CDN Latency

CDN Latency

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Agenda

1. Introduction
2. Methodology
   - CDNs collection
   - Choosing candidates
   - Collecting ping data
   - Building the graph
   - Visualization
3. Results

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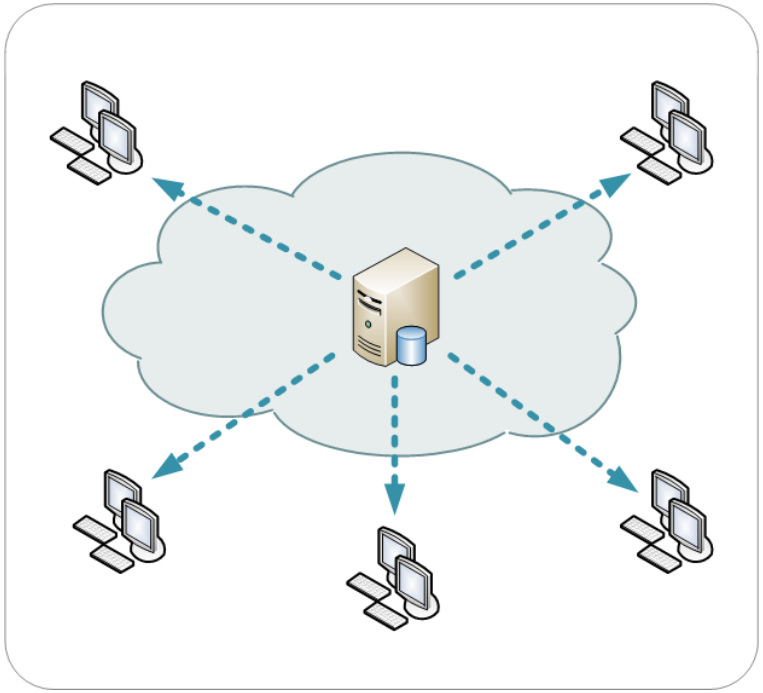
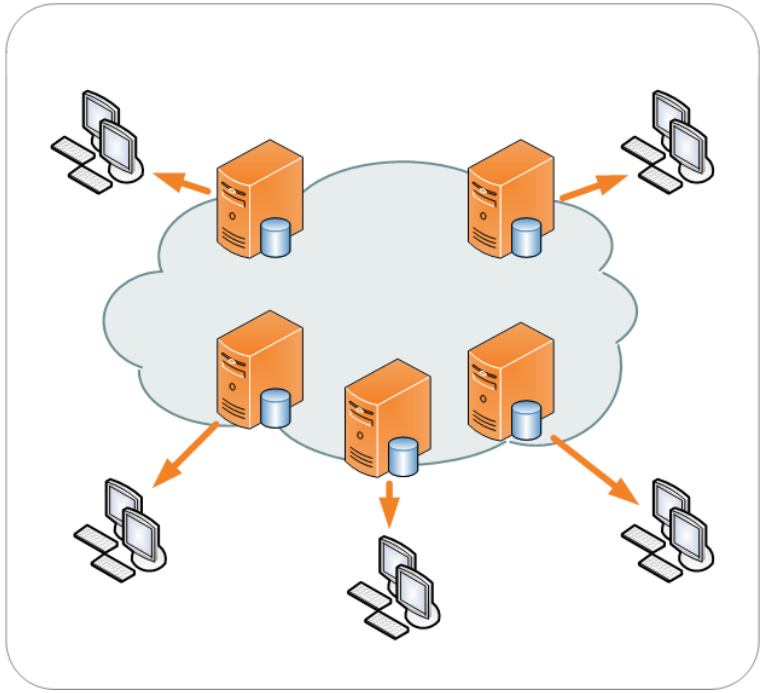
Introduction

- Measuring and Evaluating Large-Scale CDNs (Huang et al., 2008).
- The goal of a CDN is to serve content to end-users with high availability and high performance.

Introduction





Introduction

- But... Where do we deploy a new CDN server???

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Overview

1. Collect information about current CDNs
2. Select a group of possible candidates
3. Measure the latency between points (Ping time)
4. Graph analysis
5. Visualization

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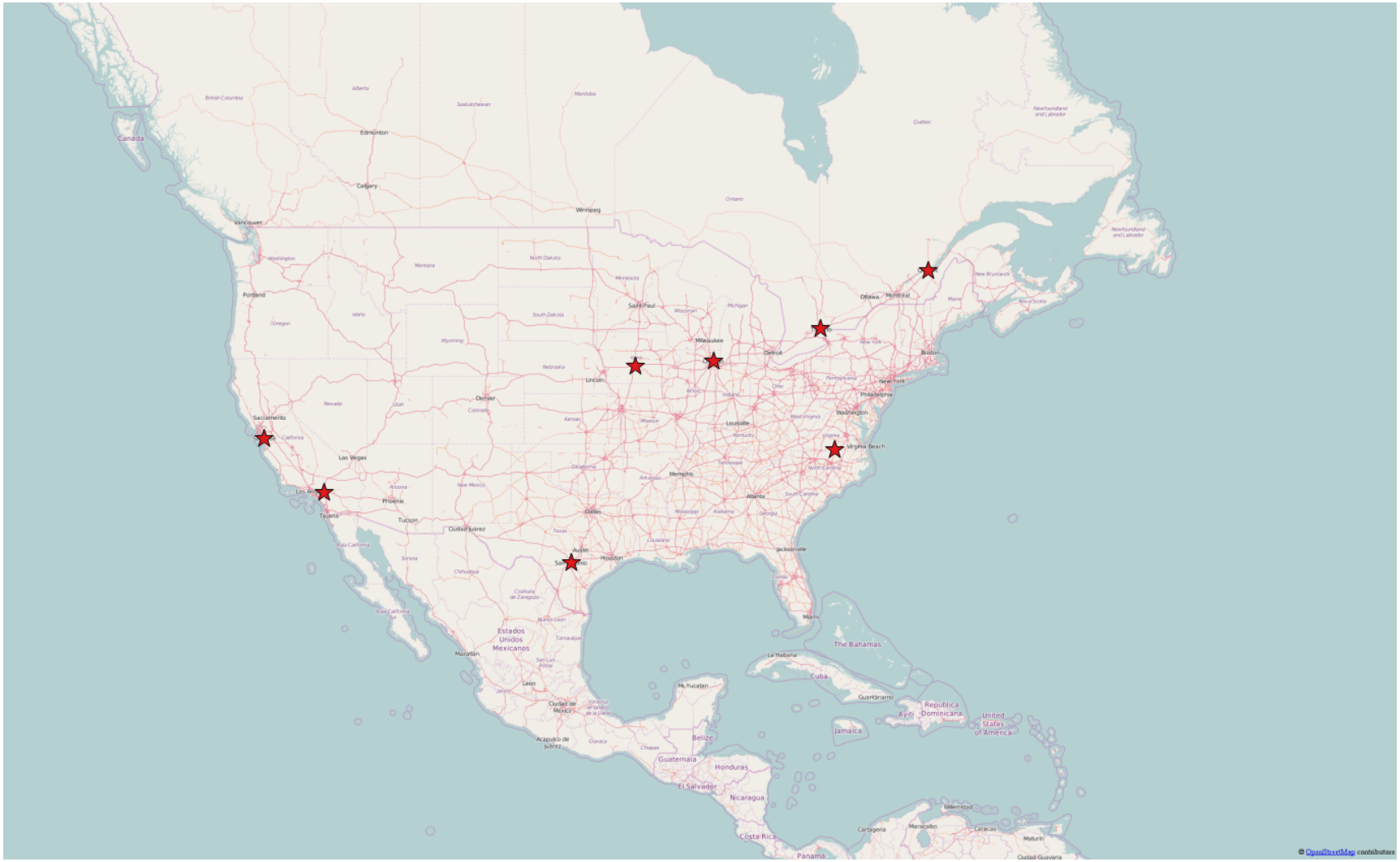
Virtual machines

- Microsoft Azure: Cloud Computing Platform & Services [1]
- 8 instances in different geographical regions
  1. East USA
  2. Central USA
  3. South Central USA
  4. West USA
  5. North Central USA
  6. East Canada
  7. Central Canada
  8. Riverside

[1] https://azure.microsoft.com/

Virtual machines



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Choosing candidates

- Universities Worldwide [2]
- Universities from USA and Canada

[2] http://univ.cc/

Choosing candidates

- Cleaning and processing
  - Remove urls which did not respond to ping
  - Remove duplicates (in the same city)
  - Remove incorrect format
  - Extract latitude and longitude (reverse geocoding)
- End up with 97 candidates

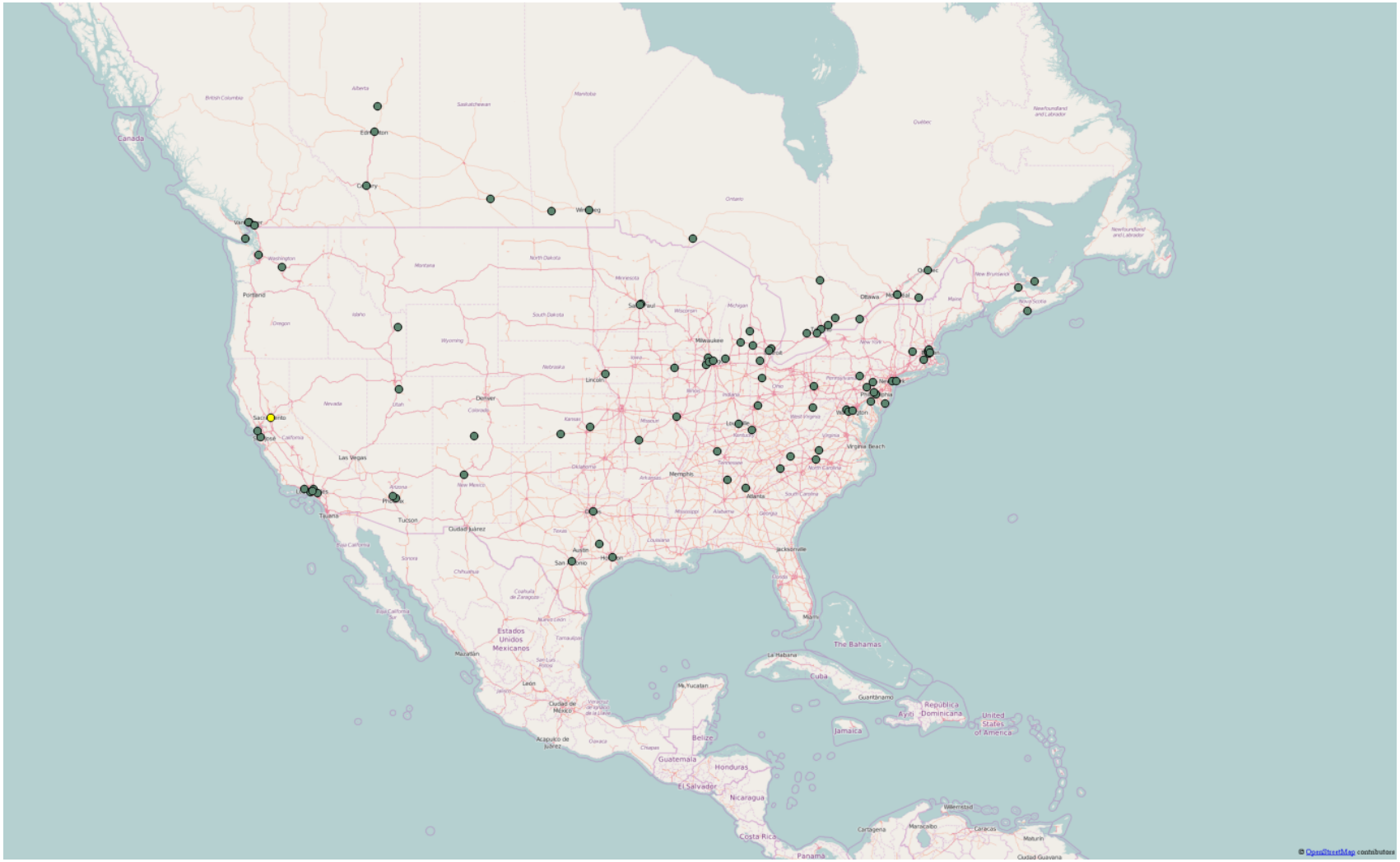
Python scripts

```
import xml.dom.minidom
import socket
from geoip import geolite2
import subprocess

doc = xml.dom.minidom.parse("usa.xml")
list = doc.getElementsByTagName("a")
for item in list:
        url = item.getAttribute("href")[7:-1]
        try:
                addr = socket.gethostbyname(url)
                match = geolite2.lookup(addr)
        except socket.error, msg:
                addr
        else:
                try:
                        output = subprocess.check_output(["ping","-c1",url])
                except subprocess.CalledProcessError,e:
                        url
                else:
                        print "{0}".format(url)
```

Python scripts

```
import socket
from geoip import geolite2
import subprocess
import geocoder
import time

f = open('dns3.txt', 'r')
for url in f.readlines():
        try:
                url = url[:-1]
                addr = socket.gethostbyname(url)
                match = geolite2.lookup(addr)
                lat = round(match.location[0],2)
                lon = round(match.location[1],2)
                g = geocoder.google([lat,lon], method='reverse')
                time.sleep(2)
        except socket.error, msg:
                print ""
        else:
                print(url+";"+addr+";"+str(lat)+";"+str(lon)+";"+g.city+";"+g.state)
```

Choosing candidates



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Ping data

- We collect ping data from each current CDN to all the candidates
- Run a script at each virtual machine
- Transmit 5 packages and extract the average ping time

Python script

```
import subprocess

f = open('dns3.txt', 'r')
for url in f.readlines():
        try:
                url = url[:-1]
                output = subprocess.check_output(["ping","-c5",url])
        except subprocess.CalledProcessError,e:
                url
        else:
                ping = float(output.split('\n')[-2:-1][0].split('/')[-3:-2][0])
                print "{0};{1}".format(url, ping)
```

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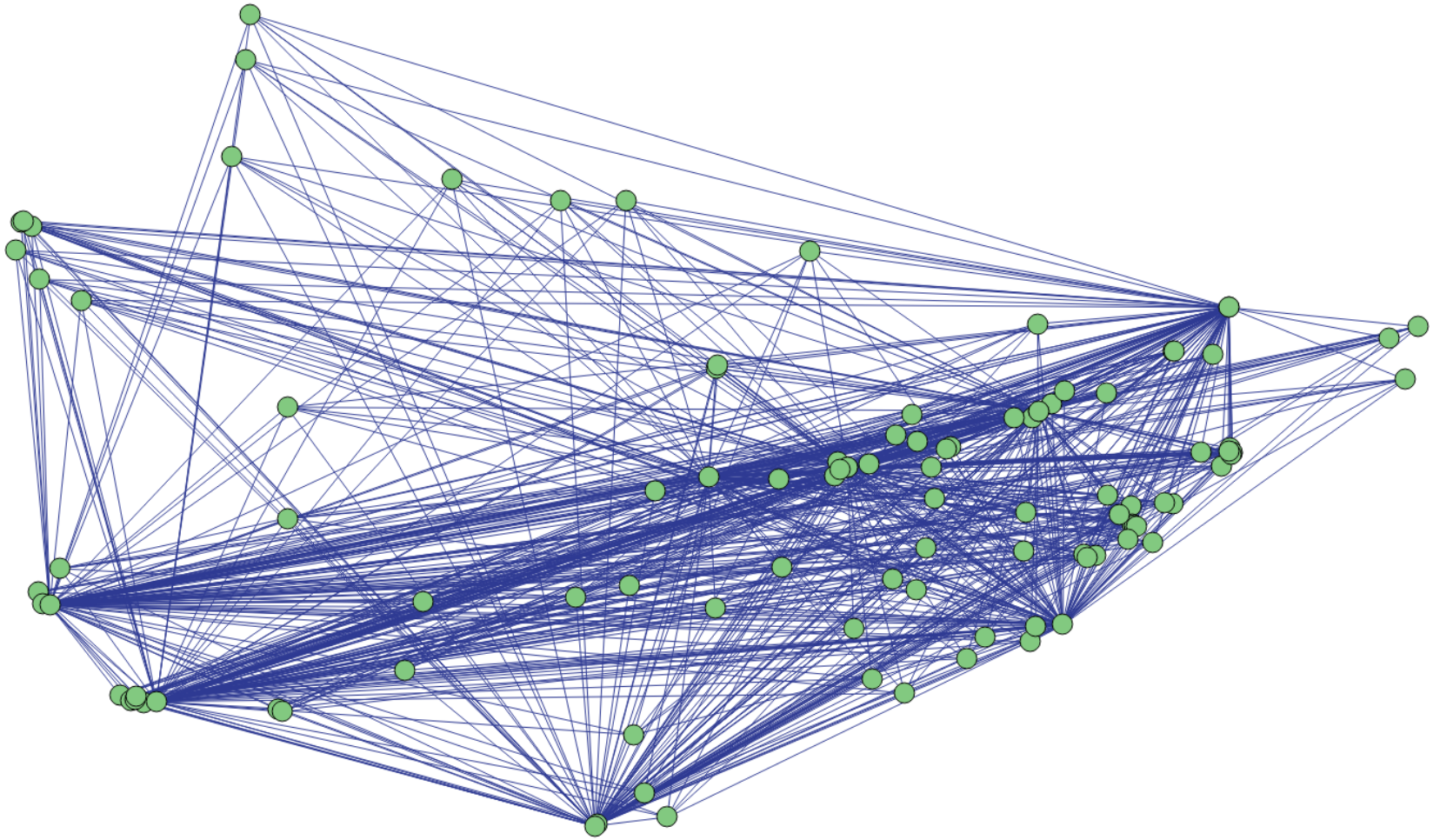
Building the graph

- Merge results for each virtual machine (CDN)
- Use `networkX` package in python
- Final graph has 105 nodes and 776 edges

Python script

```
import networkx as nx
import pandas as pd

G=nx.Graph()
## Riverside
center_y = 33.9680
center_x = -117.3194
center = (center_x,center_y)
G.add_node(center)

candidates = pd.read_csv('candidates.csv', sep=';', header=None
                                    , names=['url','ip','lat','lon','city','state'])
pings = pd.read_csv('pings.csv', sep=';', header=None, names=['url','ping'])

nodes = candidates.loc[:,['url','lat','lon']].merge(pings).loc[:,['lat','lon','ping']]

for index, node in nodes.iterrows():
        point = (node['lon'],node['lat'])
        G.add_node(point)
        G.add_edge(center,point,weight=node['ping'],cdn='Riverside')
```

Building the graph



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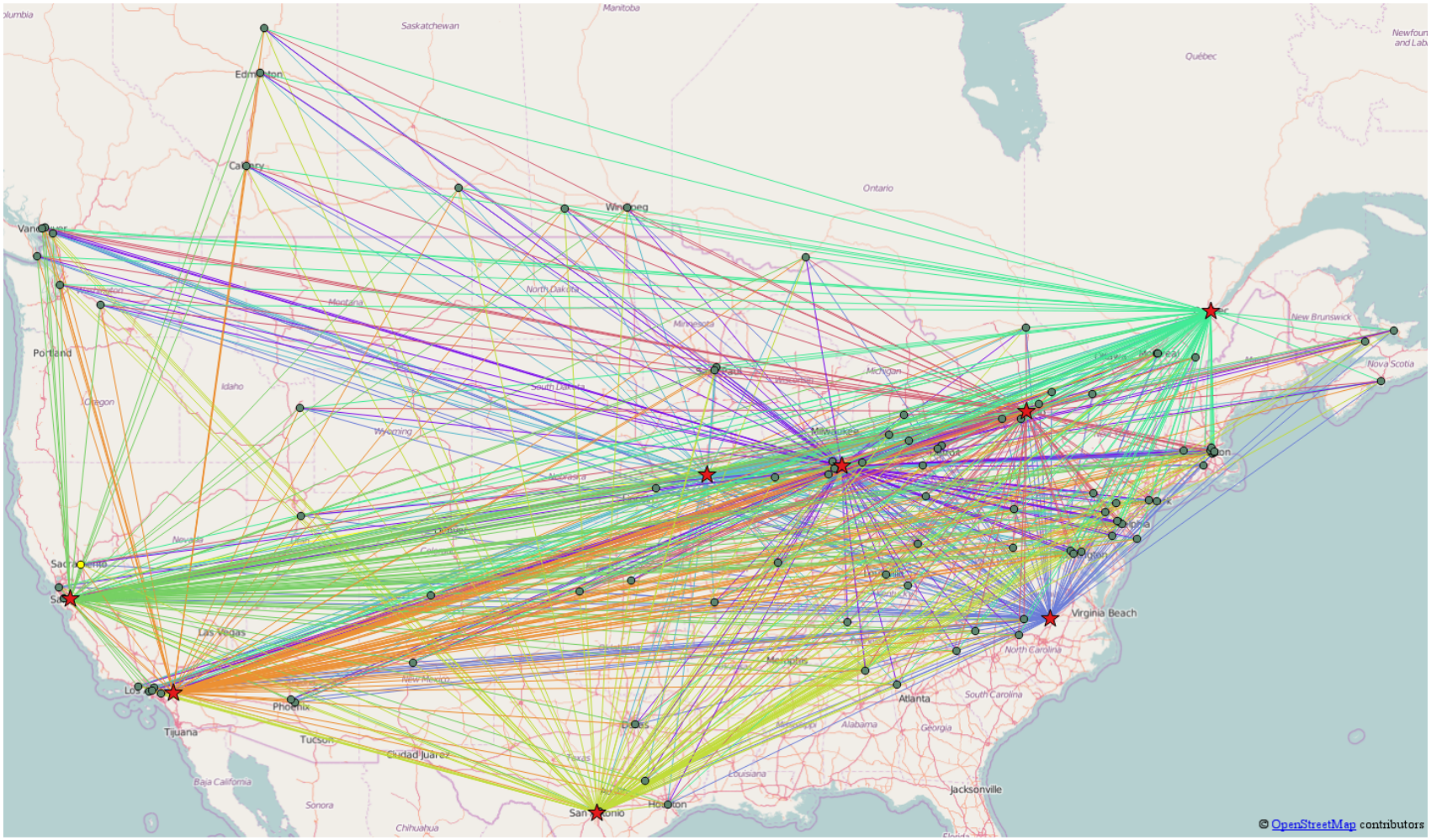
Visualization

- Use networkX to save the output to a shapefile format
- Use QGIS to visualize data

Visualization



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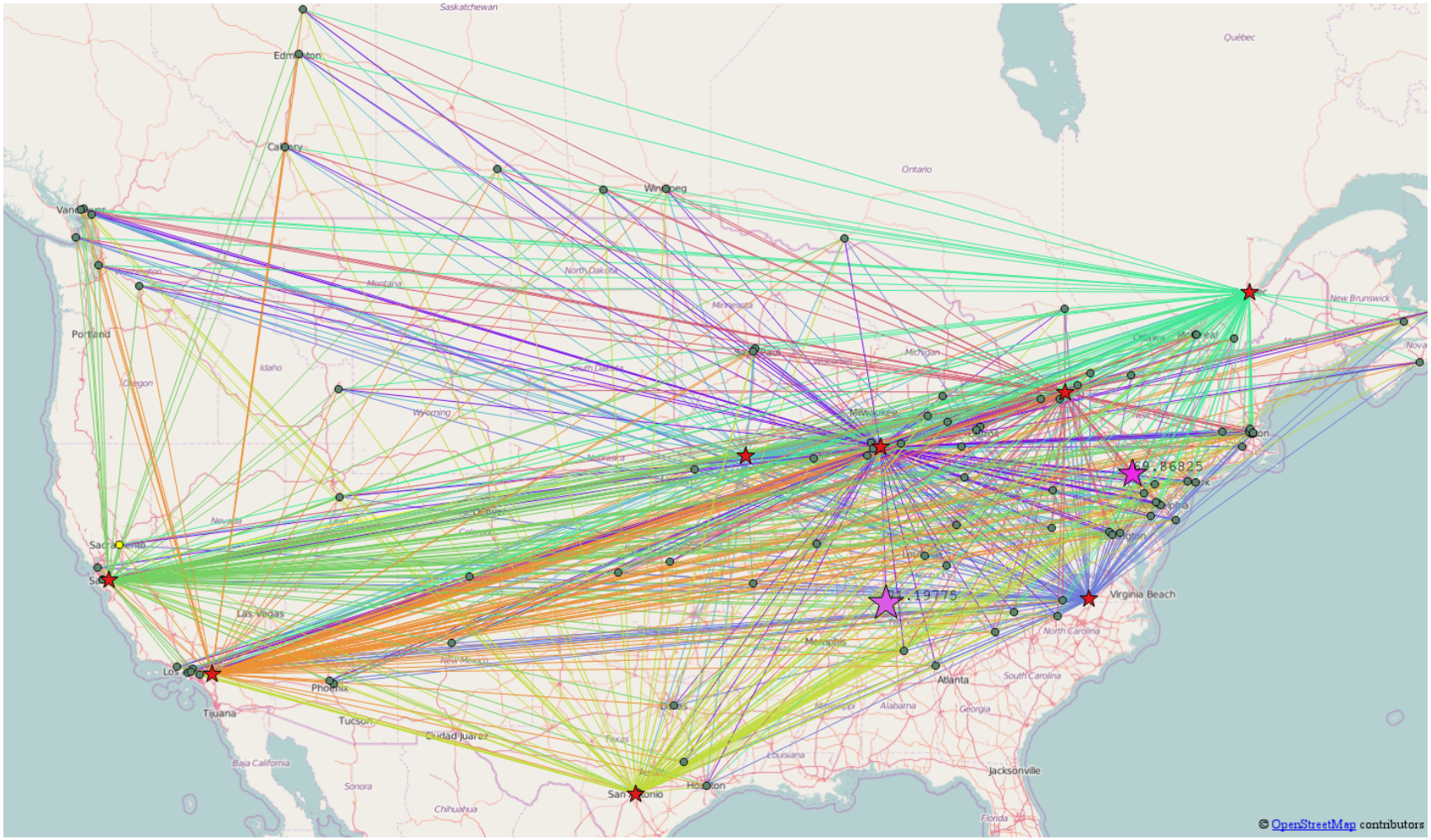
Results

- Iterate at each candidates to all the CDNs
- Compute the average ping time
- Sort by average time ascendantly

Results


Saskatchewan
Québec
Ontario
Edmonton
Calgary
Winnipeg
Vancouver
Portland
Oregon
Idaho
Montana
North Dakota
Minnesota
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New Brunswick
Nevada
Las Vegas
Phoenix
Tijuana
Tucson
Ciudad Juárez
Baja California
Sonora
Chihuahua
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North Carolina
Virginia Beach
Jacksonville
Florida
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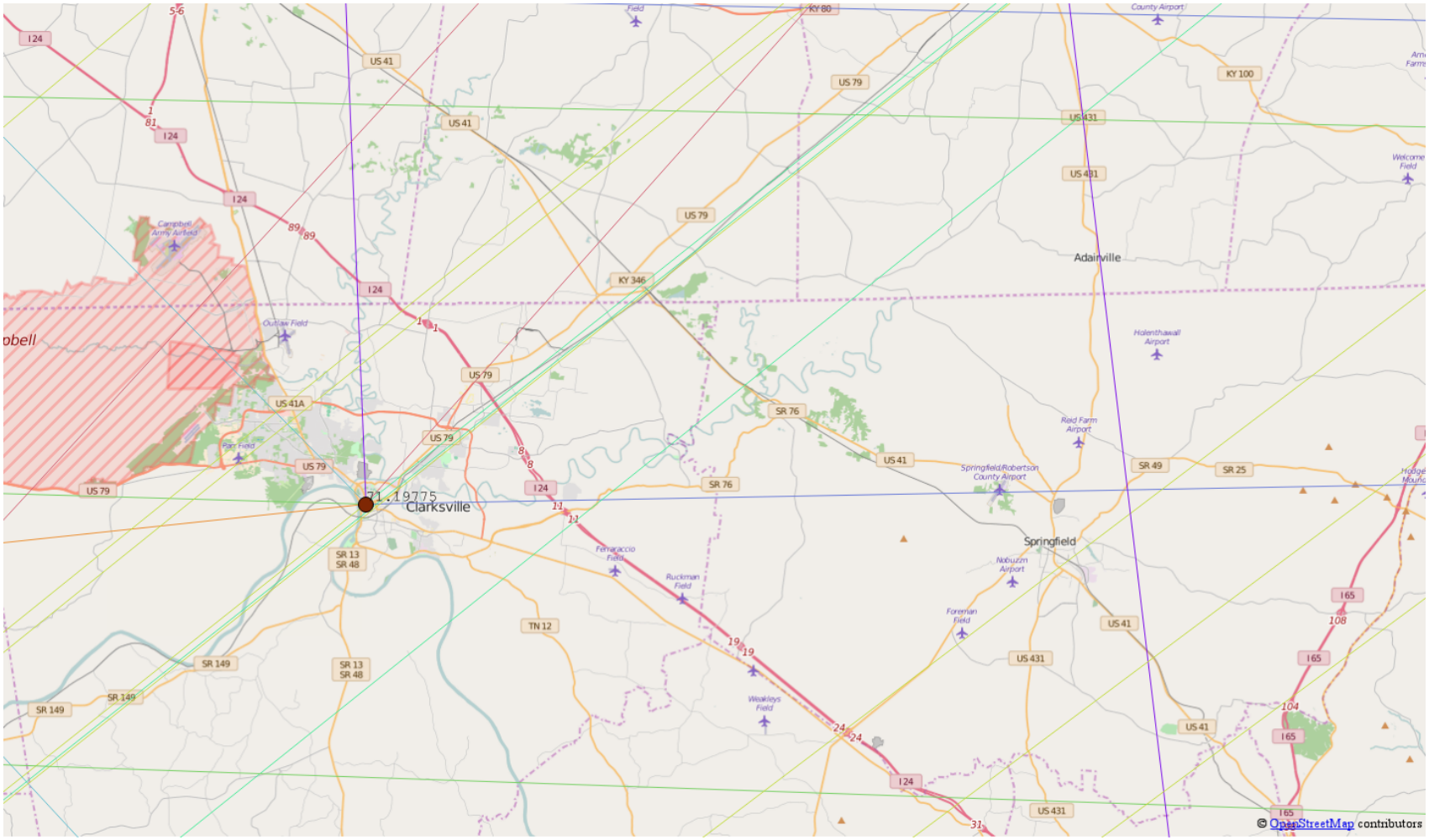
Results


Clarksville
Springfield
Adairville
US 41
US 79
I 24
KY 80
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KY 346
SR 76
SR 49
SR 25
SR 13
SR 48
SR 149
TN 12
I 65
US 41A
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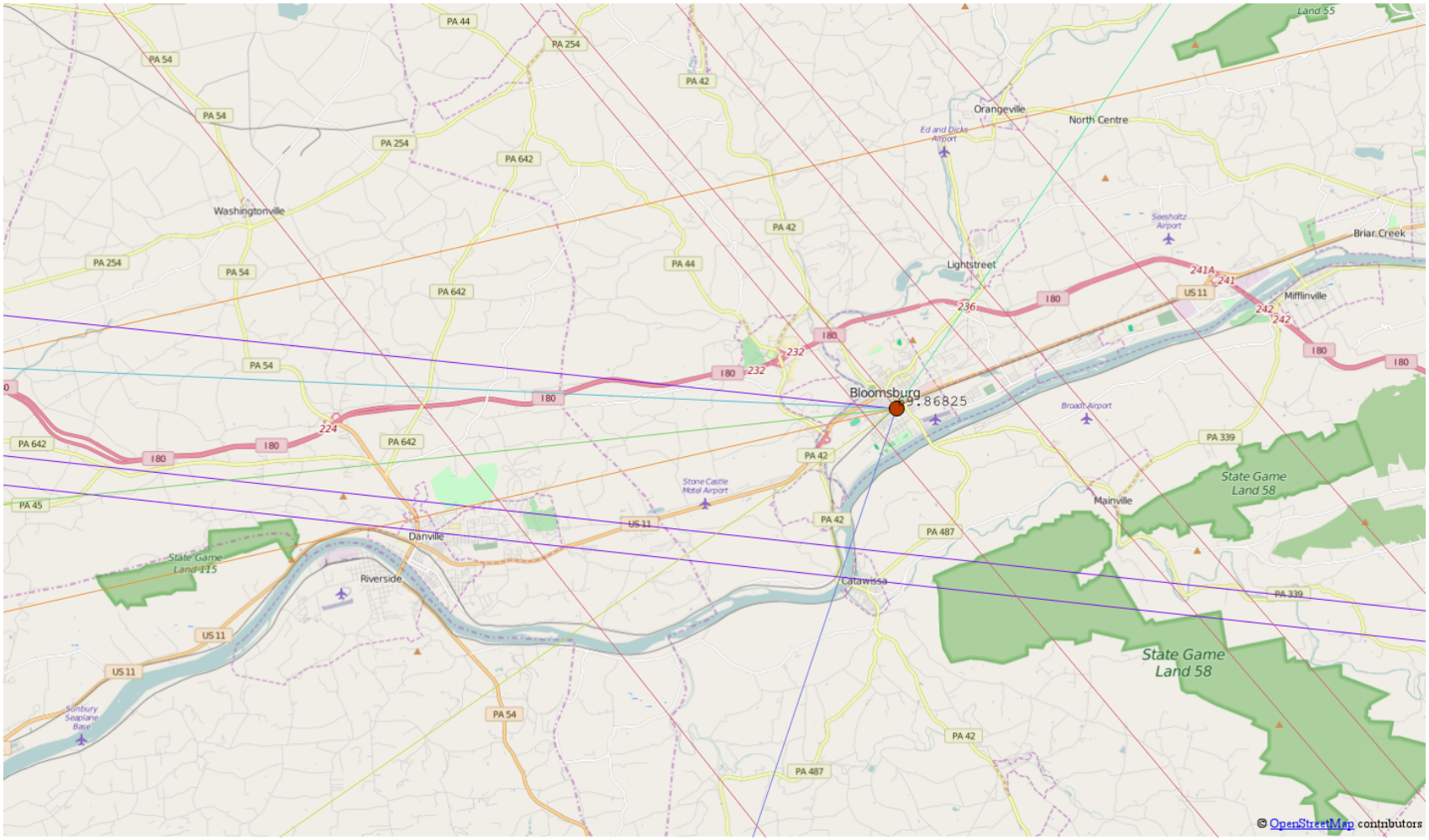
Results


Bloomsburg
Orangeville
North Centre
Lightstreet
Briar Creek
Mifflinville
Mainville
Danville
Riverside
Catawissa
Washingtonville
State Game Land 58
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PA 54
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PA 44
PA 642
PA 45
PA 339
PA 487
I 80
US 11
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