San Francisco Fire Department Response Times

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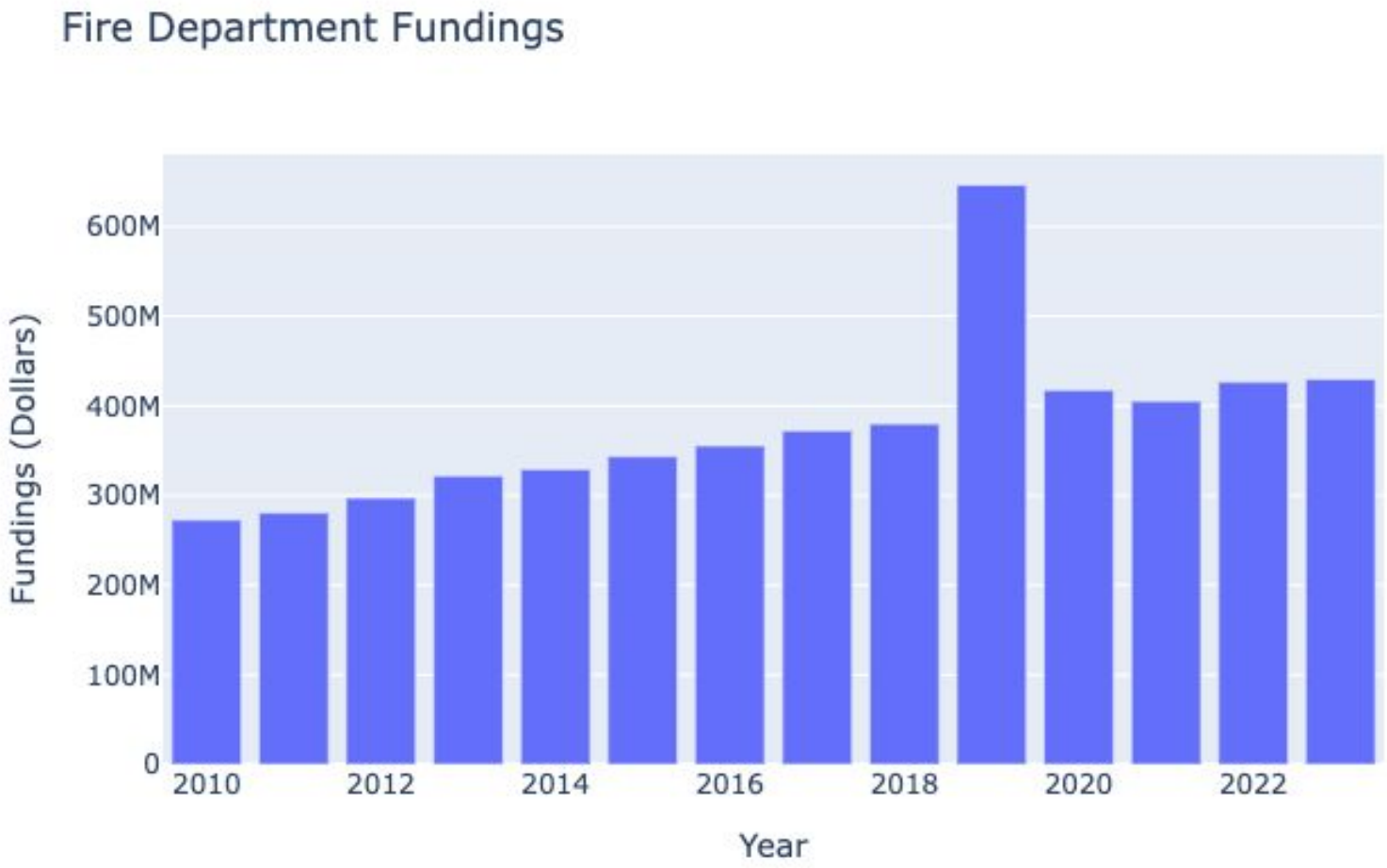
Data Description

Fire_Department_Calls_for_Service.csv: Data describing SF Fire Department calls for service

Budget.csv: data describing SF municipal budget breakdown

SF Yearly Budget Plot

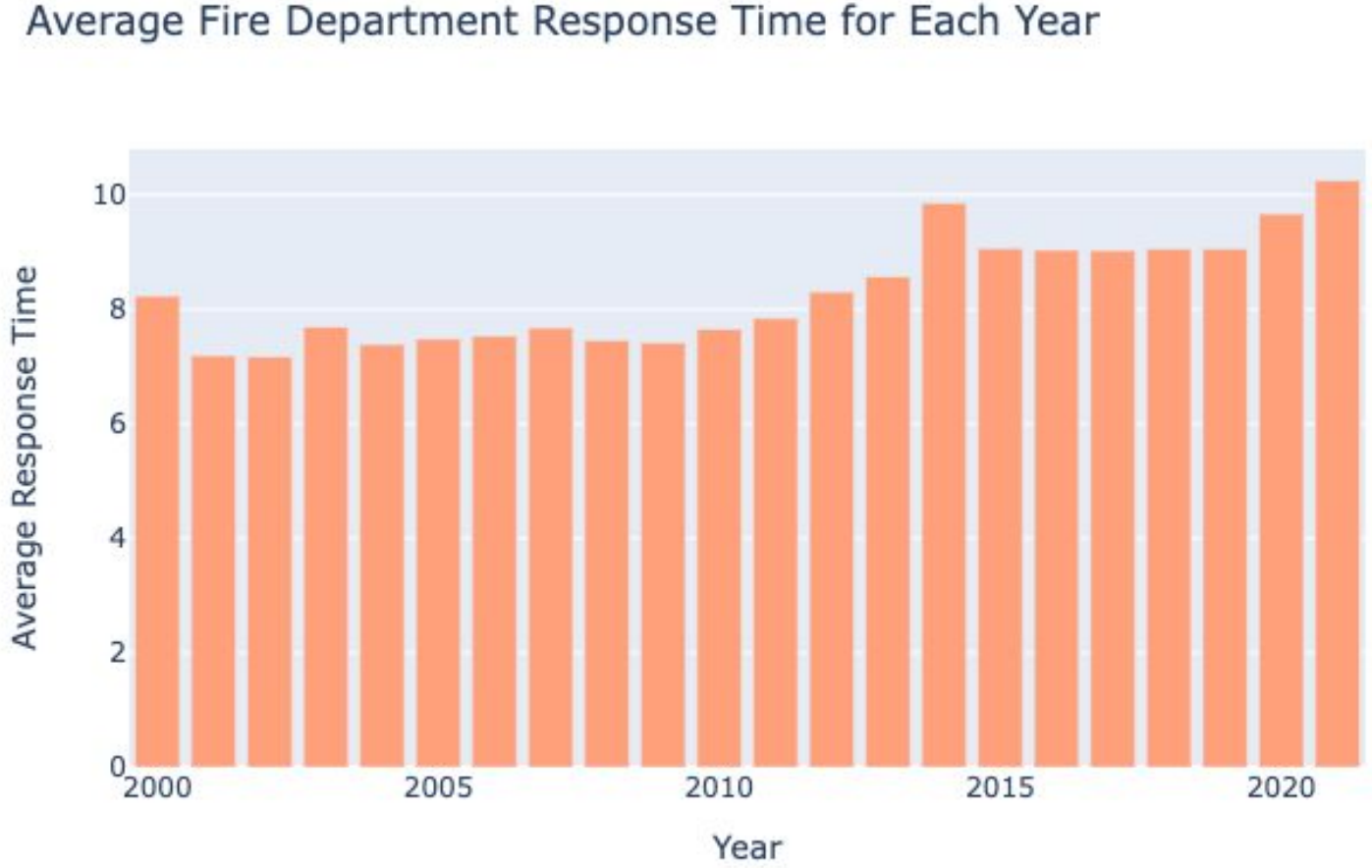
We filtered the data by spending associated with the fire department, then calculated the total spending budget for the fire department for each year between 2010 and 2023.


Fire Department Fundings
Fundings (Dollars)
600M
500M
400M
300M
200M
100M
0
2010
2012
2014
2016
2018
2020
2022
Year

Yearly Average Fire Department Response Time

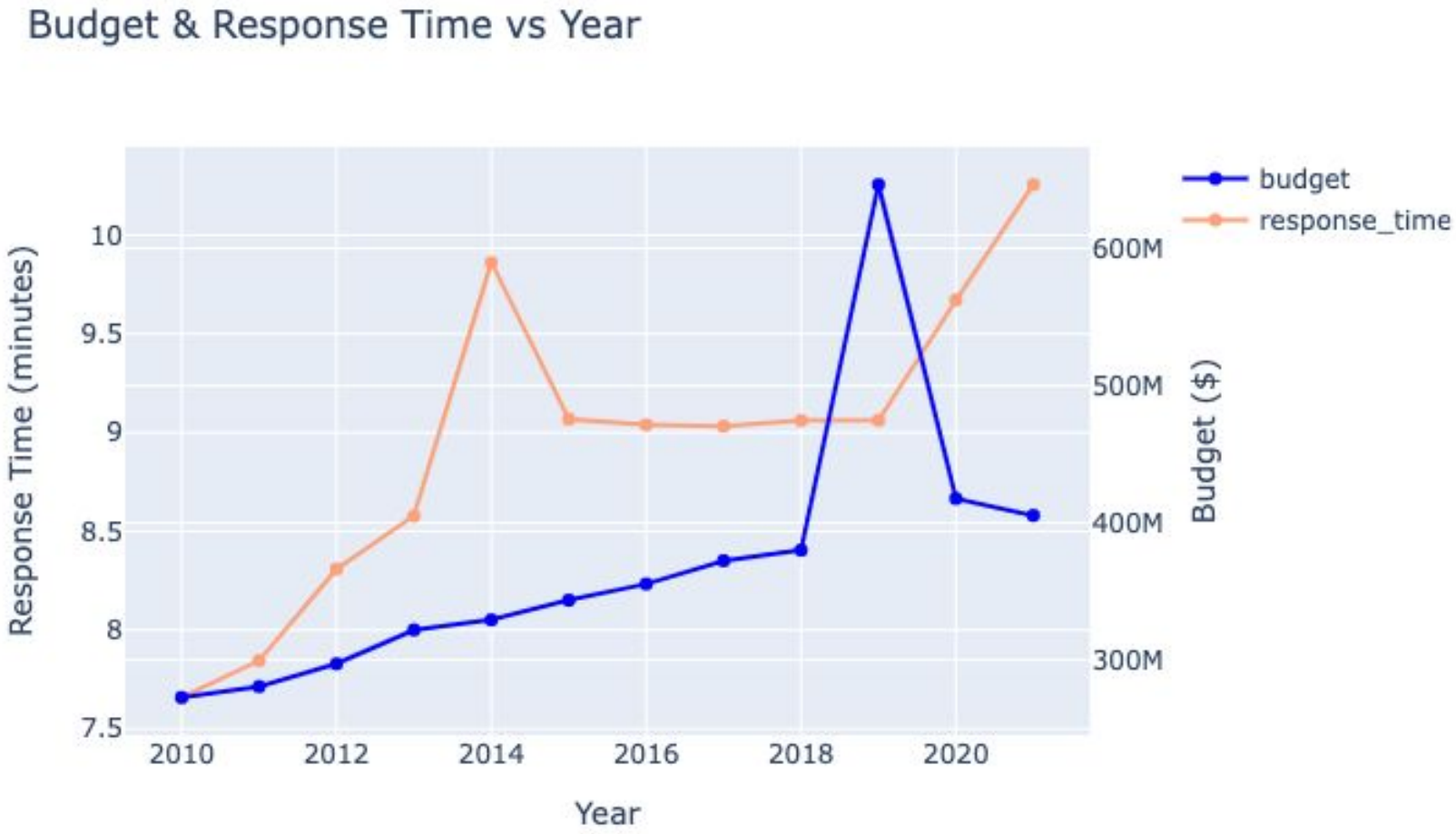
We calculated the average response time for the SF fire department for each year ranging from 2000 to 2021.

To do so we calculate the difference between the timestamp of when the emergency call was made and the timestamp of when the fire department reached the scene.


Average Fire Department Response Time for Each Year
Average Response Time
0
2
4
6
8
10
2000
2005
2010
2015
2020
Year

Budget and Response Time vs Year

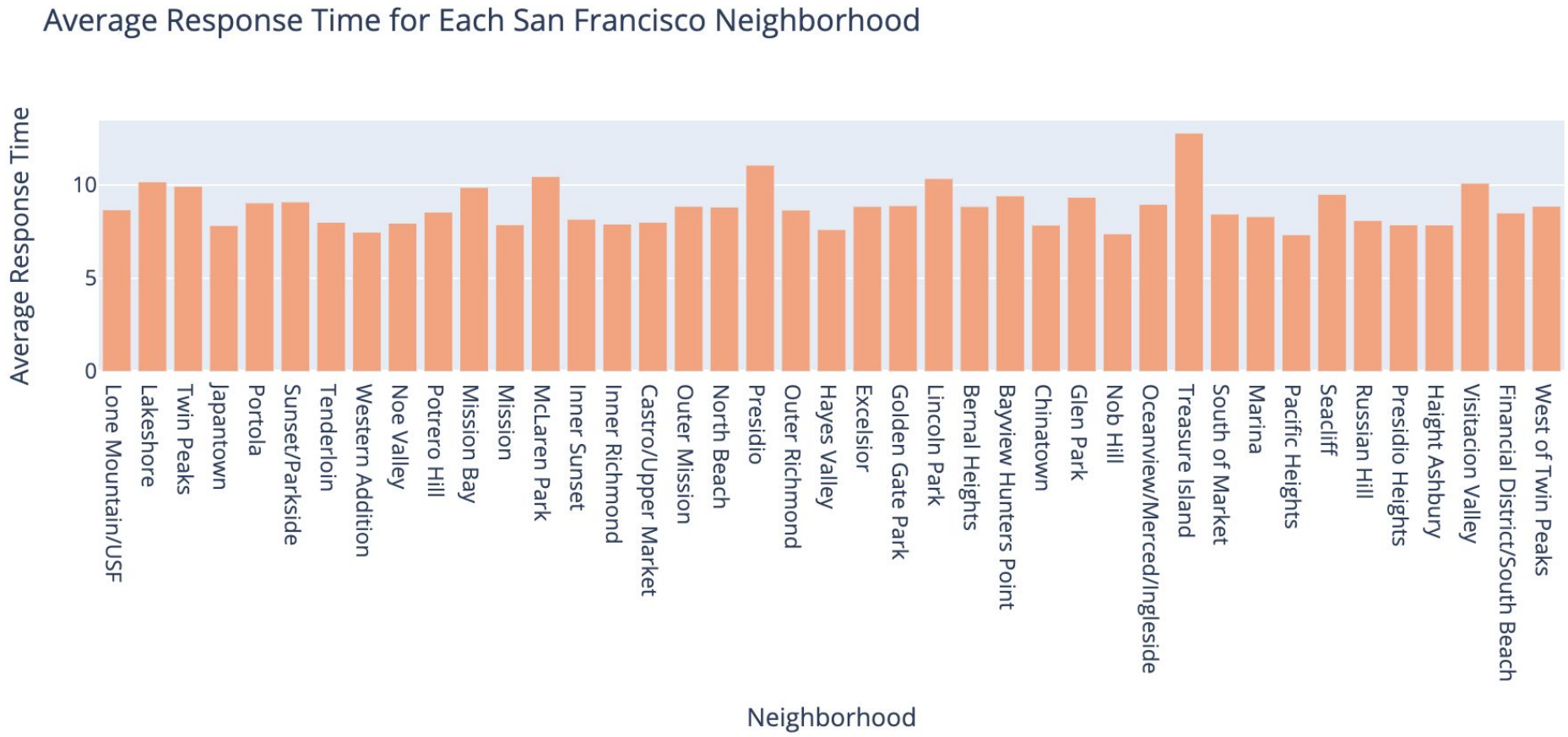
We combined the budget and response time graphs to check and see if budget had an impact on response time.


Budget & Response Time vs Year
Response Time (minutes)
10
9.5
9
8.5
8
7.5
2010
2012
2014
2016
2018
2020
Year
600M
500M
400M
300M
Budget ($)
budget
response_time

Average Response Time by Neighborhood

We calculated the average response time for the SF fire department for each neighborhood.

To do so we calculate the difference between the timestamp of when the emergency call was made and the timestamp of when the fire department reached the scene.

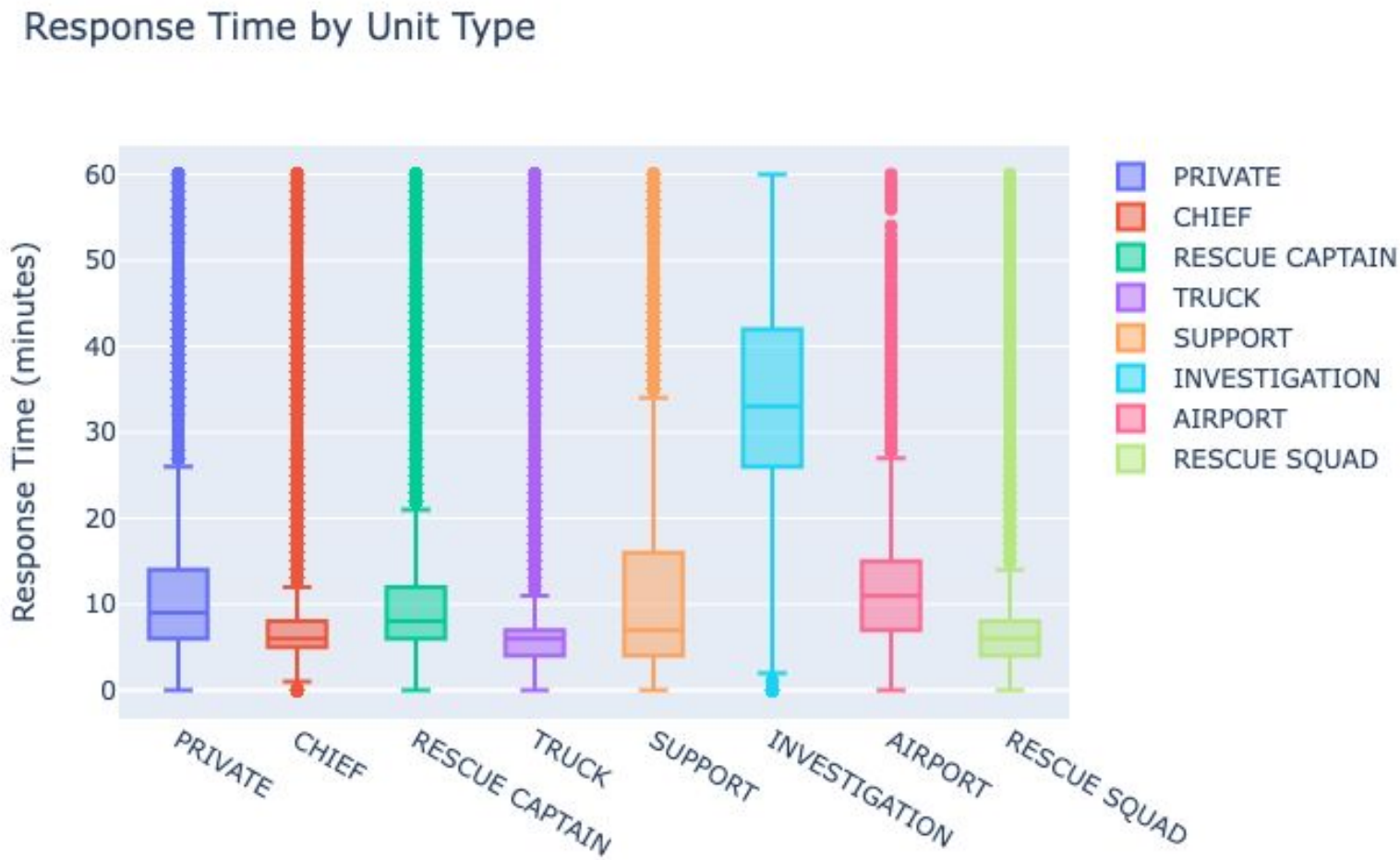

Average Response Time for Each San Francisco Neighborhood
Average Response Time
0
5
10
Lone Mountain/USF
Lakeshore
Twin Peaks
Japantown
Portola
Sunset/Parkside
Tenderloin
Western Addition
Noe Valley
Potrero Hill
Mission Bay
Mission
McLaren Park
Inner Sunset
Inner Richmond
Castro/Upper Market
Outer Mission
North Beach
Presidio
Outer Richmond
Hayes Valley
Excelsior
Golden Gate Park
Lincoln Park
Bernal Heights
Bayview Hunters Point
Chinatown
Glen Park
Nob Hill
Oceanview/Merced/Ingleside
Treasure Island
South of Market
Marina
Pacific Heights
Seacliff
Russian Hill
Presidio Heights
Haight Ashbury
Visitacion Valley
Financial District/South Beach
West of Twin Peaks
Neighborhood

Distribution of Response Time for each Unit Type

We calculated the distribution of response times for the SF fire department for each unit type to try and determine if there were any differences.

We took out outliers that had response times over 60 minutes (about 0.002% of data). We also took out the Engine and Medic unit types from this graph to improve runtime efficiency.

To calculate response time the difference between the timestamp of when the emergency call was made and the timestamp of when the fire department reached the scene.


Response Time by Unit Type
Response Time (minutes)
0
10
20
30
40
50
60
PRIVATE
CHIEF
RESCUE CAPTAIN
TRUCK
SUPPORT
INVESTIGATION
AIRPORT
RESCUE SQUAD
PRIVATE
CHIEF
RESCUE CAPTAIN
TRUCK
SUPPORT
INVESTIGATION
AIRPORT
RESCUE SQUAD

Memory Efficiency

We used rdd caching to improve efficiency of RDDs being used in multiple places, decreasing time spent running those RDDs by amounts ranging from 700% (budget dataset) to 2200% (fire response dataset).

We ran the notebook using 2GB, 4GB, and 8GB of executor memory and found our code respectively ran in 417s, 343s and 322s.

Final Cluster Setting and Execution Time

```
%%configure -f
{
    "conf": {
        "spark.pyspark.python": "python3",
        "spark.pyspark.virtualenv.enabled": "true",
        "spark.pyspark.virtualenv.type": "native",
        "spark.pyspark.virtualenv.bin.path": "/usr/bin/virtualenv",
        "spark.executor.heartbeatInterval": "10800s",
        "spark.network.timeout": "24h",
        "spark.driver.memory": "1G",
        "spark.executor.memory": "8G",
        "spark.executor.cores": "4",
        "spark.app.name": "msds694",
        "driverSize": "2G"
    }
}
```

Final run-time (s):

322.4442141056061

Lessons Learned

Budget does not seem to have an impact on response time.

Some neighborhoods have faster response times than others

Some unit types have faster response times than others.

Increasing executor memory decreased the amount of time it took to run.