# Network Simulator (NS)

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Team Leader: Andy Do
Team Members: Dibakar Barua, William Fong, Y Hoang, Daniel Romo, Zifan Yang

# Team

Back-End: Andy, William

- Implementing Various Algorithms
- Simulate Topology
- Dynamic Simulator

Front-End: Dibakar, Daniel, Y, Zifan

- Build User Friendly GUI
- Node, Edge visual Implementation
- Google Maps Integration
- Import and Export data

# Guide

- Project overview
- Requirement
- Level 1 DFD
- Simulator Inputs
- Dynamic Simulator
- Third Party API: GmapsFX
- Demo
- Failure model
- Closing Note

# Project Overview

- NS is a real world network simulation to which can simulate the network infrastructure and the network traffic accounting for client request.

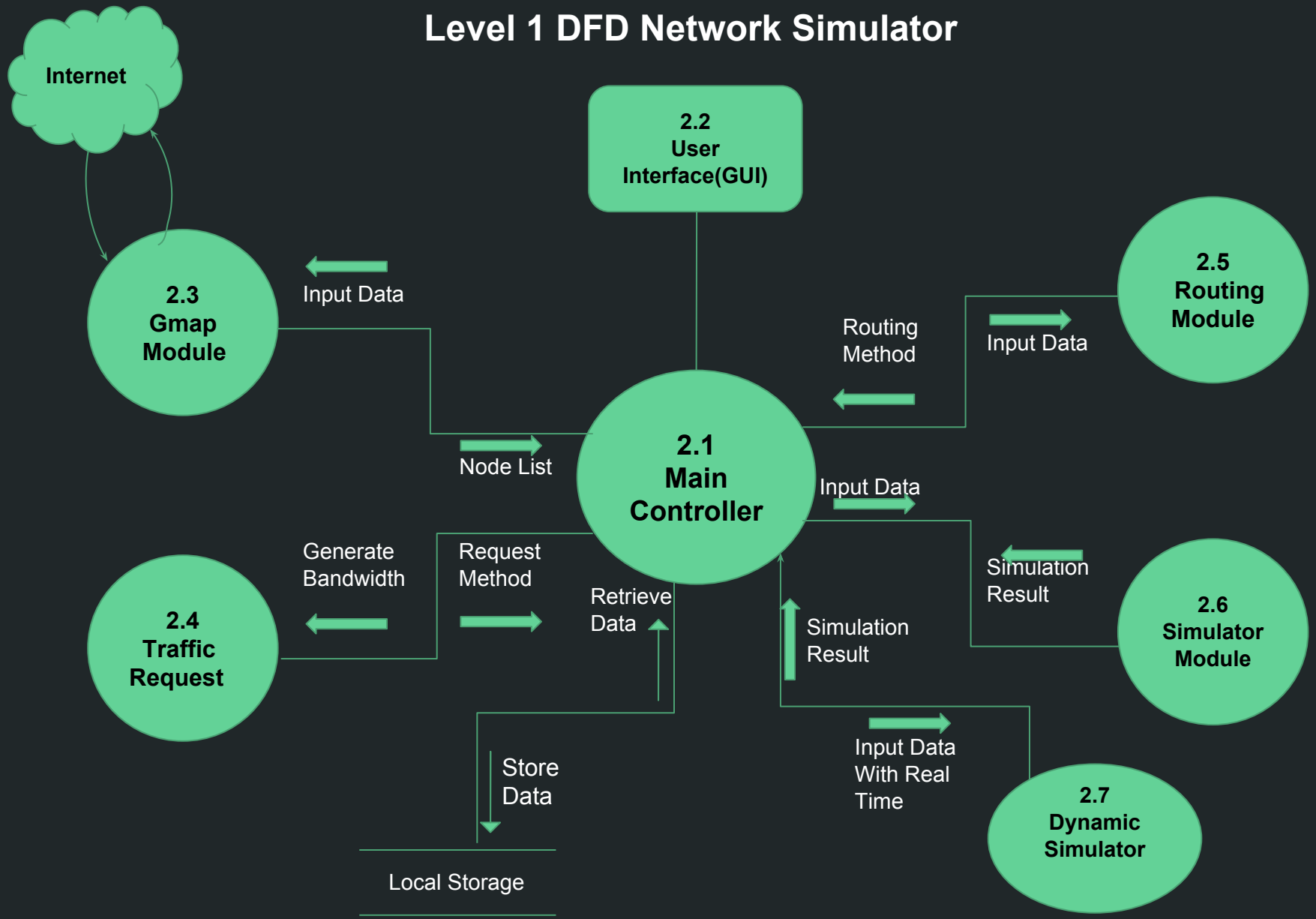
  ## Why?

  - Building a network infrastructure from the ground up is very expensive.
  - Simulation help evaluate network cheaply
  - Account for failure rate in a typical network
  - A network can be set to run in the dynamic simulation to be able to collect more data.

# Tools / Technology

- JavaFX
- Scene Builder
- Fxml
- Google Map API
  - GmapsFX
  - GeoCoding
- Github


# Level 1 DFD Network Simulator

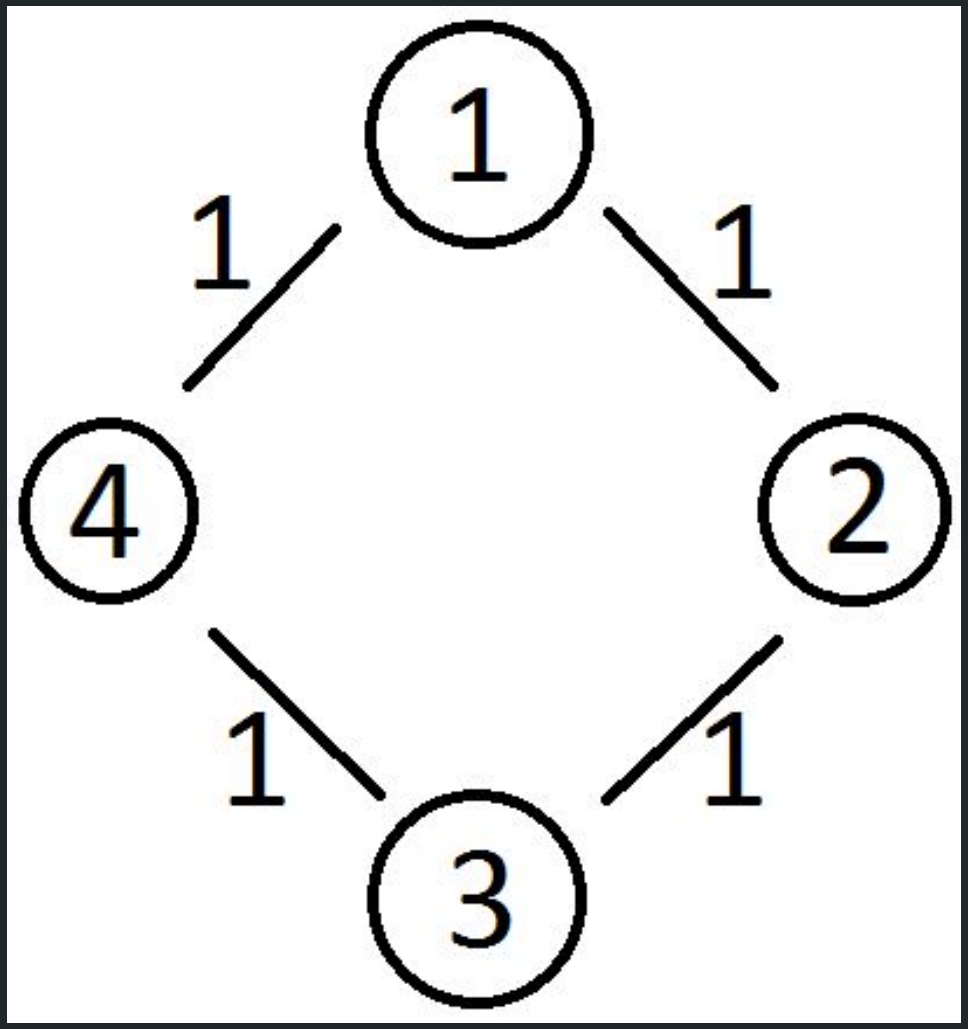


# Simulator

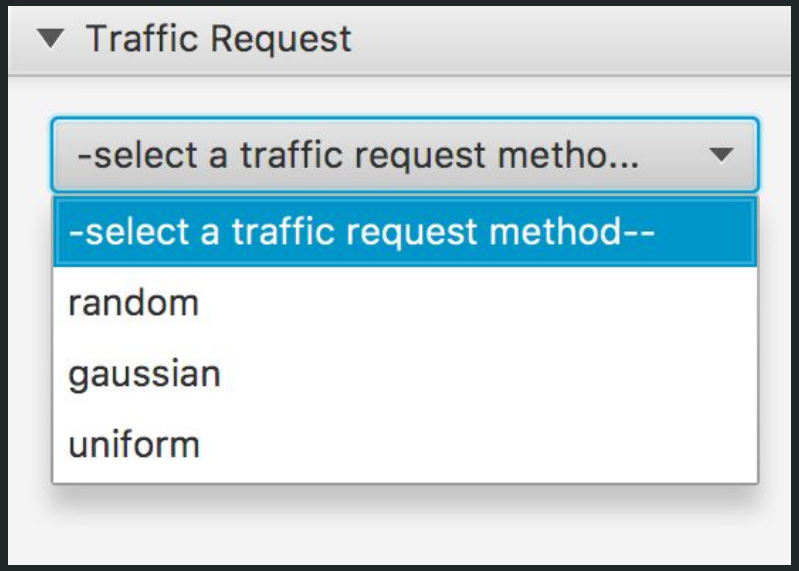
3 Inputs:

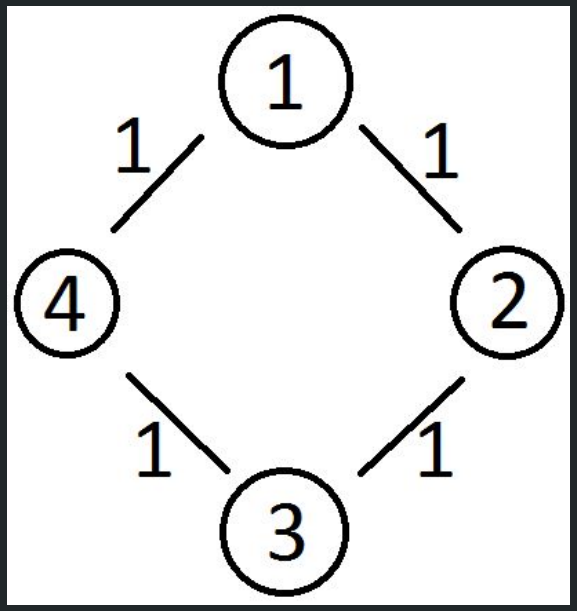
- Topology
- Traffic request method
- Routing method

# Topology



# Traffic Request

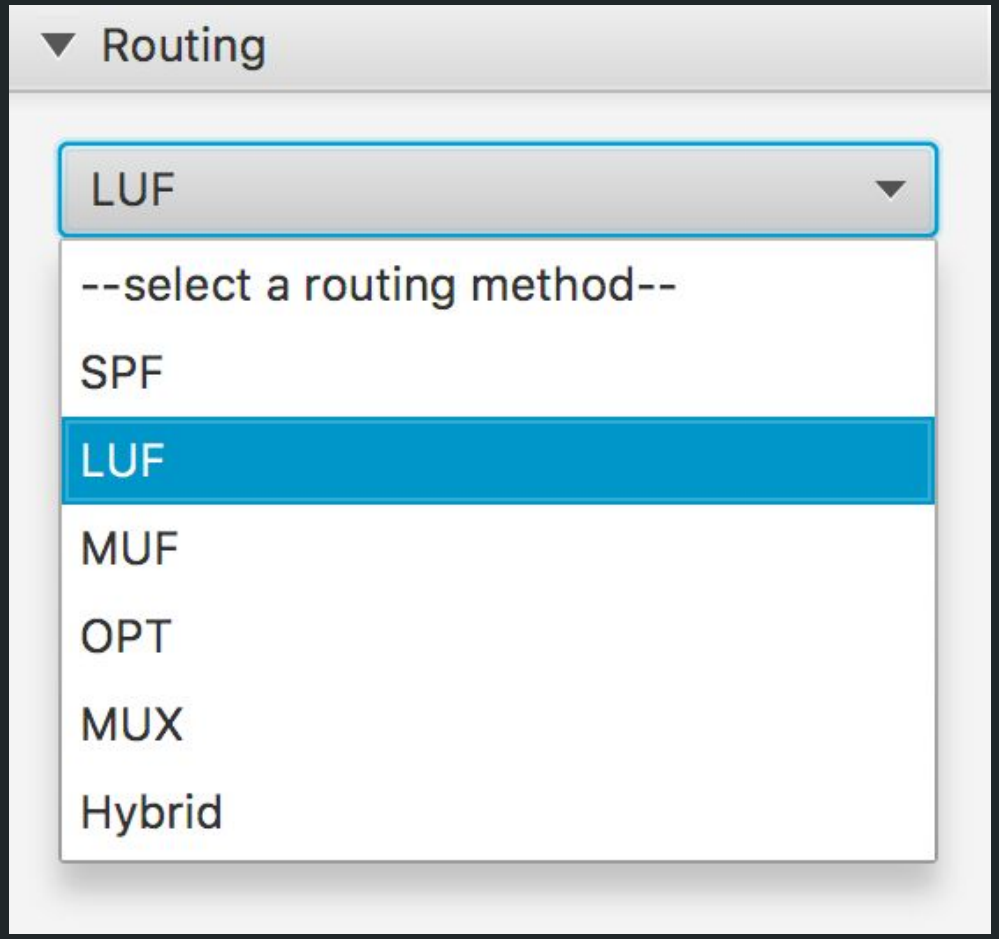



Sample Request:

| Starting Node: | Destination Node: | Bandwidth: |
|---|---|---|
| 1 | 2 | 57 |

# Routing Method



# Dynamic Simulator

- What is a dynamic simulator?
- What is the difference?

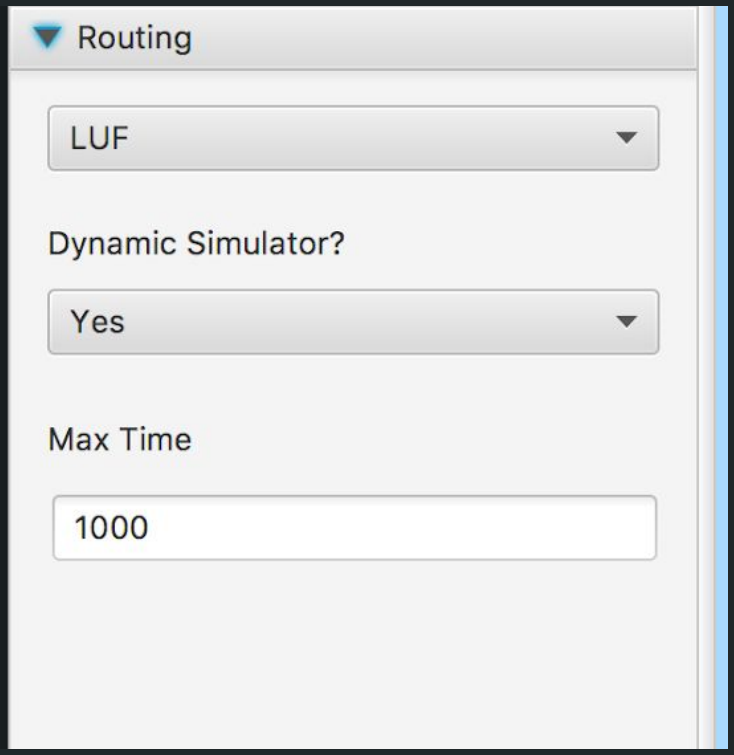
# Dynamic Simulator

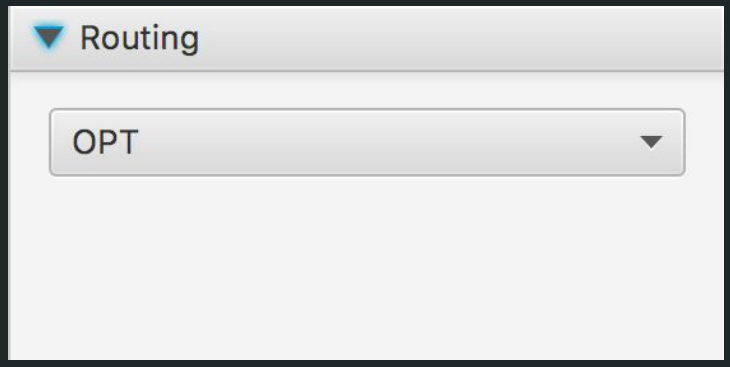
- Allows for a more real world simulation
- Specify time interval, request count, max bandwidth
- Will also have random time length and random bandwidth
- When it is generated, the bandwidth is allocated
  - If there is not enough bandwidth, drop
- When it finishes, the bandwidth is released

# Dynamic Simulator

- Limited to SPF, LUF, MUF
- Sample Request:

| Starting Node: | Destination Node: | Bandwidth: |
|---|---|---|
| 1 | 2 | 57 |
| Starting Time: | Ending Time: | |
| 0 | 256 | |



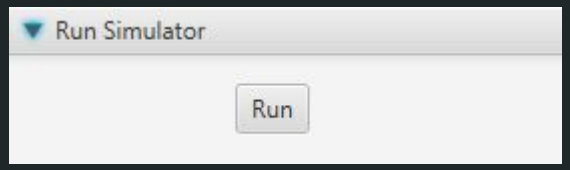



# Running the Simulator

- Output:
  - .csv file

| Second | DropRate |
|---|---|
| 0 | 0 |
| 1 | 0 |
| 2 | 0.005 |
| 3 | 0.01 |
| 4 | 0.01 |
| 5 | 0.015 |
| 6 | 0.015 |
| 7 | 0.025 |
| 8 | 0.04 |
| 9 | 0.055 |
| 10 | 0.06 |
| 11 | 0.075 |
| 12 | 0.085 |
| 13 | 0.12 |
| 14 | 0.125 |
| 15 | 0.13 |
| 16 | 0.135 |
| 17 | 0.14 |
| 18 | 0.15 |
| 19 | 0.165 |
| 20 | 0.2 |
| 21 | 0.23 |
| 22 | 0.235 |
| 23 | 0.255 |

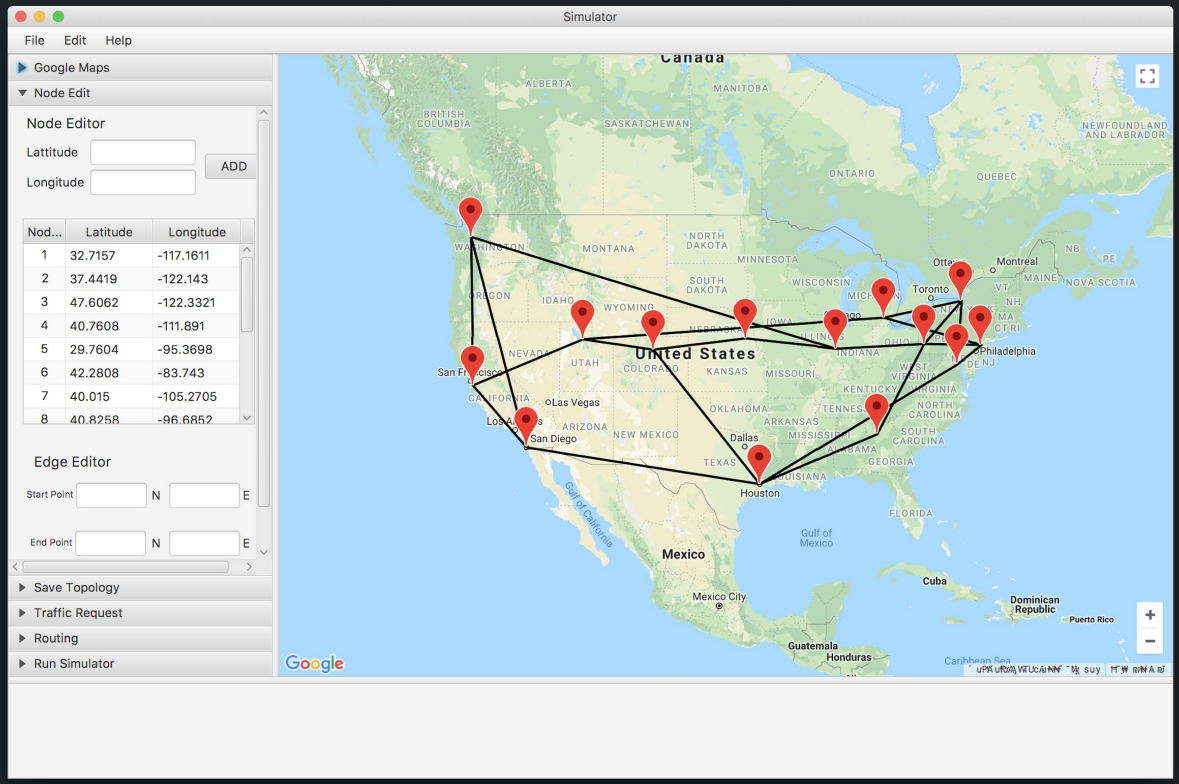
| Second | Utilizatior |
|---|---|
| 0 | 4.714286 |
| 1 | 10.29524 |
| 2 | 13.79048 |
| 3 | 17.76667 |
| 4 | 21.34762 |
| 5 | 24.56667 |
| 6 | 29.95714 |
| 7 | 33.92857 |
| 8 | 38.78095 |
| 9 | 41.60952 |
| 10 | 46.75714 |
| 11 | 51.95714 |
| 12 | 57.4381 |
| 13 | 61.94762 |
| 14 | 63.02381 |
| 15 | 67.82857 |
| 16 | 69.26667 |
| 17 | 73.00476 |
| 18 | 75.68095 |
| 19 | 78.30476 |
| 20 | 79.49048 |
| 21 | 79.22857 |
| 22 | 81.75238 |
| 23 | 83.69524 |




| Max_Banc | Transponc | Bandwidtl | Hops | Drop | Drop% |
|---|---|---|---|---|---|
| 100 | 42386 | 2117258 | 42273 | 6175 | 16 |
| 120 | 43474 | 2171880 | 36293 | 10893 | 28 |
| 140 | 44432 | 2219436 | 32035 | 14367 | 36 |
| 160 | 45488 | 2272523 | 28494 | 17251 | 44 |
| 180 | 46202 | 2307839 | 25718 | 19435 | 49 |
| 200 | 46836 | 2339936 | 23799 | 21063 | 53 |

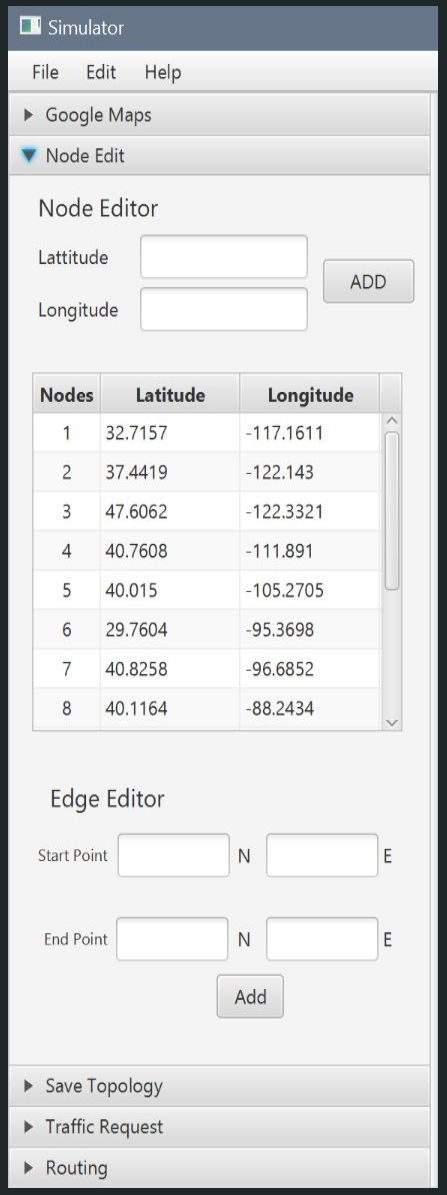
# GMAPSFX

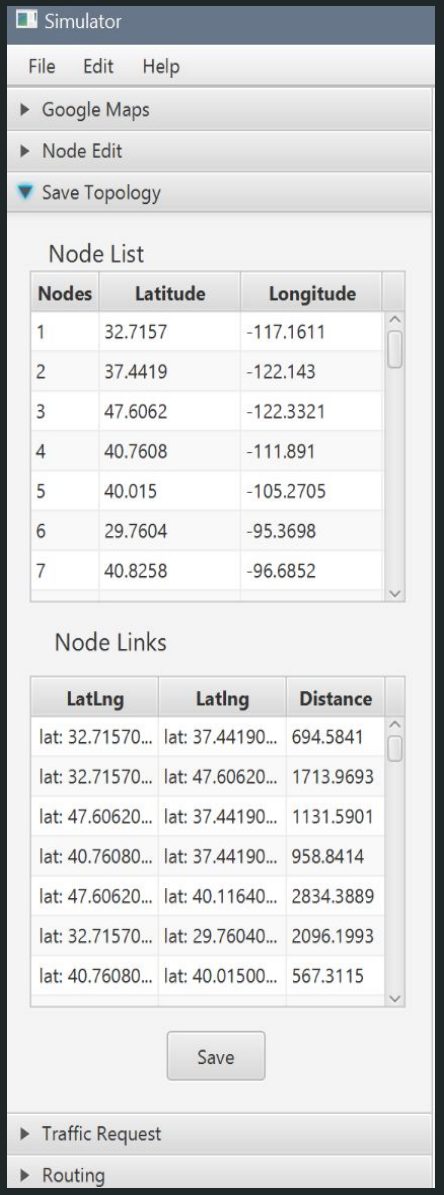
- GmapsFX is the API we are using to show the Google Maps.
- Using NSFNET topology as default
- Use listeners to get user inputs
- Display and save data into files in order to read and write



# Save and Add

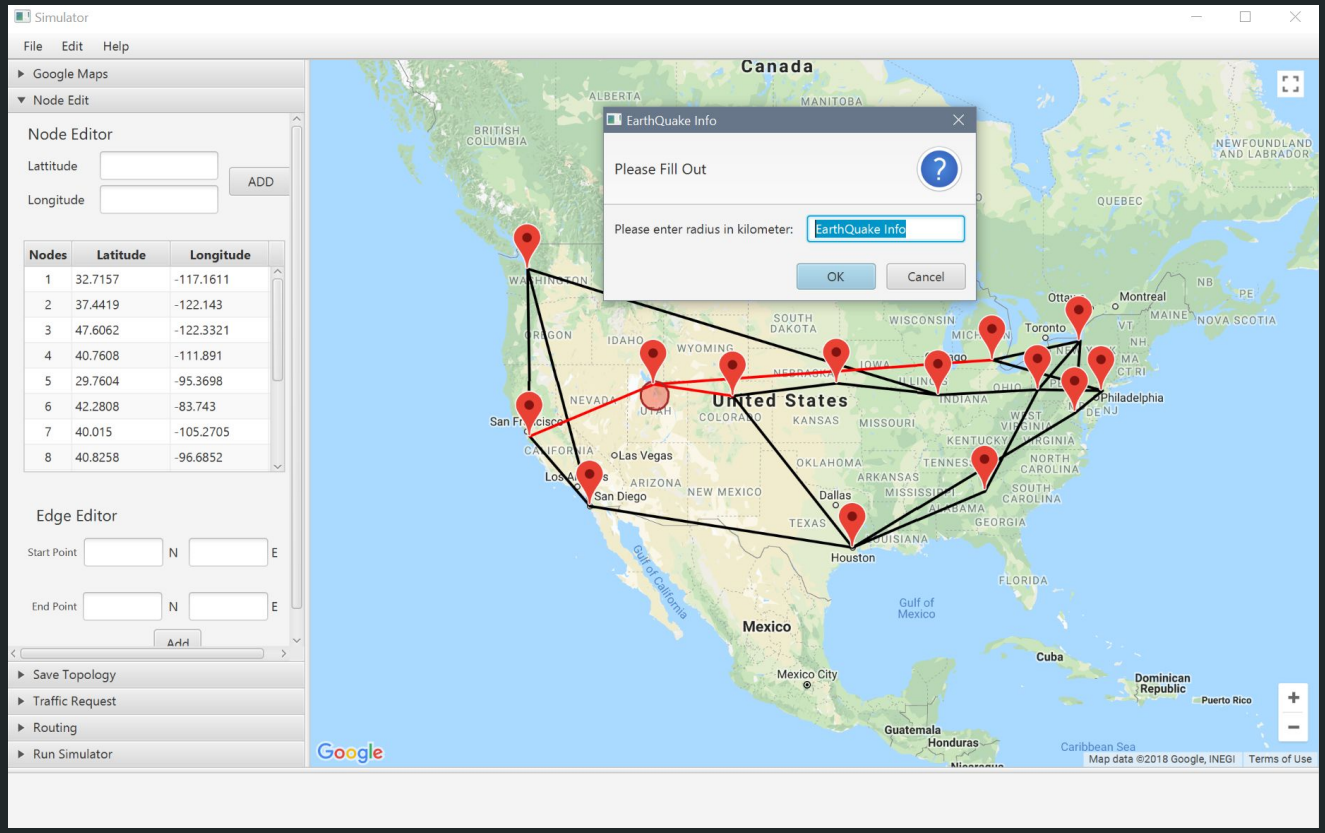
- Using the left side of the window physically display the position of the node on the node edit title pin
    - Can add nodes and links manually
- In the save topology title pin user can see all user inputs and links between nodes



# Earthquake Fault

- Disable links between topology when earthquake hits a topology
- Red links signifies disabled links
- Generates a new temporary topology

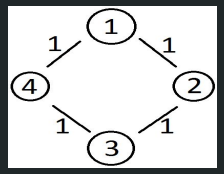


# Demo

# What We Have Accomplished

- Network Simulator: infrastructure & network traffics


- 1. Topology 2. Traffic request method 3.Routing method





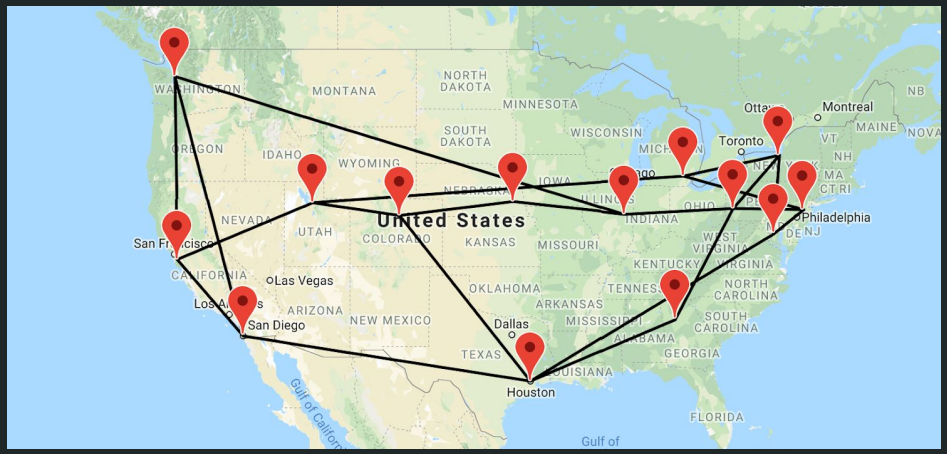
- Routing algorithm:

SPF LUF MUF OPT MUX Hybrid

- Dynamic Simulator: more real world scenario simulations

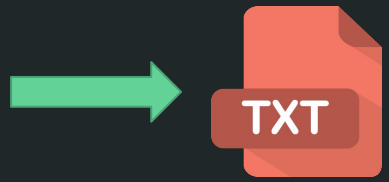
  1. Time interval  2. Request count  3. Max bandwidth

- GUI and GMap




- Text I/O

| Nod... | Latitude | Longitude |
|---|---|---|
| 1 | 32.7157 | -117.1611 |
| 2 | 37.4419 | -122.143 |
| 3 | 47.6062 | -122.3321 |
| 4 | 40.7608 | -111.891 |
| 5 | 29.7604 | -95.3698 |
| 6 | 42.2808 | -83.743 |
| 7 | 40.015 | -105.2705 |
| 8 | 40.8258 | -96.6852 |




| Nod... | Latitude | Longitude |
|---|---|---|
| 1 | 32.7157 | -117.1611 |
| 2 | | 143 |
| 3 | | 3321 |
| 4 | | 391 |
| 5 | | 3698 |
| 6 | | 43 |
| 7 | | 2705 |
| 8 | 40.8258 | -96.6852 |

# Future Plans

- Apply earthquake analysis to generate earthquake events in simulator
- Survivability of each routing method after earthquake
  - Primary/backup route

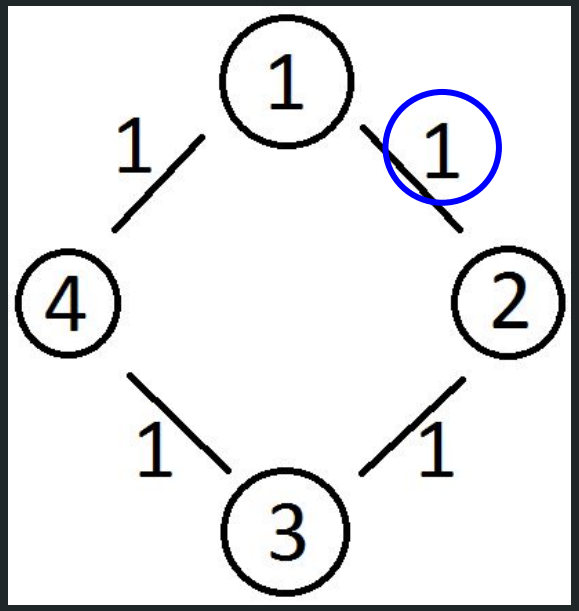
# Thank You

Any questions?

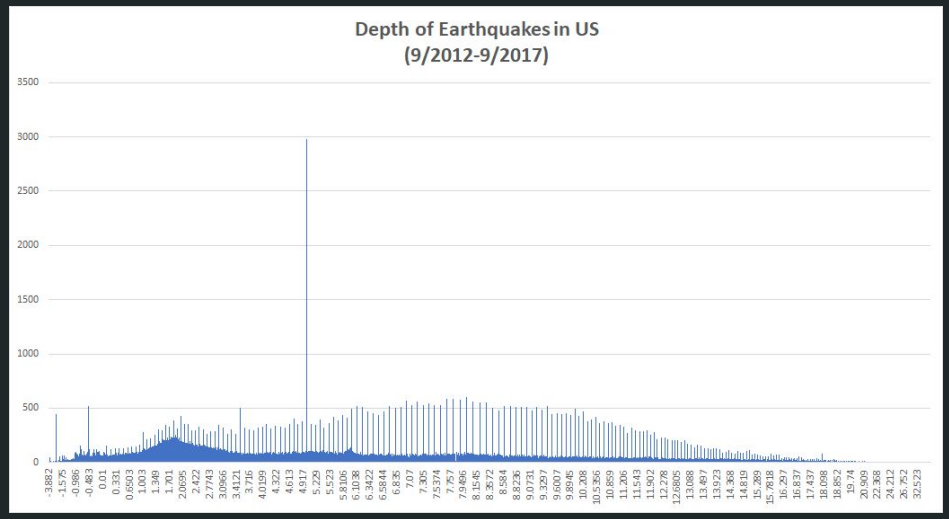
# Topology

- Adjacency matrix

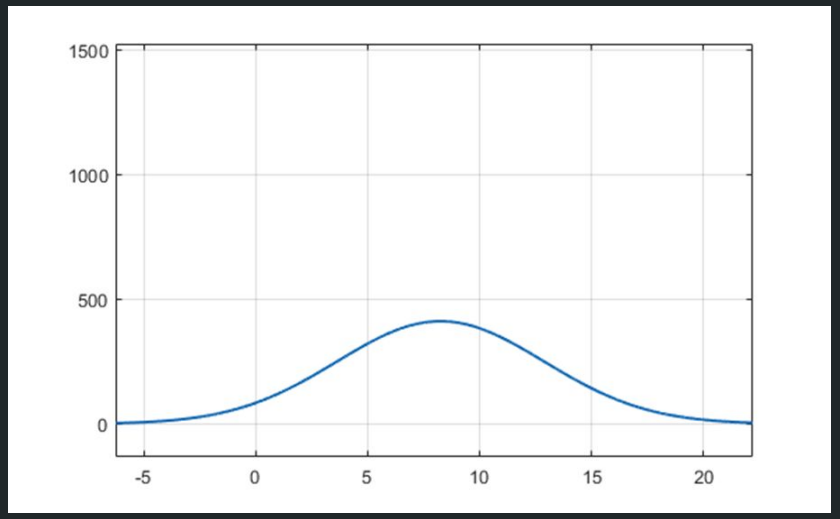
| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | 0 | 1 | 0 | 1 |
| 2 | 1 | 0 | 1 | 0 |
| 3 | 0 | 1 | 0 | 1 |
| 4 | 1 | 0 | 1 | 0 |



# Earthquake Analysis



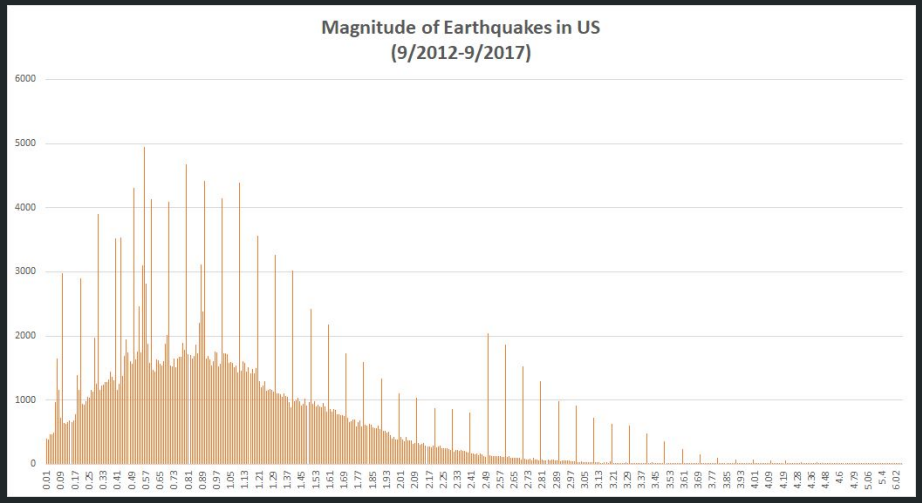

Distribution



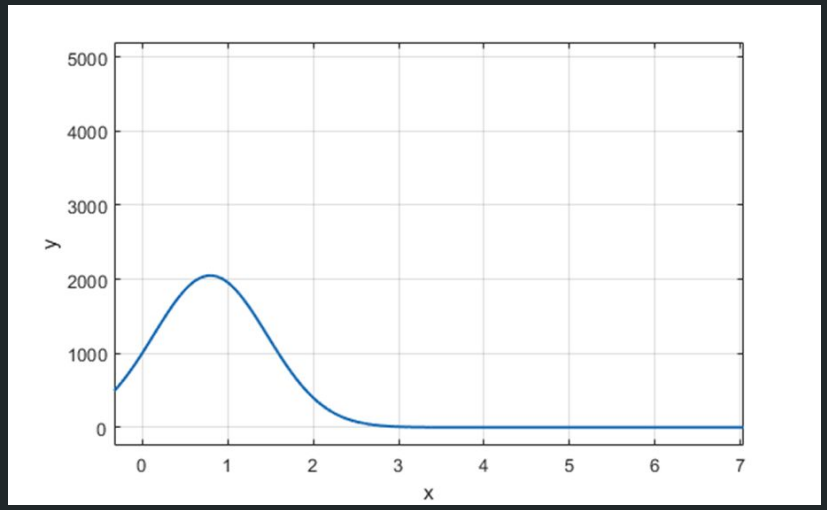

Interest Distribution

Depth

# Earthquake Analysis



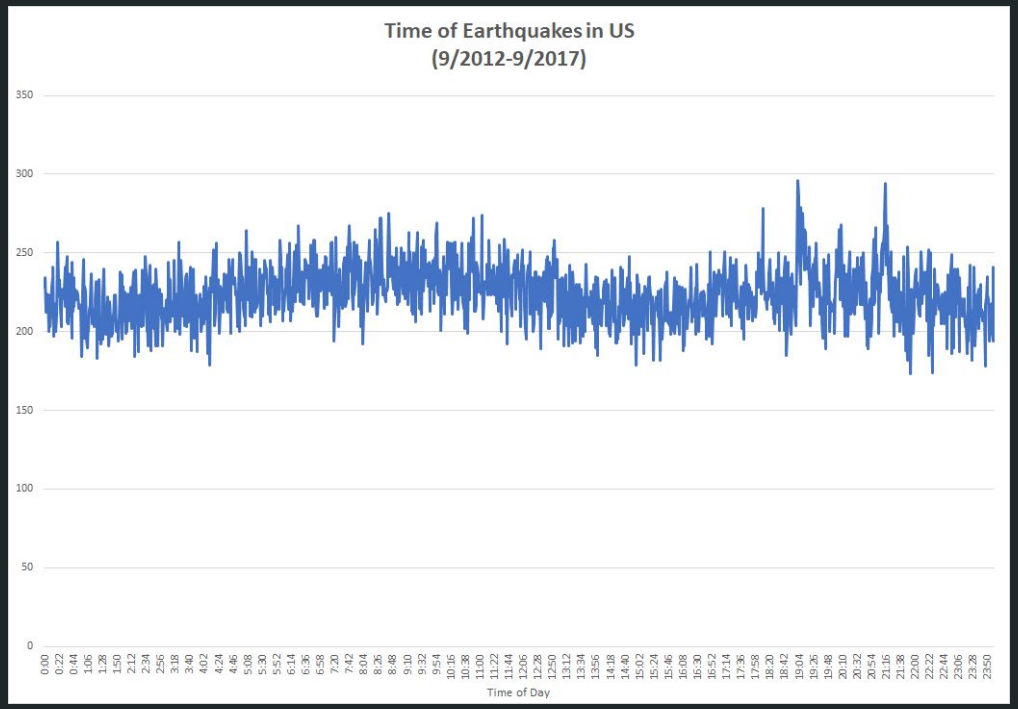

Distribution




Interest Distribution

Magnitude

# Earthquake Analysis




Time

Distribution