ACME GOURMET MEALS

Tech Stack Modernization

W205 -
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Introduction

- Recommend using BART system for deliveries to decongest traffic.
- Delivery trucks / robots to run local routes from each train station.
- New tech stacks to handle these business process upgrades - Neo4j, Redis, MongoDB

MongoDB

- Document based scalable storage mechanism for unstructured data
- JSON format – existing web applications can access data without the need for additional data translation methods.
- faster access and display of data over traditional RDBMS
- Rail operators tend to use document schedule formats
    - collaboration with the BART system to receive and utilize BART timetables and transportation routes City transit trains change daily schedules often, increasing cars for seasonal traffic or changing routes based on accidents and planned track maintenance.

- MongoDB would be an ideal medium to store planned and last minute schedule and route changes since we can import the new data as a self contained document whereas with a traditional RDBMS, the schedule and route files would first need to be parsed, data loaded into appropriate columns and possibly table or tables to be re-indexed which are costly operations.
- With MongoDB we can adjust quickly to changed routes and schedules and ensure that our product deliveries reach our customer base with a high degree of confidence.
- In addition, based on changing dynamics of passenger flow, we can provide pop-up pick up and drop off locations as well as route our delivery mobile robots to congested stations.

Redis

Neo4j

- Recommend using BART system for deliveries.
- Local road routes from Train stations to customer addresses.
- BART Lines to be captured as graphs
- Stations as nodes, lines as relations
- Need to run shortest path algorithm to suggest best delivery route.

- Neo4j would be ideal for holding the BART system in the form or a graph.
- Provide out of the box implementation of shortest path and other algorithms.
- RDBMS will not be able to capture the BART system as a graph and any shortest path algorithms will have to be implemented by the Data Engineering Team.

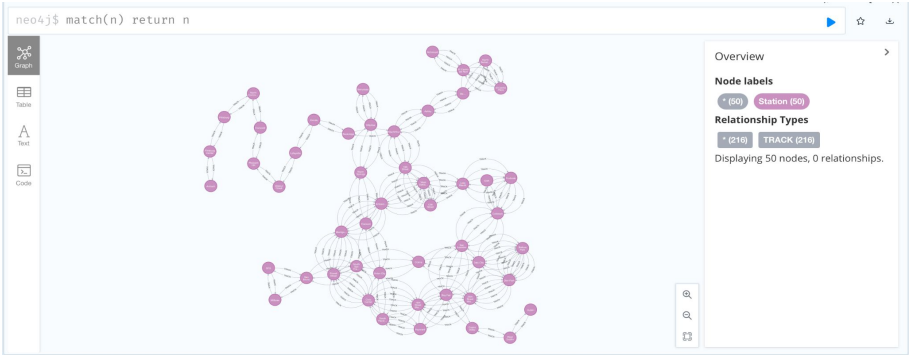
Business Improvements

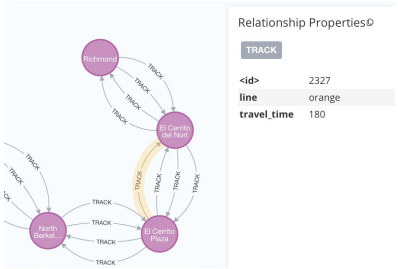
- Use NoSQL and Neo4j
- Identify current patterns to discover opportunities
- Utilize extensive BART network to transport products
- Offer convenient Station pickup / drop off or mobile delivery
- Offer seasonal popup locations

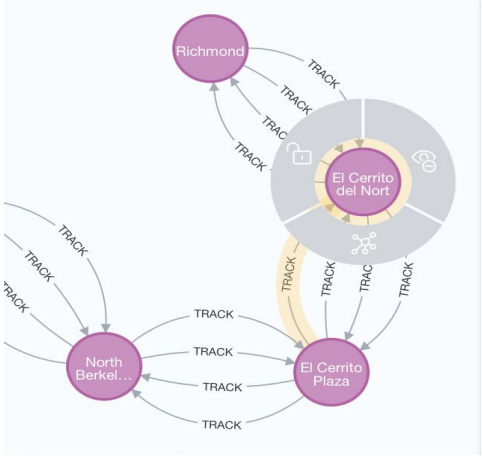
- Redundant system design – multiple channels
  - Re-route transport of goods
  - Utilize mobile robots to bypass congestion
  - Last mile solution

Neo4j Graph

- Graph layout - BART stations
- Relationships - tracks
- Nodes contain
  - Location
  - Active customers near station per station zip code
- Tracks show transit time and Line color







Node Properties

Station

<id>	51
latitude	37.925183
longitude	-122.316939
name	El Cerrito del Norte
pop	258
transfer_time	311
zip	94530

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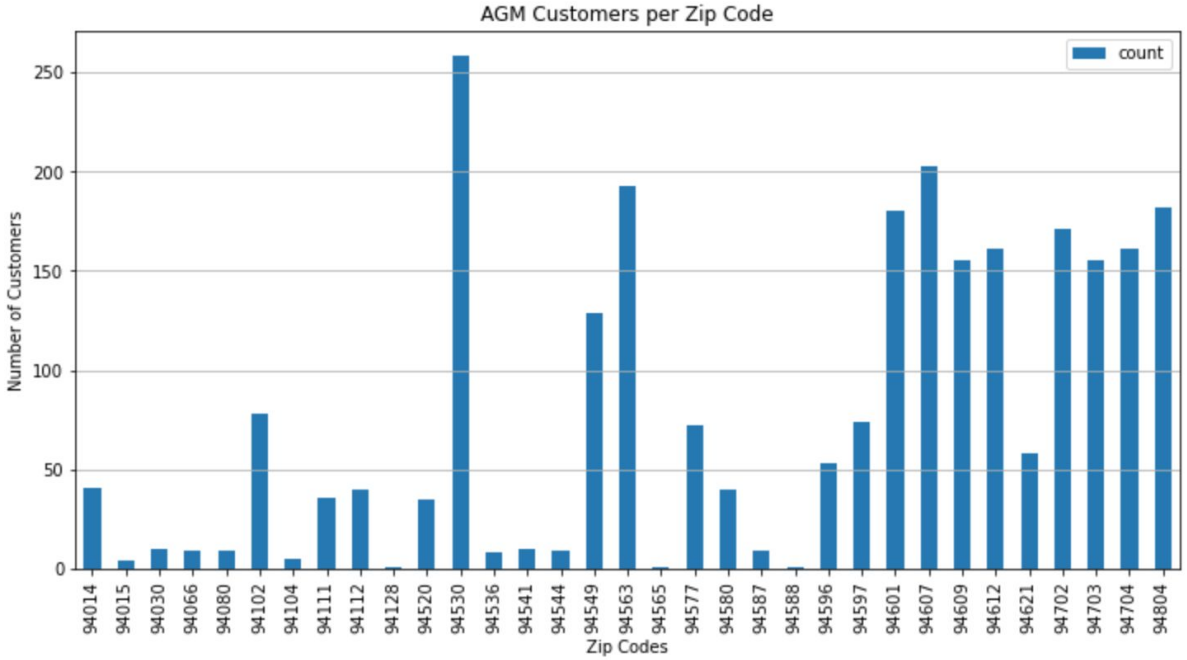
Graph Data Science Results

- Analyze customer data
- Identify large clusters of customers by zip = Station



Graph Data Science

- Cluster analysis and graph analysis
  - Page Rank algorithm using Stations as Pages to determine most used stations
  - Mapped to customer counts per area
- Determine best locations for permanent pick up and drop off locations
- Track patterns and determine pop up locations
- **Identify high rank scores with low customers to drive business in those areas**
  - **West Oakland, San Bruno**

	name	score	customers
0	Coliseum	1.387533	58
1	Bay Fair	1.375688	40
2	MacArthur	1.291159	155
3	San Leandro	1.230845	72
4	Balboa Park	1.163400	40
5	West Oakland	1.158007	0
6	San Bruno	1.142995	9
7	19th Street	1.117343	161
8	Pittsburg Center	1.115549	1
9	Milpitas	1.115419	0
10	El Cerrito del Norte	1.110790	258
11	Glen Park	1.071030	0
12	Embarcadero	1.067680	36
13	Fruitvale	1.065852	180
14	Pittsburg	1.043628	0
15	Warm Springs	1.043566	0
16	El Cerrito Plaza	1.036565	0
17	24th Street Mission	1.022083	0
18	Montgomery Street	1.019887	0
19	Fremont	1.003626	8
20	12th Street	1.003171	203
21	North Concord	1.002297	0
22	Daly City	0.999236	4
23	16th Street Mission	0.998272	0
24	Powell Street	0.997340	5
25	South San Francisco	0.991943	9
26	Civic Center	0.990911	78
27	North Berkeley	0.990261	171
28	Lake Merritt	0.984534	0
29	Union City	0.977743	9
30	Concord	0.974632	35
31	South Hayward	0.960322	9
32	Downtown Berkeley	0.953952	161

Graph Data Science

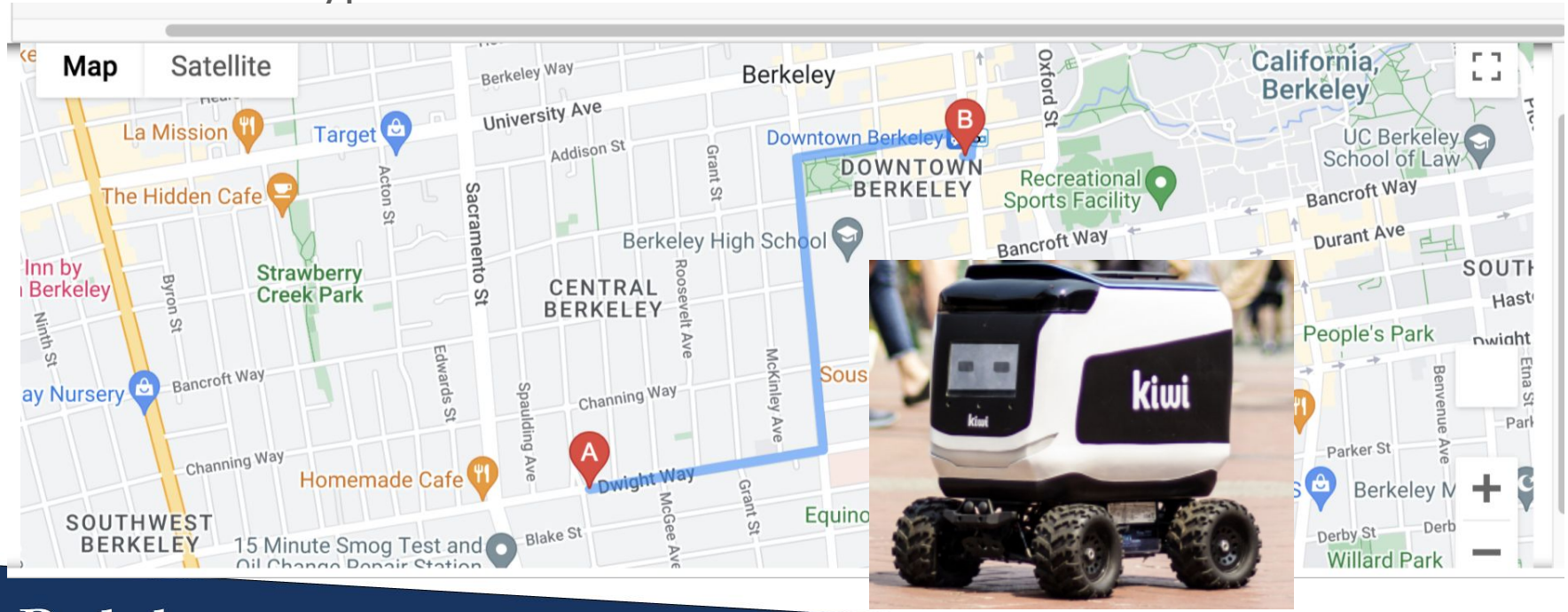
- Determine shortest path from a pick up to drop off location
- Algorithms on graph data
  - Shortest path using transit time
  - A* based on location
  - Identify other business relevant measures
- Mobile path planning

Antioch to Richmond
shortest path

```
------------------------------
   Total Cost:  4380
   Minutes:  73.0
------------------------------
Antioch, 0, 0
Pittsburg Center, 420, 420
Pittsburg, 600, 1020
North Concord, 360, 1380
Concord, 180, 1560
Pleasant Hill, 360, 1920
Walnut Creek, 120, 2040
Lafayette, 300, 2340
Orinda, 300, 2640
Rockridge, 300, 2940
MacArthur, 240, 3180
Ashby, 240, 3420
Downtown Berkeley, 180, 3600
North Berkeley, 120, 3720
El Cerrito Plaza, 180, 3900
El Cerrito del Norte, 180, 4080
Richmond, 300, 4380
```

Path Planning

Integrate with Google Maps to task mobile delivery units for last mile and to bypass track closures



Use Cases – Redis Traffic Flow

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Other Enhancements

- Presented Use Cases are based on customer zip codes compared to station locations
- Models can easily extend to using customer specific addresses