AGM NoSQL Database Overview

205 Project 3 Presentation

Members:

- Kara Christensen
- Negin Djalali
- Gray Selby
- Yidai Yao

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Why Now?

- $98,739,408 in gross revenue last year
- 29,836 customers a month

Upskilling with NoSQL databases will allow us to **implement the leadership team's vision** of the future:

- Integration with BART
- Dynamic Menus
- Delivery Via Robot

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Integration With BART

- Goal
  - Allow customers to pick up meals at certain BART stations
  - Use BART transport network for deliveries:
    - From our headquarters to select stations
- Benefits
  - BART has lots of traffic, especially with commuters who may be looking for lunch or dinner
  - BART avoids traffic
  - Limits carbon footprint

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Integration With BART

Adding Pickup at BART Stations

- Conduct a pilot with a select number of stations
- Populus stations that are also well connected to the BART network

We recommend Neo4j

Why not a relational database?

- Neo4j includes algorithms to quickly identify stations with high ‘betweenness’ or ‘closeness’ centrality

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Neo4j: Integration With BART

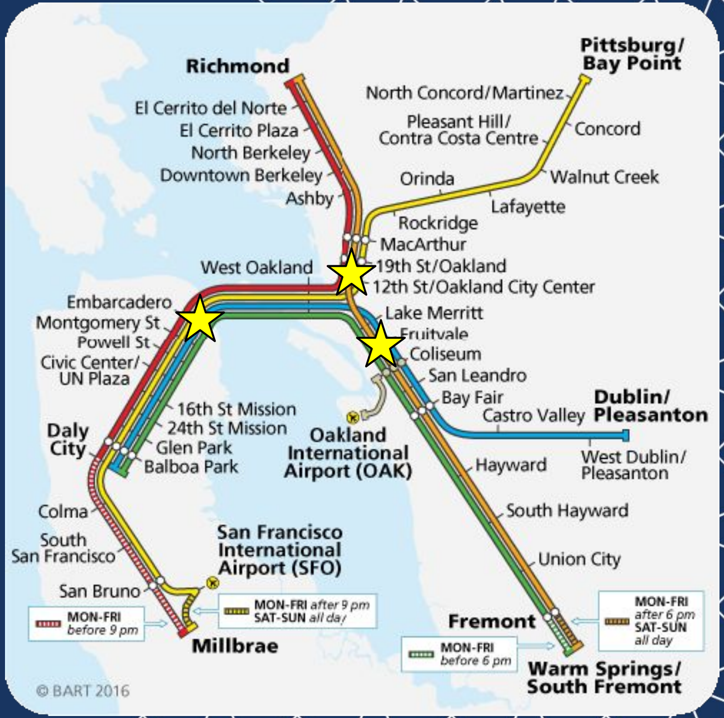
- ***Selecting Pickup at BART Stations as calculated by betweenness centrality***

Betweenness

	name	betweenness
0	Rockridge	5509.000000
1	MacArthur	5239.000000
2	Orinda	4997.000000
3	Lafayette	4469.000000
4	Walnut Creek	3925.000000
5	12th Street	3752.333333
6	Lake Merritt	3723.000000
7	West Oakland	3647.750000
8	Coliseum	3603.750000
9	19th Street	3535.000000
10	Fruitvale	3521.666667
11	Pleasant Hill	3365.000000
12	Embarcadero	2920.750000
13	Concord	2789.000000
14	Montgomery Street	2774.750000

Considering Ridership

	station	avg_exits
0	Embarcadero	400825
1	Montgomery Street	328108
2	12th Street	118680
3	19th Street	115691
4	Fruitvale	98468



Neo4j: Integration With BART

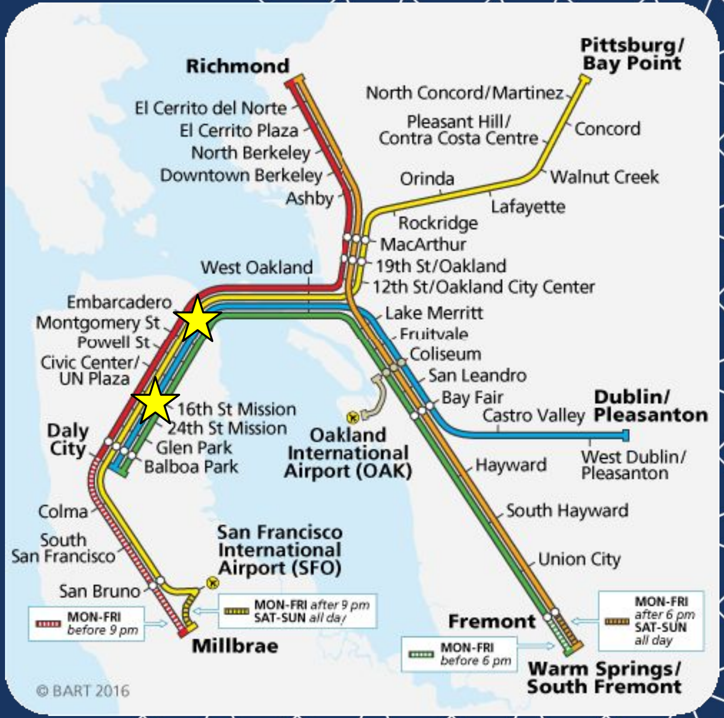
- ***Selecting Pickup at BART Stations as calculated by closeness centrality***

Closeness

	name	closeness
0	West Oakland	0.137729
1	12th Street	0.135047
2	Lake Merritt	0.133280
3	Embarcadero	0.132576
4	19th Street	0.127444
5	Montgomery Street	0.126801
6	Fruitvale	0.125870
7	Powell Street	0.120608
8	MacArthur	0.119942
9	Coliseum	0.117110
10	Civic Center	0.114187
11	San Leandro	0.110960
12	Rockridge	0.110284
13	Ashby	0.109433
14	16th Street Mission	0.107698

Considering Ridership

	station	avg_exits
0	Embarcadero	400825
1	Montgomery Street	328108
2	Powell Street	303280
3	Civic Center	225182
4	16th Street Mission	149587



Neo4j: Integration With BART
- *(Single Source) Shortest Path*

- Trial deliveries from our HQ in Downtown Berkeley
- Search the BART graph and weight connections based on travel time to determine efficient delivery paths

Why not a relational database?

- Neo4j allows us to treat shortest path as a weighted graph problem

	station	totalCost
0	Downtown Berkeley	0.000000
1	North Berkeley	120.000000
2	Ashby	180.000000
3	El Cerrito Plaza	300.000000
4	MacArthur	439.666667
5	El Cerrito del Norte	480.000000
6	19th Street	619.666667
7	Rockridge	719.000000
8	12th Street	739.666667
9	Richmond	780.000000
10	Orinda	1019.000000
11	Lake Merritt	1106.000000
12	West Oakland	1176.250000
13	Lafayette	1319.000000
14	Fruitvale	1386.000000

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MongoDB Business Case
- Dynamic Menus

- Goal
  - Provide menu offerings dynamically based on the trending meal choices at different BART stations
  - Collects and analyzes customer feedback, ratings, and local food trends
  - Constantly adjusts menu offerings to reflect customers' preferences
- Benefits
  - Enhances customer satisfaction by providing options popular in local areas
  - Ongoing updates and adjustments for a consistently optimized experience
  - Positions AGM as an innovative leader in the food service industry

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MongoDB Business Case
- Implementation

- Document
  - Each BART station
    - Key information:
      - Station ID: Index
      - Location: Latitude, longitude
      - Meal choices: Sub-document
- Sub-Document
  - Meal Choice
    - Key information:
      - Meal ID: Index
      - Rating: Numerical, 1 (lowest) to 5 (highest)
      - Feedback: Quantitative, reflect dining experience

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MongoDB Business Case

- ## Data Structure Example

```
{
  "station_id": 1,
  "station_name": "Downtown Berkeley",
  "location": {
    "latitude": 37.869799,
    "longitude": -122.268197
          },

  "meal_choices": [
    {
      "meal_id": 1,
      "meal_name": "Pistachio Salmon",
      "ratings": [1,2,3,4,5],
      "feedback": ["Good taste!", "Fast service!", "Overcooked"]
    },

    {
      "meal_id": 2,
      "meal_name": "Brocolli Stir Fry",
      "ratings": [1,2,3,4.5,5],
      "feedback": ["Delicious!", "Good seasoning"]
    }
                ]
}
```

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MongoDB Business Case
- Advantages over Relational Database

- Schema Flexibility
  - Document-oriented database
  - Accommodate dynamic data
    - Adding, modifying fields
- Dynamic Data Handling
  - Fluid representation of data
  - Better performance without complex operations
- Scalability
  - Horizontal
    - Growing dataset associated with BART stations
  - Vertical
    - Increasing demands of dynamic menu offerings

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Redis Business Case

- Goal
  - Using robots to optimize food delivery
  - Real-order tracking
  - Automated task handling
- Benefits
  - Efficiency and speed as robots can navigate through traffic
  - Cost optimization: Using robots for food delivery can reduce human labor costs
  - Scalability and expansion: Accommodating more customers and serve a large database without compromising delivery times

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Redis Business Case

- Why Redis?
  - Real-time data handling
  - Key-Value Store: managing current status of robots
  - Communication between different components
- Why not Relational Database?
  - Performance overhead: cannot deal with high amount of data updates
  - Fixed Schema: not suitable for rapidly changing data structures

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Conclusion

NoSQL Databases will allow us to **accomplish the companies vision** more effectively than relational databases alone.

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