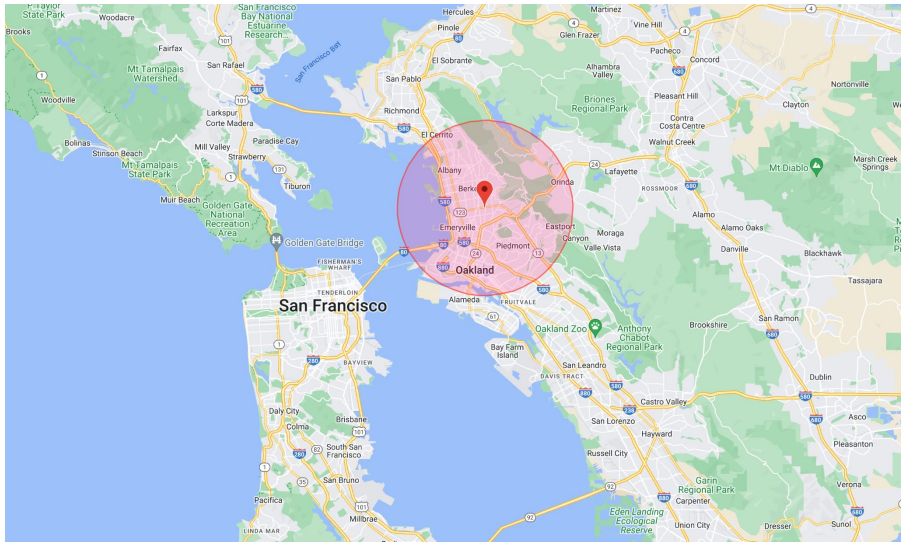
The New Era of Meal Delivery

Jack Galvin, Aris Chalini, and Matt Lauritzen

Contents

Business Context

- The business completed a successful PoC with a delivery service (Peak Deliveries), but the **delivery area was limited to a 5 mile range.**
- We aim to explore additional ways (outside of a partnership with Peak) of **capturing market share** beyond the Berkeley area.
- Creating an internal delivery service allows Acme to **expand sales opportunities** as we see fit and with a higher profit margin.



Options Under Consideration

- **Adding more pickup locations** within BART stations will allow riders to easily pick up meals during their commutes without having to exit the turnstiles
- **Using public transit (BART)** to deliver meals is a cost-effective and environmentally-friendly method of delivery
- **Purchasing drones** bypasses painful Bay Area traffic and is a quicker method of delivery than public transit alone
- We will not consider the use of **delivery robots** as we see no additional or unique benefit to doing so which is not comprised within one or a combination of the above options.

Amazon has already proven the capability of delivery drones

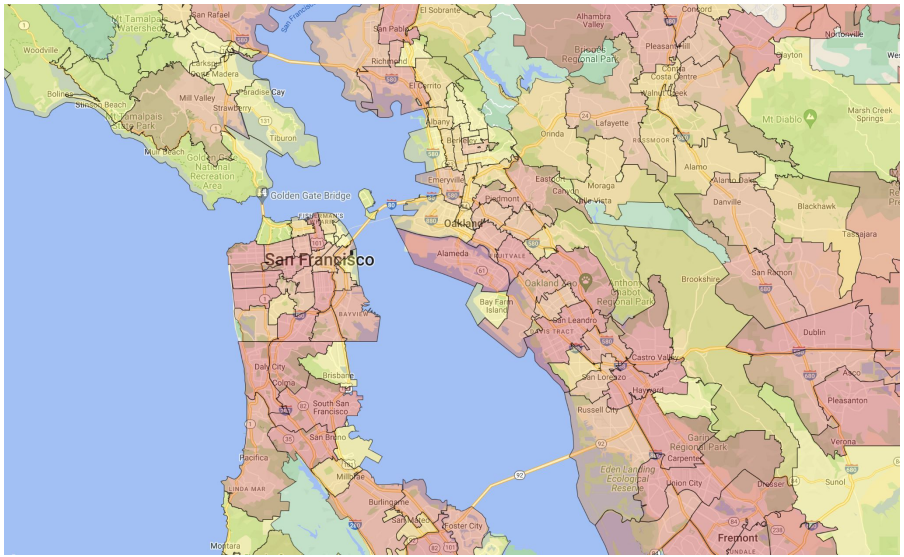
Image source: https://www.businessinsider.com/drone-delivery-services

Methodology

- We deployed the following methodology to assess options for expansion:
  - Build a graph database (Neo4j) to **represent connections** between BART stations
  - **Analyze each** of the aforementioned options in isolation (new locations, BART, drones)
  - Assess how many of the **options could be used in parallel**
- To examine a hybrid approach, we:
  - Produce a **list of candidate stations** within which to open pickup locations
  - Refine the list based on **proximity to the existing store**
  - Finalize the list using the **density of the surrounding population**

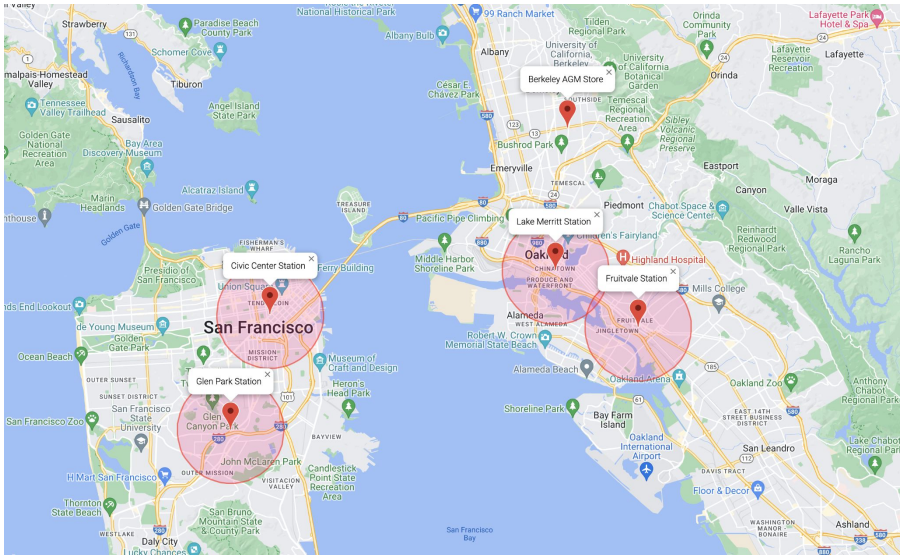
Decision Criteria and Assumptions

- Satellite pickup locations are chosen based on the following criteria:
    - The BART station must have a **higher measure of betweenness centrality** than the Ashby station. This is a measurement of how many BART paths pass through that given station.
    - **Distance** from the Ashby station to satellite locations is considered using **shortest path** (Dijkstra)
    - Delivery radii for **drones must not overlap**



Recommended Approach

- We recommend **phasing expansion** to avoid the risk of outlay of large upfront capital in real estate and to allow the business to assess success and modify as necessary.
    - Phase 1 - open **4 satellite pickup locations** within BART stations
    - Phase 2 - use **lessons learned from Phase 1** to determine stations for additional pickup locations (“drone-centric” and / or “pickup-centric”)
    - Phase 3 - **expand** beyond the East Bay and SF Peninsula



Operational Considerations and Assumptions

Operational Considerations

- Meals will continue to be made within the existing Berkeley store
- Meals will be carried twice daily by runners using BART to the satellite pickup locations (once in the morning, once in the late afternoon)
- We envision the need for additional technology as we scale:
    - Neo4j - great for visualizing the BART network as a graph and has a useful gds library (Cypher) for graph centrality and community detection algorithms
    - MongoDB - would be useful to have POVs at different levels (line level, station level, zip code level, etc) for additional analytics
    - Redis - would be useful if we wanted near real-time (re)routing of runners / drones delivering meals

Assumptions

- The delivery radius of a drone that is capable of carrying packages is 1.5 miles
- Total meals delivered per day: 540 * 2 = 1080 (Peak delivered 540 meals per day from PoC)
- Runner can transport 30 meals in each trip, which would require 9 round-trip BART rides for each location
- Drone price: $4,000

Cost Benefit Analysis

- Runner Transportation Costs:
  - Glen Park transportation costs: $81.90
  - Civic Center transportation costs: $74.70
  - Lake Merritt transportation costs: $37.80
  - Fruitvale transportation costs: $41.40
  - Total daily transportation costs: $235.80
- Drone Costs:
  - 4 drones * $4,000 = $16,000
- Projected Daily Revenue:
  - $12,960 (1080 meals / day * $12 per meal)
- Projected Annual Revenue
  - $4,704,480 ($12,960 * 363 days)
- Projected Annual Profit (Revenue - Cost)
  - ***$4,602,884.60***