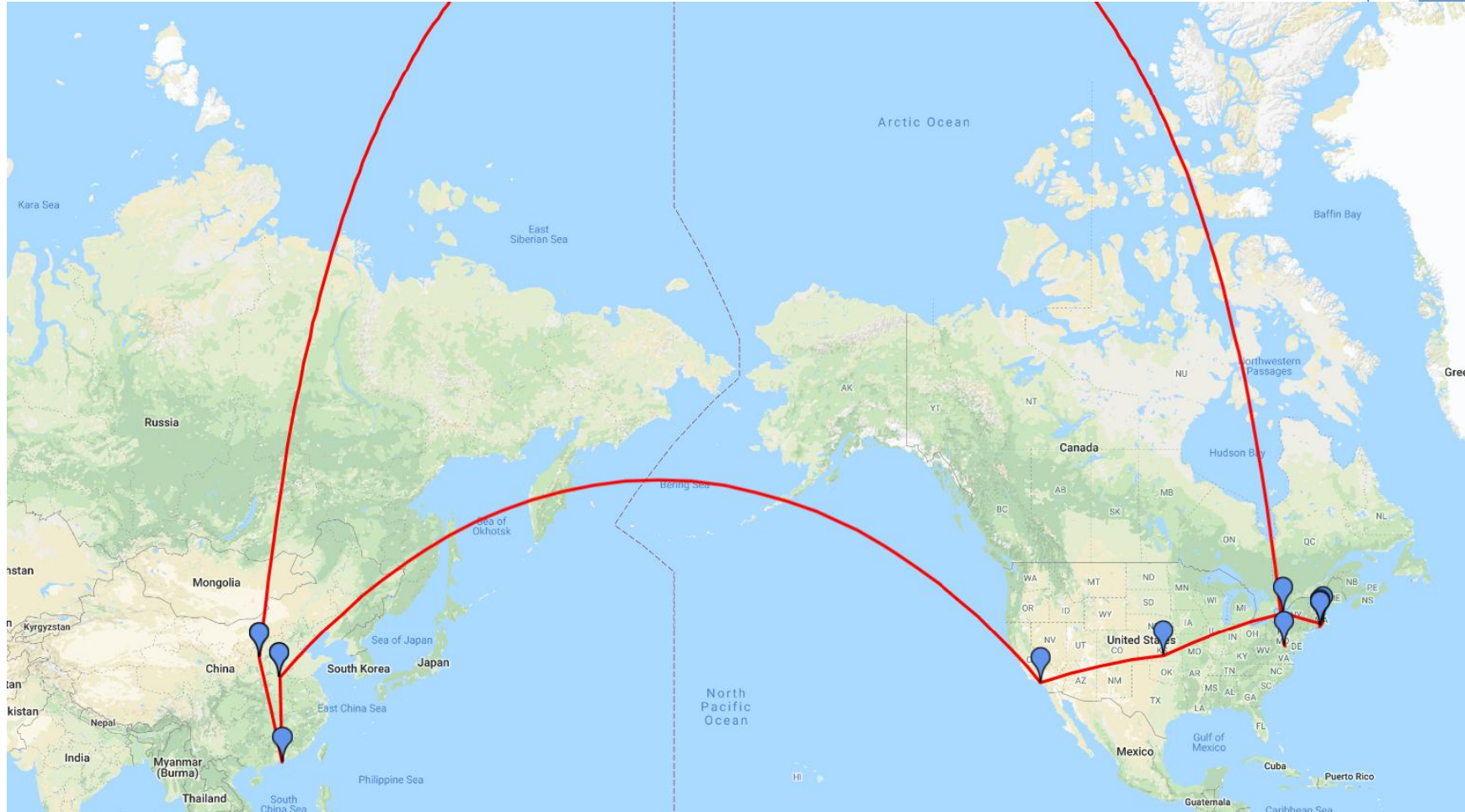
IP: 66.102.251.33 Latitude: 38.9841 Longitude: -77.3827

Location: 901, Barker Hill Road, Herndon, Fairfax County, Virginia, 20170, United States of America

Distance(miles): 354.2771207052319

3. Experiment Result

Type II Traceroute :
Destination: Sina.com



The background features abstract, overlapping geometric shapes in various shades of blue, primarily on the right side of the slide. The shapes include triangles and polygons of different sizes and opacities, creating a modern, layered effect. The text 'Thank You!' is centered in a blue, outlined font.

Thank You!