



Domestic Airline Analysis

Team Rocket
Consulting



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Agenda



Background



Project goals



Dataset



Data processing



EDA



Client cases



Recommendations





Background



Airline delays are a logistical and financial problem to passengers, airlines, and governing bodies like the FAA.



Identifying locations and causes of delays



Taking preventative measures and mitigating the risks



Additionally, knowledge of these risks can help travel aggregators plan campaigns based on historical prices



Team Rocket Consulting- Project Goals

1

Perform information analysis for target clients and provide actionable insights:

- Southwest Airlines
- Kayak



2

• Personal Goals:

- Real life, non-Kaggle, raw data
- Large amounts of public data
- Data= \$\$\$
- Database building



Dataset and Cleanup



Data...Data...Data...

Reporting Carrier On-Time Performance



Airline Ticket Fare



Aug 2016 to Aug 2019



35 GB ⇒ 5GB (20 million rows)



Bureau of Transportation

Open**Flights**.org



Southwest®

Database



Consolidate raw data
to yearly dates and
filter certain variables



Consolidate
information into
our database.



Spark SQL

Query for different
projects



Pandas

Merge tables

Analysis



databricks®



+ a b | e a u

Data Analysis



Click The Dashboard

Client Case 1- Kayak



Users on Kayak

Input : Origin, Destination, Month

Destination : AUS

Month : 10

Origin : LAX

 12:59 am – 8:11 am
American Airlines

1 stop
DFW
5h 12m
LAX - AUS

\$147
American Airlines
Basic Economy
[View Deal](#)
Main Cabin \$182

Depart LAX - AUS

5h 12m

Thu, Oct 15  12:59 am – 5:56 am
Los Angeles (LAX) - Dallas (DFW)
American Airlines 1405 · Narrow-body jet · Airbus A321-100/200
Basic Economy: Fare restrictions apply

Change planes in Dallas (DFW) 1h 14m

Thu, Oct 15  7:10 am – 8:11 am
Dallas (DFW) - Austin (AUS)
American Airlines 1176 · Narrow-body jet · Boeing 737-800
Basic Economy: Fare restrictions apply

Delay Information??





Query Database for given route and month...



For each Airline flying that route, obtain :

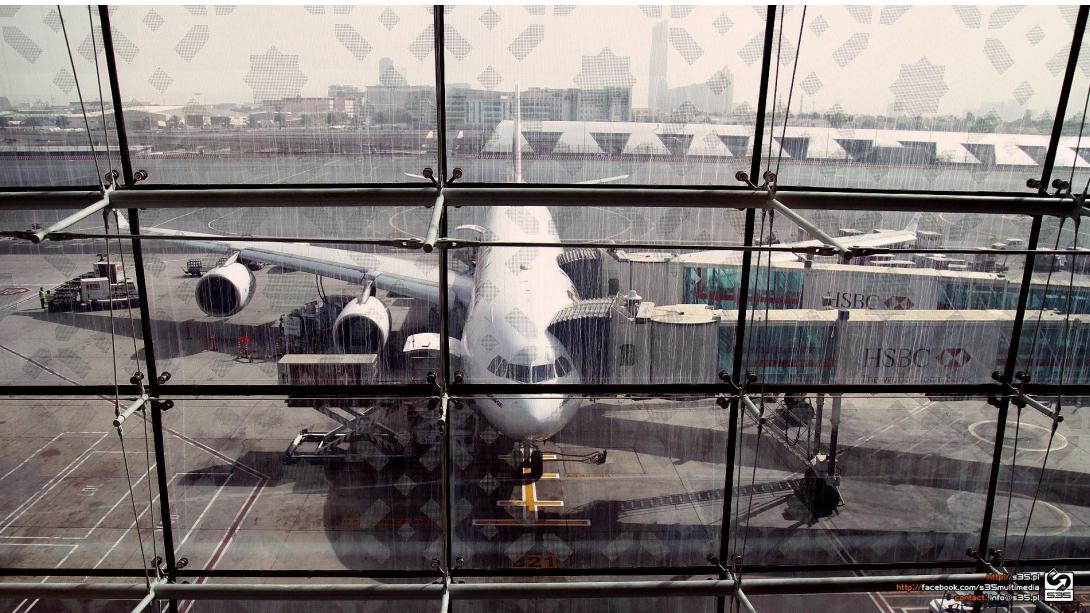
- Number of Flights,
- Number of Cancelled Flights,
- Number of Diverted Flights
- Average Delay for each airline

| | FLIGHTS | CANCELLED | DIVERTED | Total_Delay | DEP_DELAY | ARR_DELAY | WEATHER_DELAY | CARRIER_DELAY | NAS_DELAY | SECURITY_DELAY | LATE_AIRCRAFT_DELAY |
|--|---------|-----------|----------|-------------|-----------|-----------|---------------|---------------|-----------|----------------|---------------------|
|--|---------|-----------|----------|-------------|-----------|-----------|---------------|---------------|-----------|----------------|---------------------|

OP_UNIQUE_CARRIER

| | | | | | | | | | | | |
|------------------------|--------|------|-----|------------|-----------|------------|----------|-----------|-----------|----------|-----------|
| American Airlines Inc. | 2185.0 | 19.0 | 7.0 | 6.458453 | 8.597600 | 3.335340 | 0.053412 | 27.694363 | 5.792285 | 0.160237 | 33.160236 |
| Delta Air Lines Inc. | 1613.0 | 2.0 | 4.0 | 3.046671 | 6.825574 | -2.497822 | 0.251232 | 22.842365 | 7.211823 | 0.000000 | 23.886700 |
| SkyWest Airlines Inc. | 1110.0 | 3.0 | 5.0 | -0.595463 | 3.059621 | -6.058076 | 0.442308 | 31.423077 | 6.259615 | 0.096154 | 25.711538 |
| Southwest Airlines Co. | 1531.0 | 8.0 | 5.0 | 7.413834 | 11.381484 | 1.604743 | 0.000000 | 18.378378 | 3.945946 | 0.000000 | 28.208494 |
| Spirit Air Lines | 122.0 | 1.0 | 0.0 | -3.919008 | -1.231405 | -7.950413 | 0.000000 | 36.666668 | 32.555557 | 0.000000 | 0.000000 |
| United Air Lines Inc. | 20.0 | 0.0 | 0.0 | -14.490001 | -4.950000 | -28.799999 | NaN | NaN | NaN | NaN | NaN |

Average Ticket Price for each Airline for that route

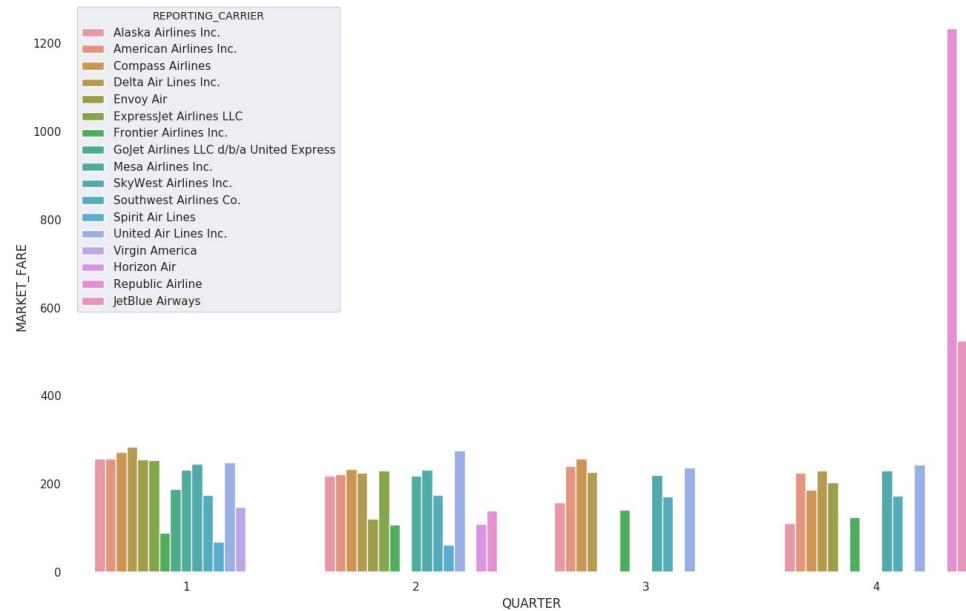
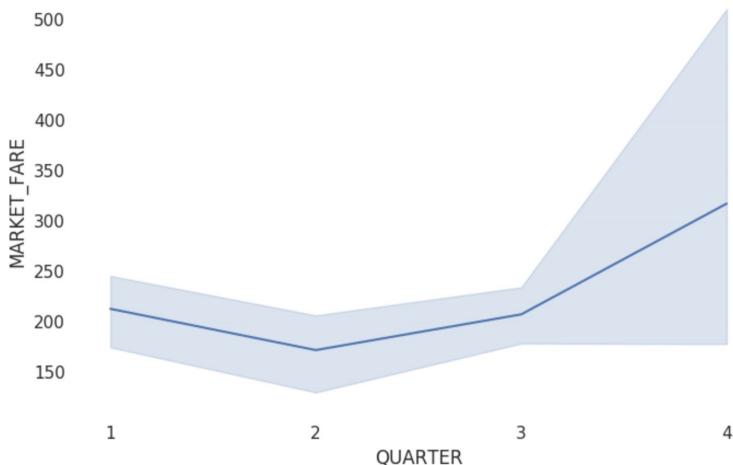


MARKET_FARE

REPORTING_CARRIER

| | |
|--|------------|
| Sun Country Airlines d/b/a MN Airlines | 209.531674 |
| Mesa Airlines Inc. | 223.594167 |
| Horizon Air | 236.396000 |
| Compass Airlines | 277.206126 |
| Alaska Airlines Inc. | 286.391481 |
| Virgin America | 318.929903 |
| Envoy Air | 332.276914 |
| SkyWest Airlines Inc. | 394.439659 |
| ExpressJet Airlines LLC | 419.770000 |
| JetBlue Airways | 437.033788 |
| United Air Lines Inc. | 457.485909 |
| Delta Air Lines Inc. | 529.189439 |
| Republic Airline | 548.013478 |
| Endeavor Air Inc. | 593.866641 |
| American Airlines Inc. | 711.045870 |
| PSA Airlines Inc. | 789.152500 |

Average Market Fare trend for each Airline for a given route



Client Case 2- Southwest





Most Delayed Routes



Motivation: Limited capital (human and financial) means decreasing costs on the most delayed routes creates the largest Return on Investment

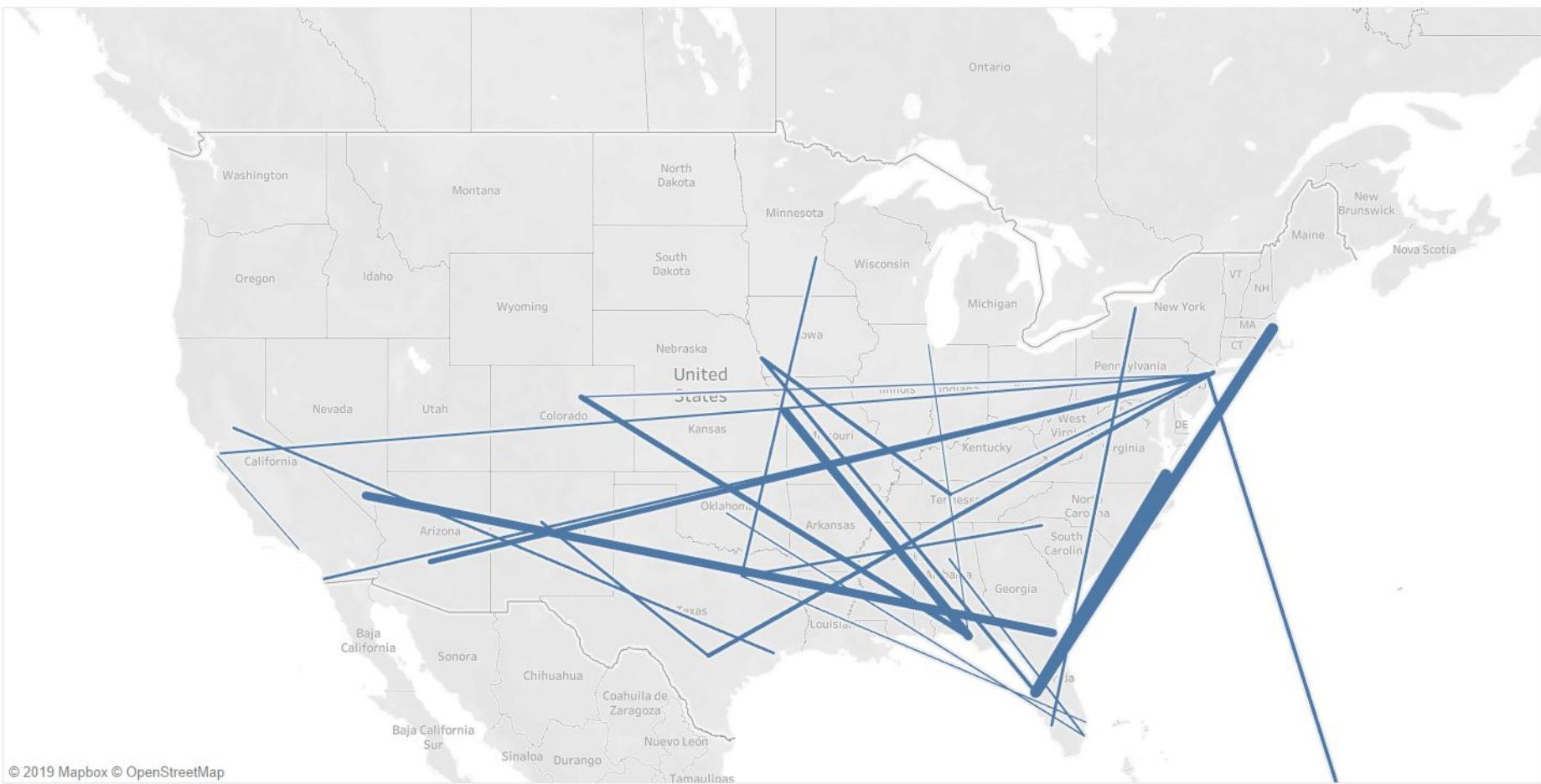


Goal: To display the worst performing routes



Key Performance Metric: Weighted Average Total Delay

SW Self Delayed





Flight Volume Recommendation System



Motivation: There is fierce competition between the 4 major airlines and decreasing market share for another airline is beneficial for our bottom lines

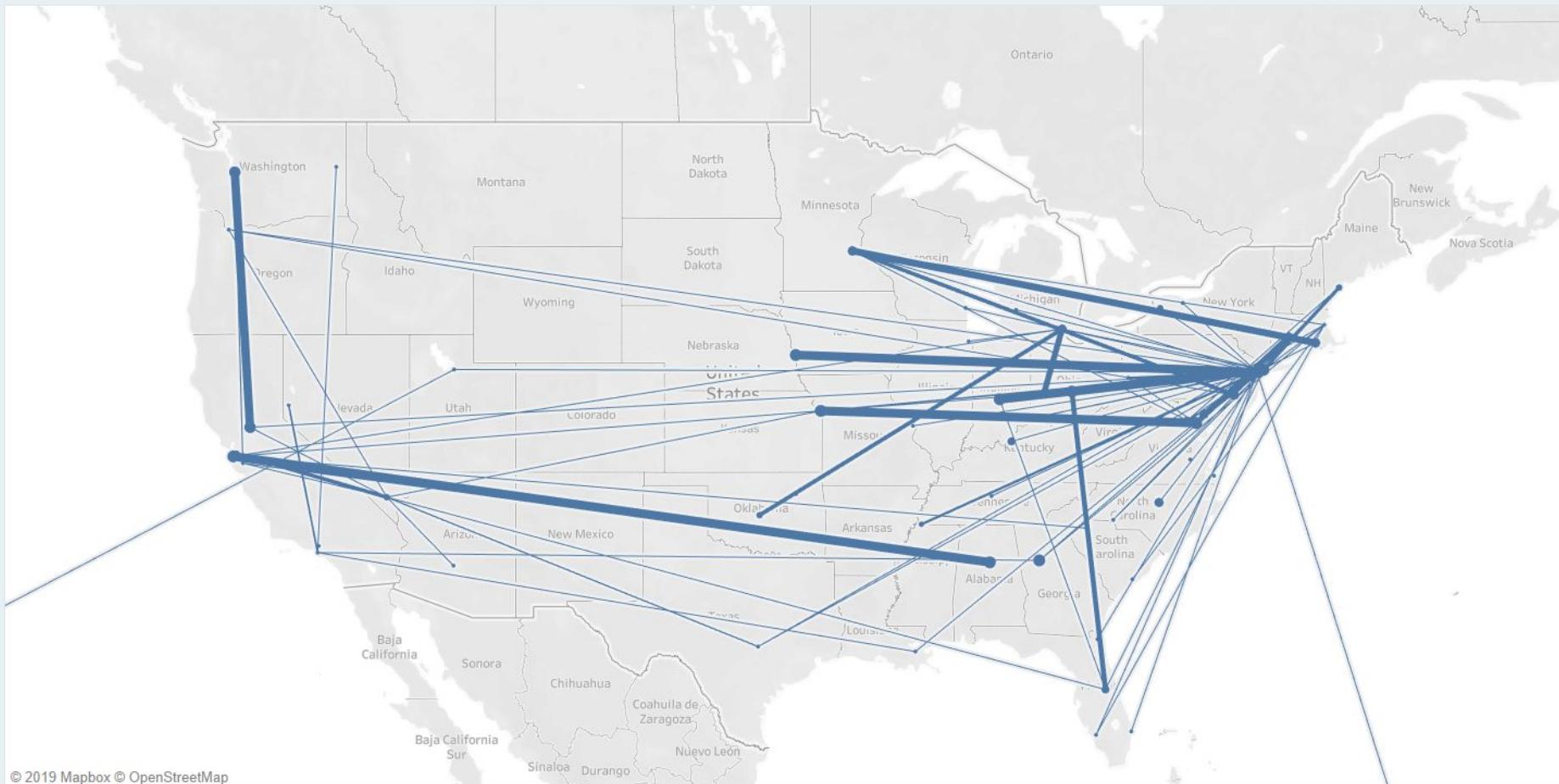


Goal: To find routes where we can potentially decrease competitor market share on a contested route

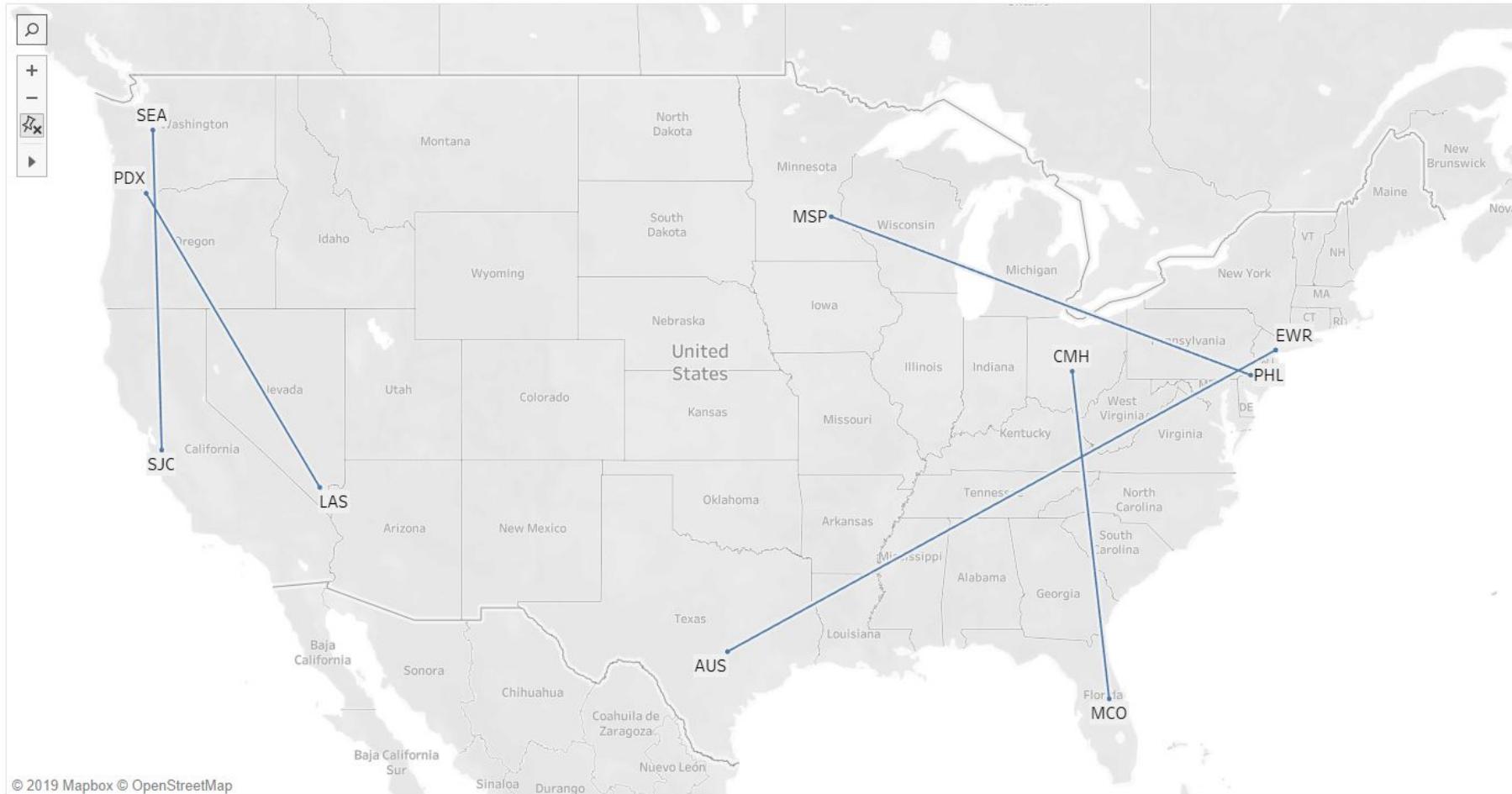


Key Performance Metric - Total Delay per Flight Volume for a Route

Southwest Airlines Competitors Most Delayed Routes

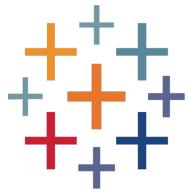


Recommended Increases for Southwest Airlines





Key Takeaways



The KAYAK logo is composed of five orange squares arranged horizontally. The letters "K", "A", "Y", "A", and "K" are written in white in the center of each square. A registered trademark symbol (®) is located at the top right of the "K" square.

The Southwest Airlines logo consists of the word "Southwest" in a bold, blue, sans-serif font. A small yellow heart icon is positioned to the right of the "west" part of the word.



Future Work



Recommend entirely new routes for airlines to increase total market share



Increase routes during Holidays and special events to capitalize on expected increase in demand



Gather data for overbooked flights and tie it with delays and demand to help the route planning team

Southwest®

Any Questions?



Team Rocket's Blasting off Again!!!!

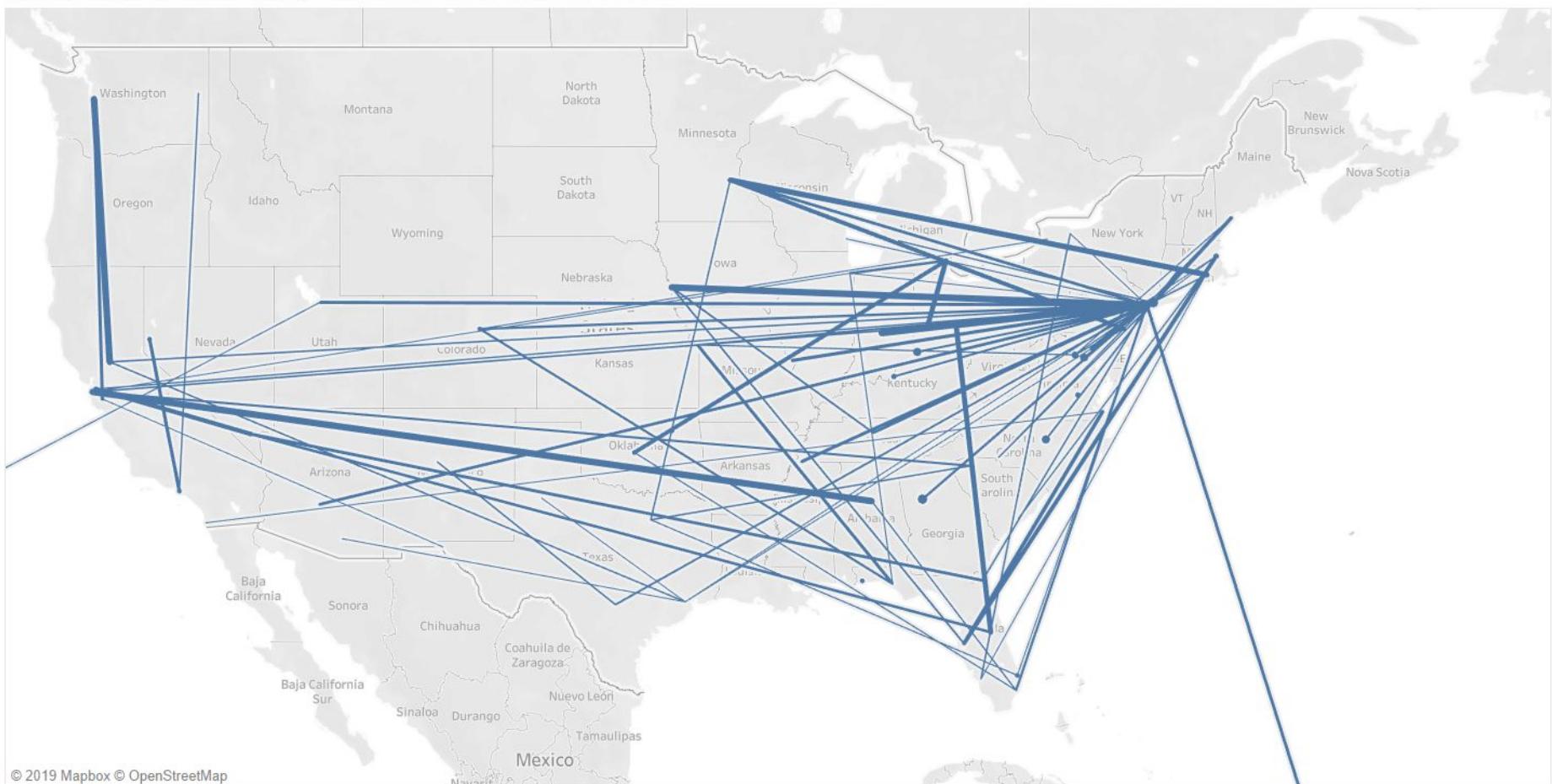


TERRANQUEEN

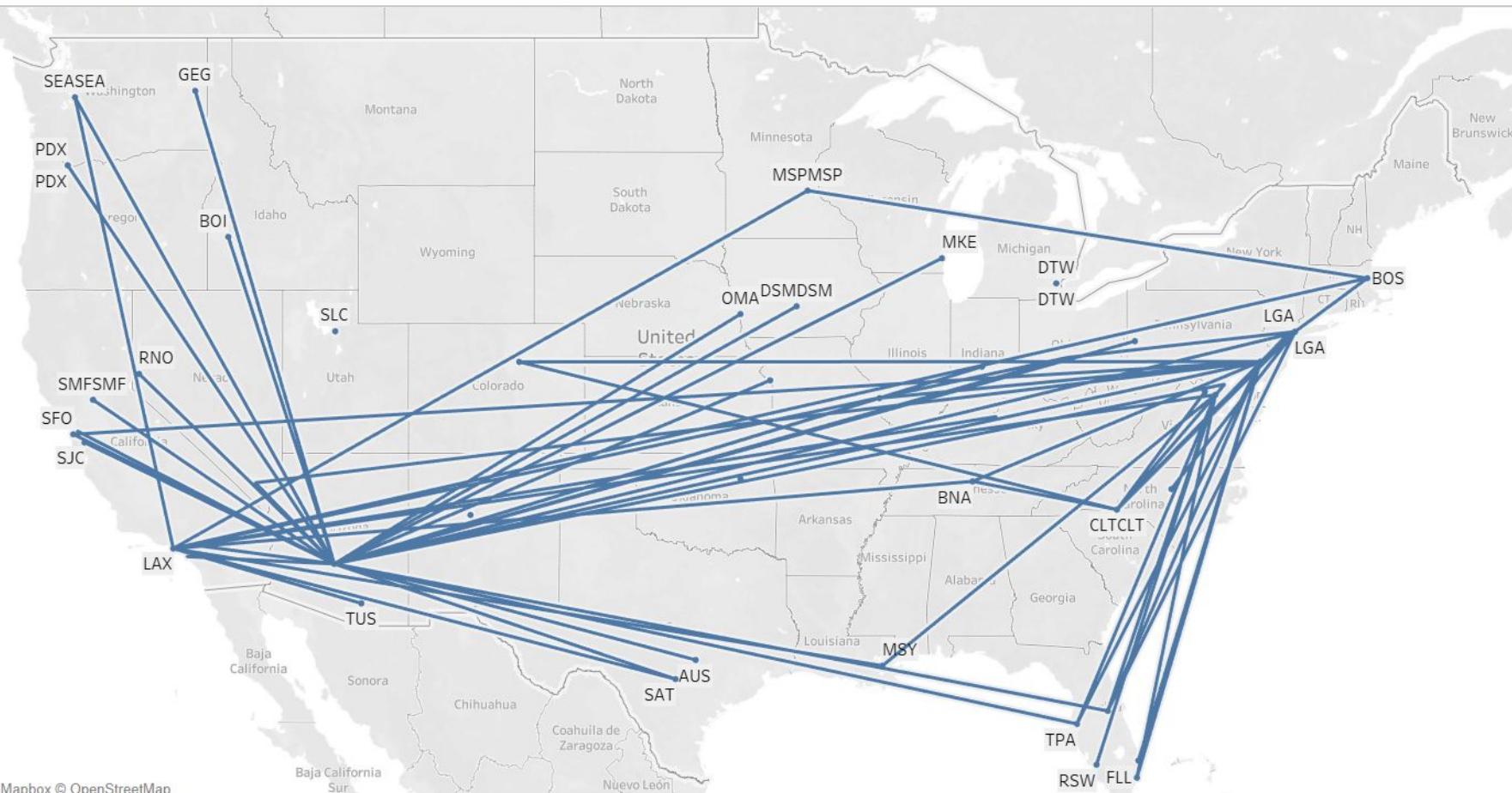


Appendix

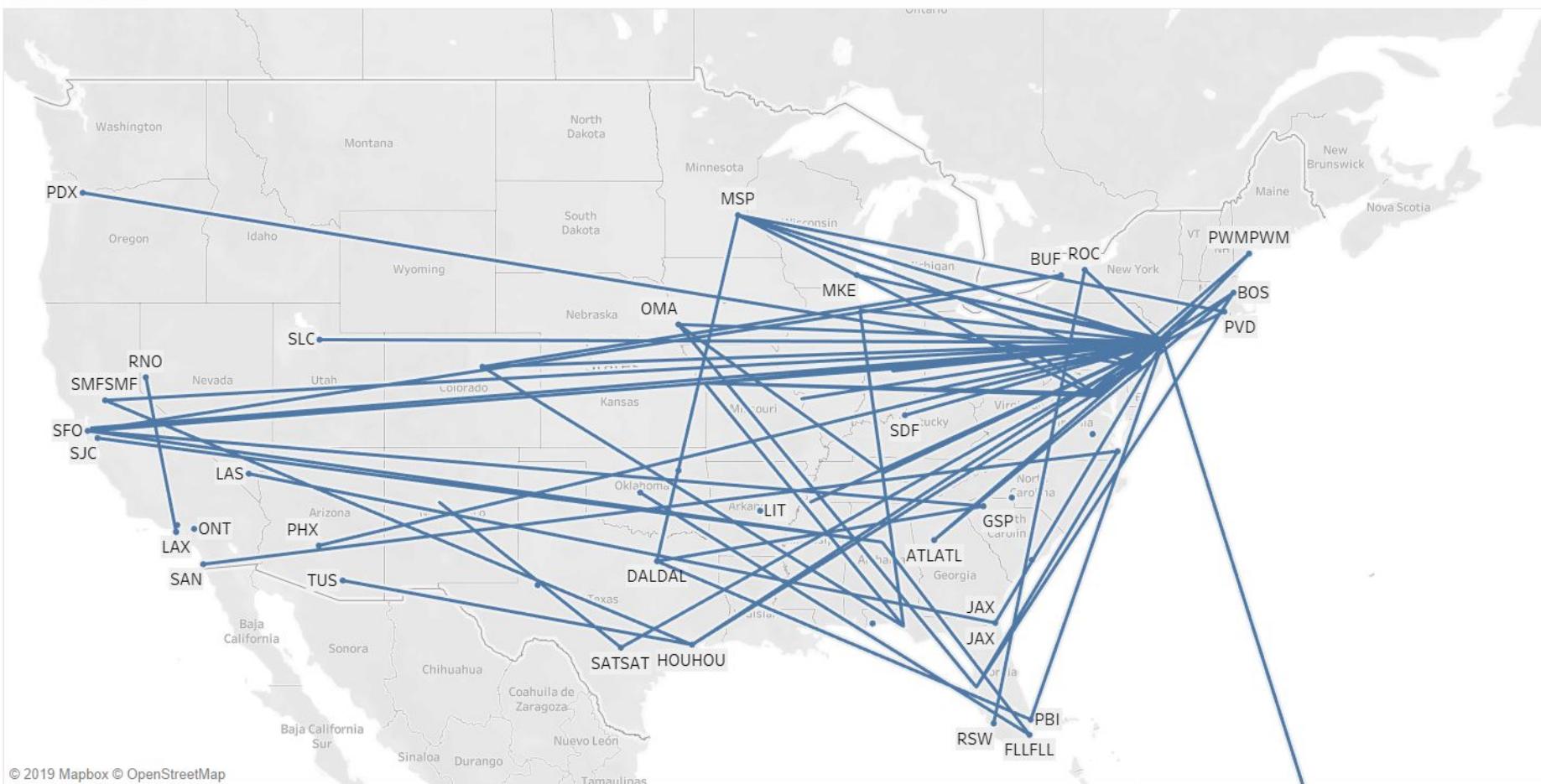
American Airlines Competitors Most Delayed Routes



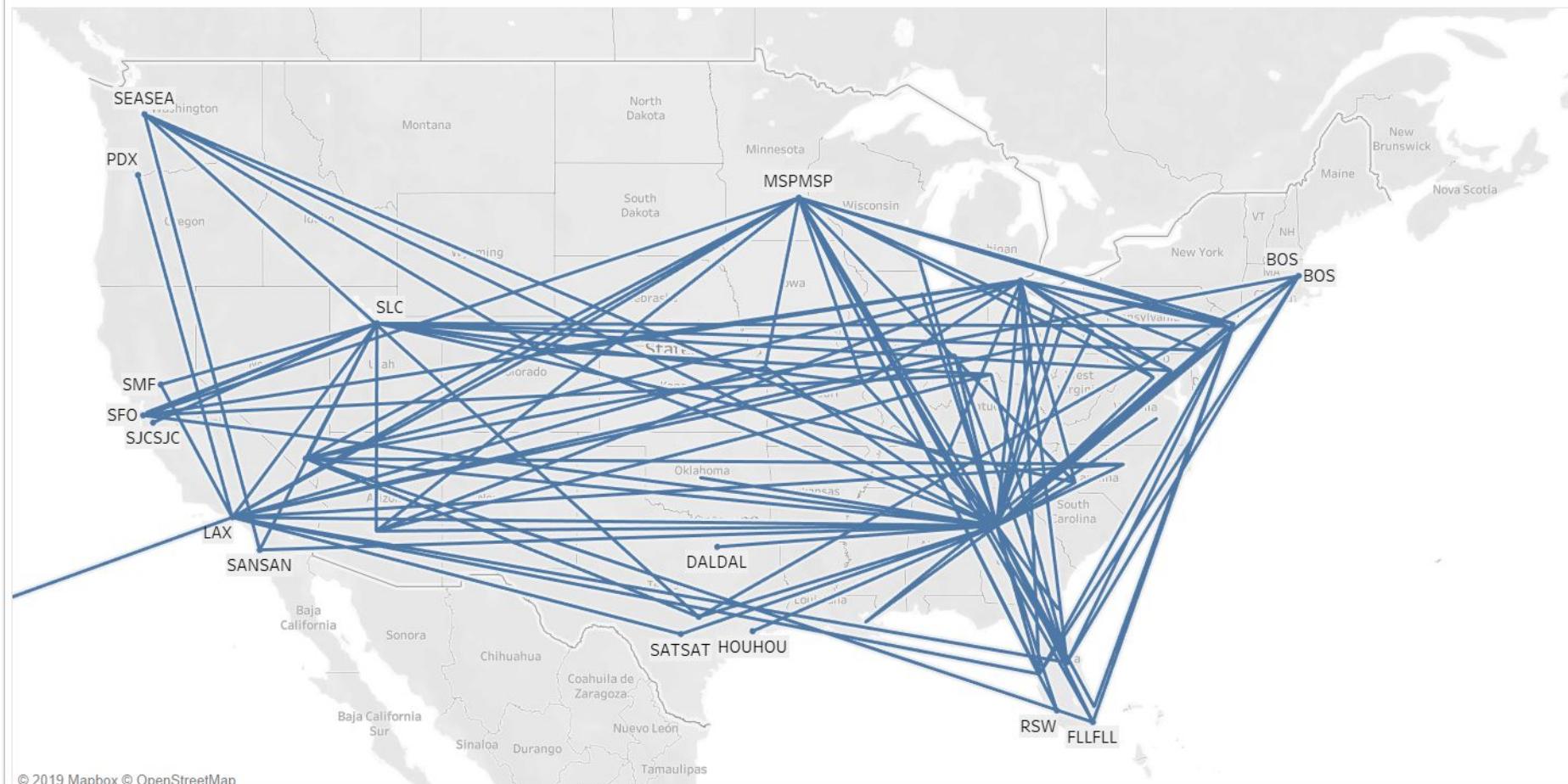
American Airlines Recommended Increased Routes



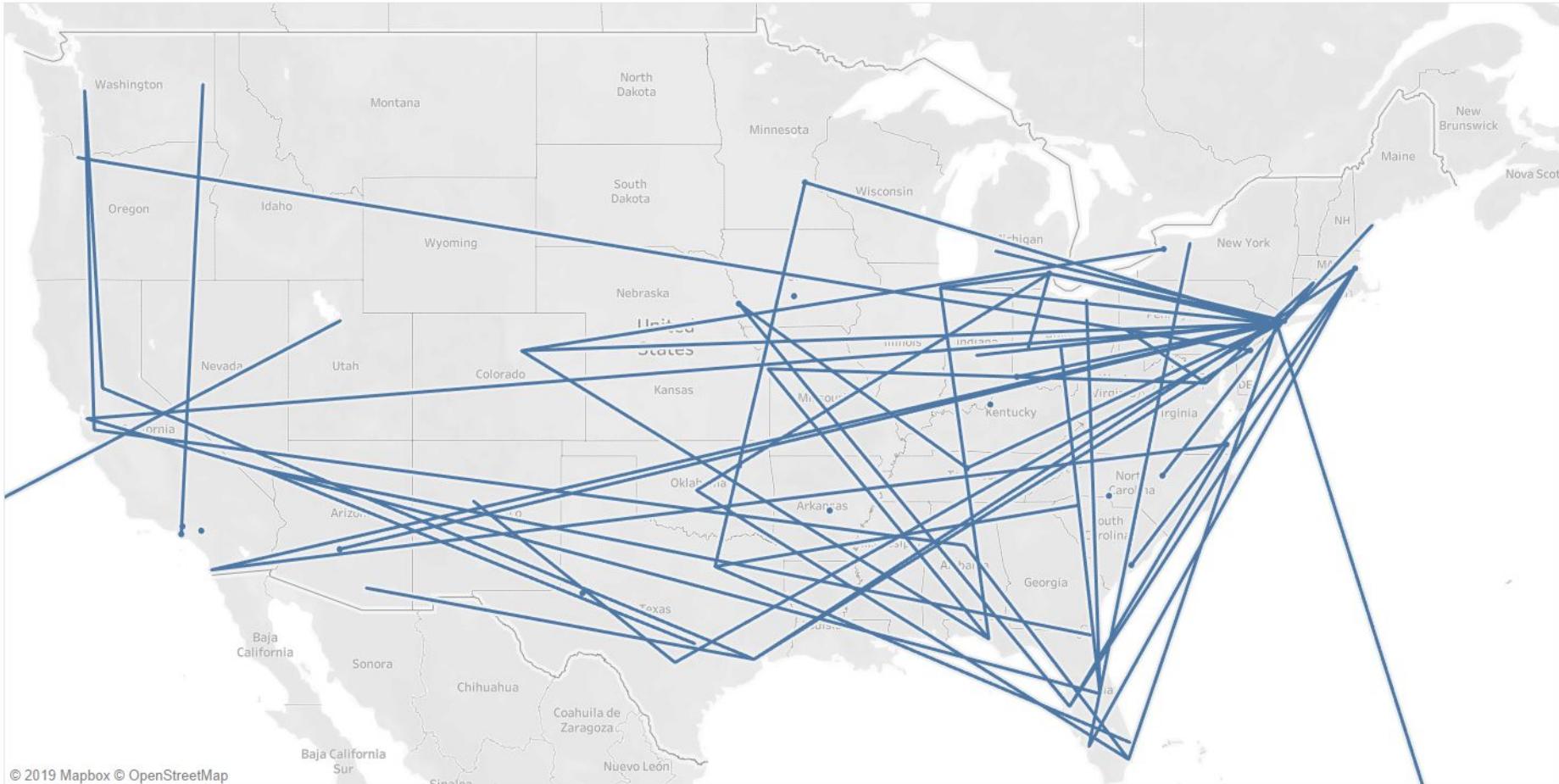
DL Delayed



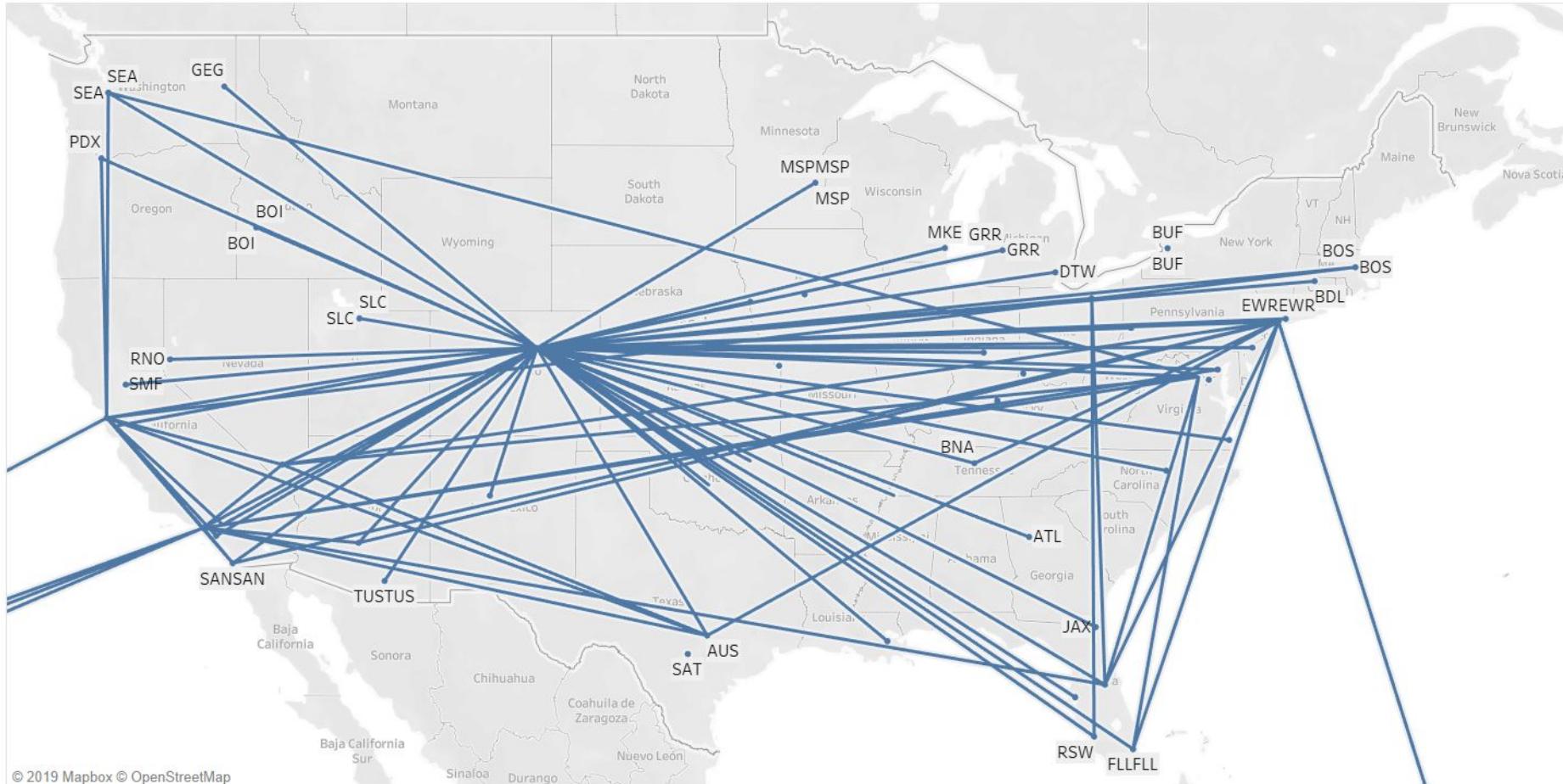
Delta Airlines Recommended Increased Routes



United Airlines Competitors Most Delayed Routes



United Airlines Recommended Increased Routes



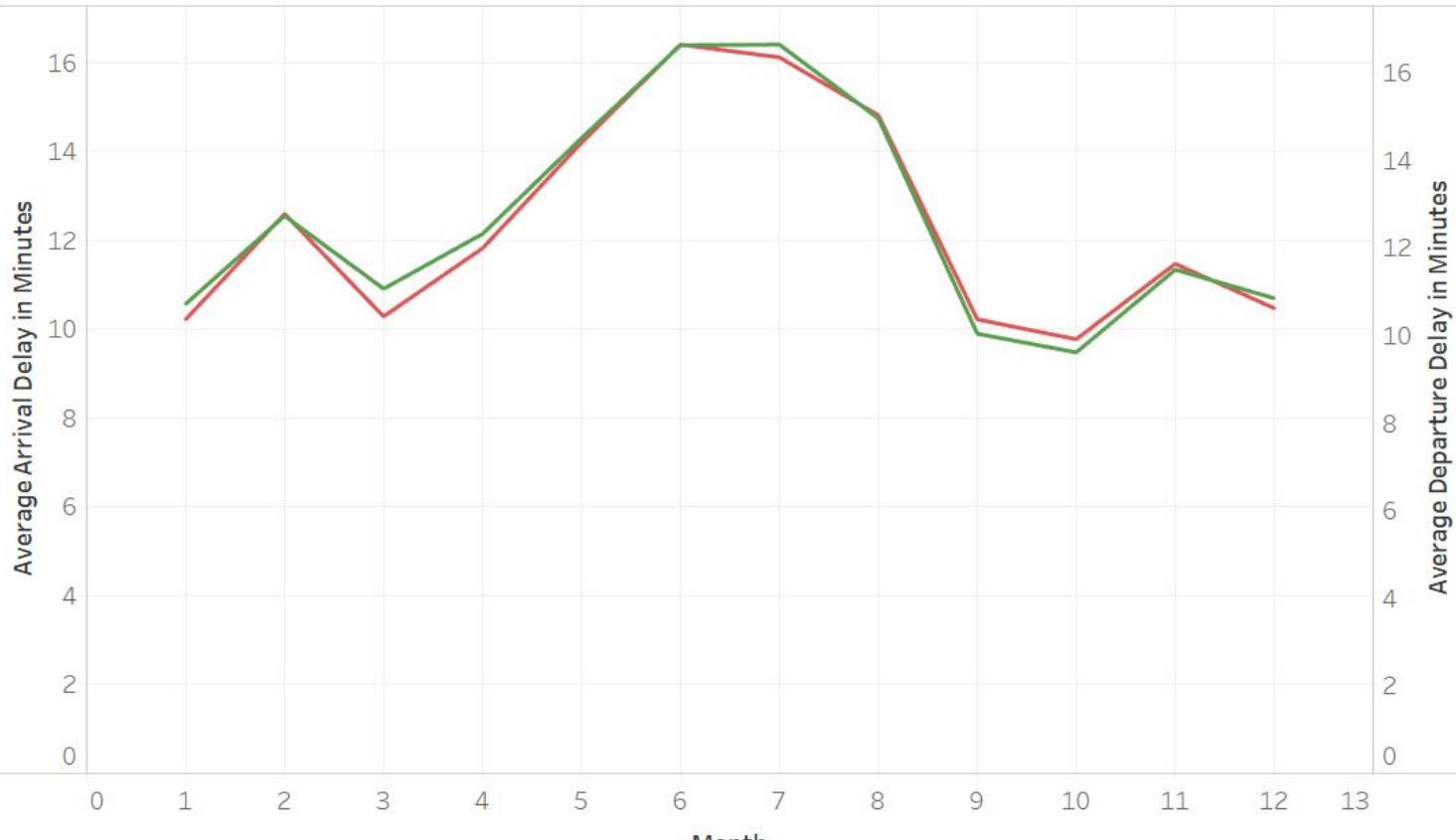
Top 10 Busiest Airports



DEST

- ATL
- DFW
- DEN
- ORD
- LAX
- PHX
- LAS
- CLT
- SFO
- MCO

Average Delay by Month



Measure Names

- Avg Arrival Delay
- Avg Departure Delay

Delay due to Airlines

