Acme Gourmet Meals (AGM) Vision Alignment - NoSQL Recommendations

DATASCI 205 Section 010 (Spring 2023)
Bailey Kuehl, Jee Park, Mahmoud Ghanem

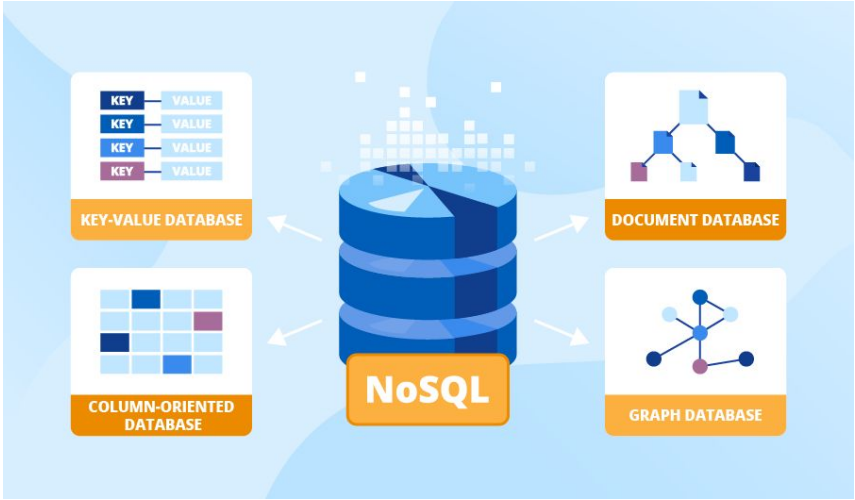
Overview

1. NoSQL Databases
2. Business proposal 1: Pick-up Locations
    a. Neo4j
        i. Shortest Path
        ii. Harmonic Centrality
        iii. Minimum Spanning Tree
3. Business proposal 2: Delivery Technology
    a. Redis
    b. MongoDB
4. Recommendations

NoSQL is a great way to expand our current technology.

- **Scalable** and **Flexible** than SQL.
- A **better** choice for solving **this** business case.

- **Examples**:
  - Neo4j
  - MongoDB
  - Redis



Adding pickup locations enables business growth.

How?

Neo4j

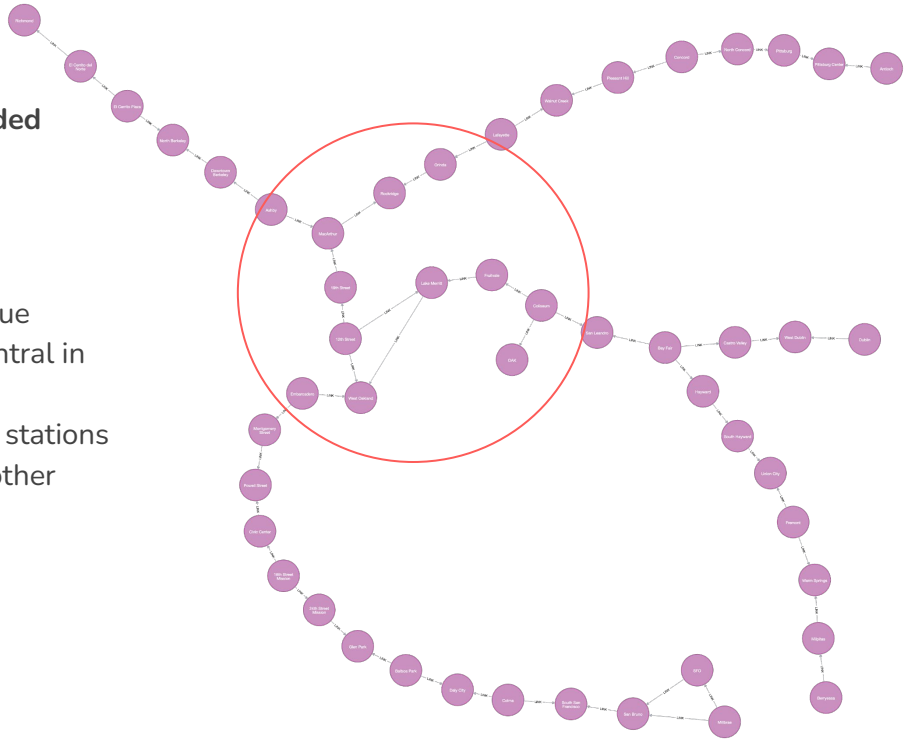
Capabilities / Use cases

- Neo4j is a NoSQL graph database.
- The problem is highly graph-oriented given the need to calculate proximity and best routes available between locations.
- Assess feasibility of using the public transportation system to increase delivery requests by leveraging Neo4j.

Neo4j: Harmonic Centrality

Harmonic centrality is a **recommended approach** for using Neo4j

- Visualize the station map by closeness
- The numerical closeness value indicates which station is central in relation to other stations
- Zero closeness indicates the stations are the furthest away from other stations in the graph



	name	closeness
0	West Oakland	0.078231
1	Rockridge	0.078231
2	Powell Street	0.061224
3	South San Francisco	0.061224
4	Pittsburg Center	0.057823
5	Union City	0.057823
6	Lake Merritt	0.051020
7	MacArthur	0.051020
8	Glen Park	0.051020
9	West Dublin	0.051020
10	North Berkeley	0.051020
45	El Cerrito Plaza	0.000000
46	Embarcadero	0.000000
47	Fremont	0.000000
48	Lafayette	0.000000
49	Millbrae	0.000000

Neo4j: Shortest Path

Business Case:

- What's the shortest distance between Store and Client using BART?

Problem/Considerations:

- The travel time need be minimized and cost of travel should be minimal.

Solution:

- Determine the shortest path using BART from store to client.

```
store_location = (35.803999,-120.272999)
customer_location = (39.903999,-125.572999)
delivery_path(store_location, customer_location)
```

```
--------------------------------
   Total Cost:  5340
   Minutes:  89.0
--------------------------------
Store, 0, 0
depart Berryessa, 139, 139
orange Berryessa, 0, 139
orange Milpitas, 300, 439
orange Warm Springs, 540, 979
orange Fremont, 360, 1339
orange Union City, 300, 1639
orange South Hayward, 300, 1939
orange Hayward, 240, 2179
orange Bay Fair, 240, 2419
orange San Leandro, 240, 2659
orange Coliseum, 240, 2899
orange Fruitvale, 240, 3139
orange Lake Merritt, 300, 3439
orange 12th Street, 180, 3619
orange 19th Street, 120, 3739
orange MacArthur, 180, 3919
orange Ashby, 240, 4159
orange Downtown Berkeley, 180, 4339
orange North Berkeley, 120, 4459
orange El Cerrito Plaza, 180, 4639
orange El Cerrito del Norte, 180, 4819
orange Richmond, 300, 5119
arrive Richmond, 0, 5119
Customer, 221, 5340
```

Neo4j: Minimum Spanning Tree

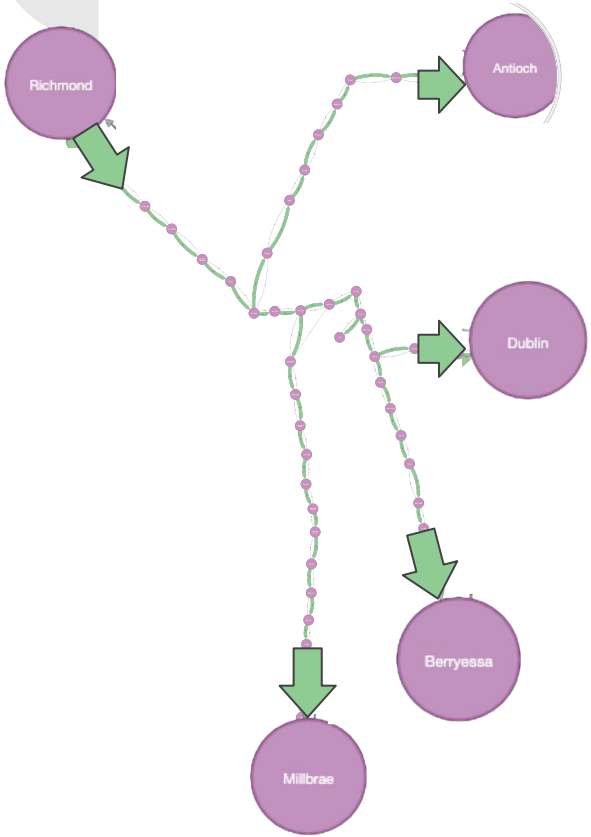
Problem/Considerations:

- Minimize cost, travel distance

Solution:

- Determine minimum spanning tree for path from Customer → Pick-Up location while minimizing cost
- Shows every station, so any pick-up route can be shown

Neo4j: Minimum Spanning Tree



Incorporating more delivery methods will increase profits by increasing our reach.

Motivation:

Expanding beyond the traditional road-routes will reach more customers.

Drones

Robots

Problem:

Existing relational database resources would not excel in this application.

- **Non-grid based**: would have to pull *all* traffic across *all* routes
  - Query and join multiple relational tables to get all needed information
- **Speed:** increased querying and joining will take time
  - Need to act quickly for delivery

Delivery drones could increase reach.

How?

- MongoDB

Capabilities:

- Used for grid-based problems:
  - **Known traffic issue** (construction, special events/closures, etc.)
- Store a list of traffic issues within the grid
  - Only pull grid pieces relevant to potential routes
  - Can update this information daily

Delivery robots could increase reach.

How?

- Redis

Capabilities:

- Used for grid-based problems:
  - **Unpredictable traffic** (car accidents, bad weather, other road obstructions)
- Store a list of traffic issues within the grid
  - Only pull grid pieces relevant to potential routes
  - Can update this information every minute

Final Thoughts and Recommendations

Invest in Neo4j

→ Delivery Path
→ Pickup Locations

Invest in MongoDB and/or Redis, depending on budget

→ Customer Data
→ Live Tracking

References

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3. https://www.dreamstime.com/delivery-location-succes-illustration-level-icon-great-design-any-purposes-express-service-shipping-business-eps-image217807886
4. https://www.scnsoft.com/blog/nosql-databases
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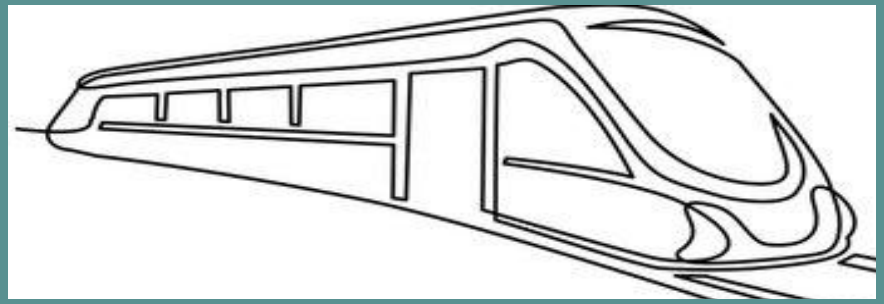

Thanks for Riding Along!

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Map


North Concord/ Martinez
Pittsburg/ Bay Point
Pittsburg Center
Antioch
Change trains at transfer platform
Concord
Pleasant Hill/Contra Costa Centre
Walnut Creek
Lafayette
Orinda
Rockridge
EAST BAY
Richmond
El Cerrito del Norte
El Cerrito Plaza
North Berkeley
Downtown Berkeley
Ashby
MacArthur TIMED TRANSFER (SOUTHBOUND)
19th St/Oakland TIMED TRANSFER (NORTHBOUND)
12th St/Oakland City Center
West Oakland
OAKLAND
SAN FRANCISCO
Embarcadero
Montgomery St
Powell St
Civic Center/UN Plaza
Lake Merritt
Fruitvale
Coliseum
San Leandro
Bay Fair
Castro Valley
West Dublin/ Pleasanton
Dublin/Pleasanton
16th St Mission
24th St Mission
Glen Park
Balboa Park
Oakland International Airport (OAK)
Hayward
South Hayward
Union City
Fremont
Daly City
Colma
South San Francisco
San Bruno
San Francisco International Airport (SFO)
Millbrae
Warm Springs/South Fremont
Milpitas
Berryessa/North San José
PENINSULA
SAN JOSE
Antioch–SFO+Millbrae Line
Dublin/Pleasanton–Daly City Line
Berryessa/North San José–Richmond Line
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