ONDC
Open Network for Digital Commerce

Delivery Route Optimization

Team - **The Quad**

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The Quad - Delivery Route Optimizer

- Route optimization service providing APIs for small retailers and logistics providers to consume

- APIs return optimal routes based on
  - criteria such as distance (or) duration
  - profile such as driving etc.

- Built on OSRM (Open Source Routing Machine) that is backed by OpenStreetMap data

Accessing the APIs

The Delivery Route Optimizer service is deployed in GCP (Google Cloud Platform).

APIs can be accessed here.

User personas

User Persona 1

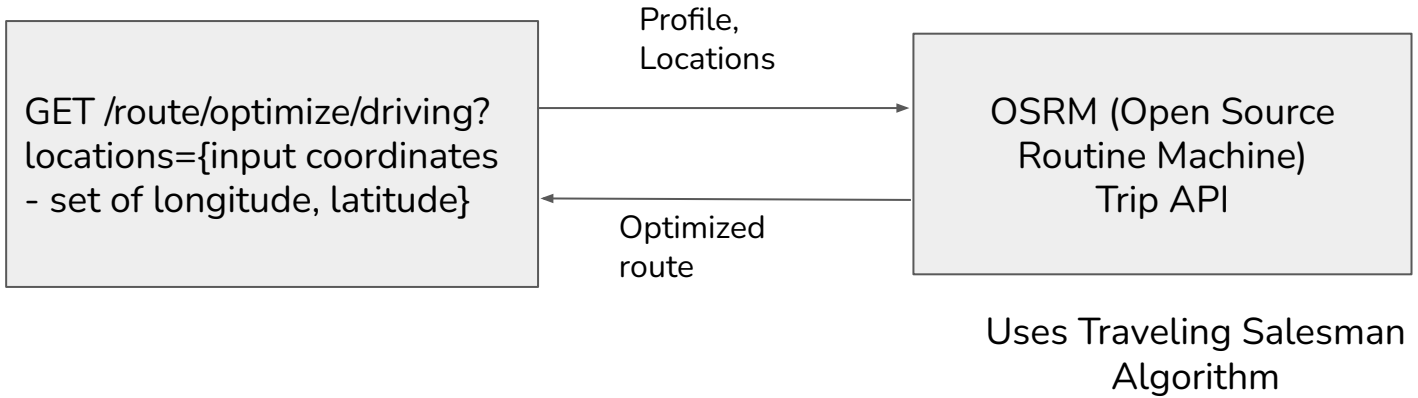
Gupta Kirana Store, is a small retailer, who is **not connected** to any **logistic provider**.

The store delivers products to the customers on their own i.e. they have their own delivery person employed.

On any day, the store receives a set of orders which are handed over to the employed delivery person who would want to find out an optimal route between the set of delivery locations so that the cost or time is subsidized.

This use case is - **single delivery agent, single pickup point, multiple delivery points**

Basic Route Optimization API



Demo of Basic Route Optimization API

Favorites

By Dinesh Balasubramaniam · 7 places

FOLLOW

Airport Terminal Link

Sholinganallur

Chennai, Tamil Nadu

Fort St. George Museum

4.2 ★★★★☆ (4,114)

Museum ·

Rajaji Rd, near Legislature and Secretariat

Fort dating to 1644 with museum & church

Closed · Opens at 9:00 am

Barbeque Nation

4.1 ★★★★☆ (8,458)

₹₹₹ · Restaurant ·

Ground Floor, Ramaniyam Isha Blk

1,Thoraipakkam, 11, Old Mahabalipuram Rd

Open until 10:00 pm

Dine-in · Takeaway · No-contact delivery

Phoenix Marketcity

4.5 ★★★★½ (93,296)

Shopping mall · 142, Velachery Rd

Sprawling indoor mall with a cinema

Open until 10:00 pm

In-store shopping · Curbside pickup

Central Railway Station

4.1 ★★★★☆ (281)

Bus station

Input locations

PICKUP POINT

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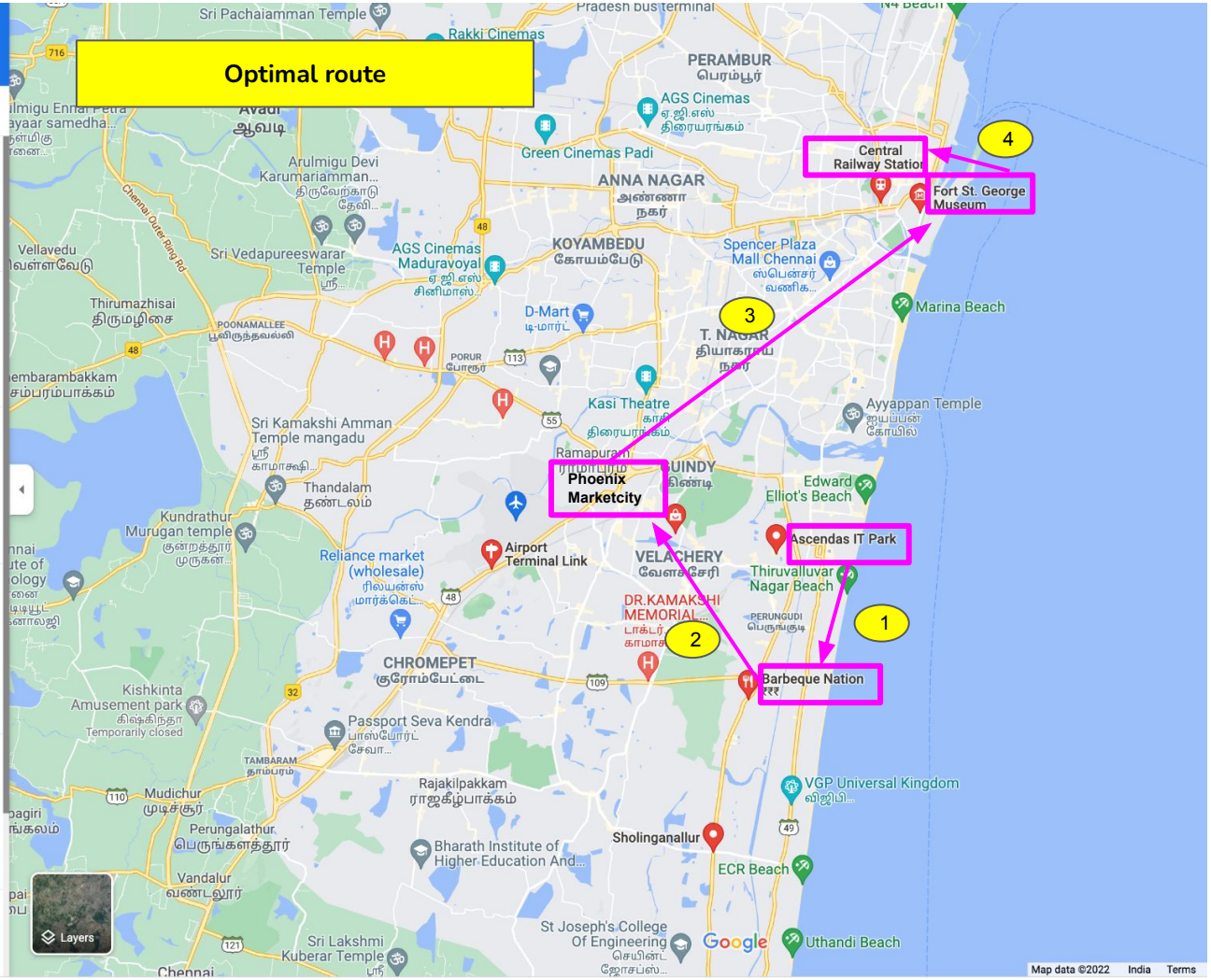
Optimal route



User Persona 2

Bharat Stores, is a retailer, who is predominantly **online based**.

The store receives online orders and runs its **own logistics service** to meet the high delivery needs.

The logistics service associated with Bharat Stores would like to group the orders optimally and assign them to different delivery agents such that each delivery agent picks up multiple orders which have close delivery points.

This use case is - **multiple delivery agents, single pickup point, multiple delivery points**

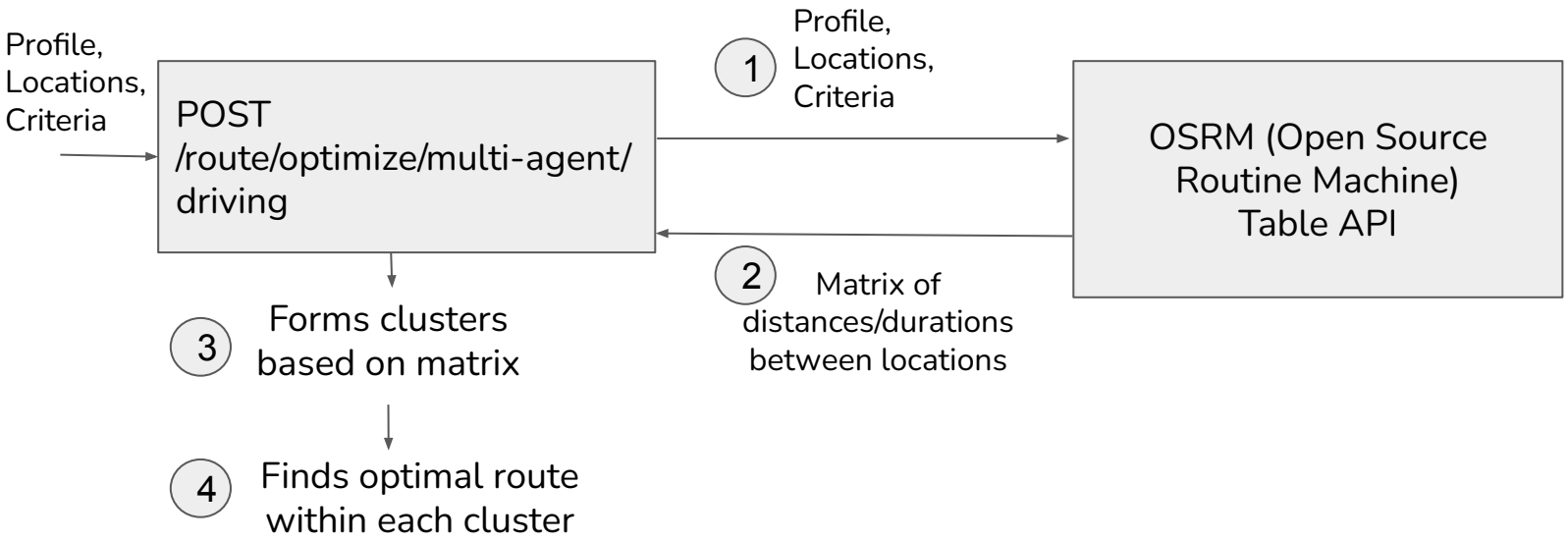
Example of User Persona 2

Delivery Points **A, B and C** are nearer to each other. Delivery Points **D and E** are closer to each other but are farther from A, B and C.

In this case, the logistics service would want to group A, B and C orders and assign them to Delivery Person **P1**. Similarly, they would want to group D and E and assign them to Delivery Person **P2**.

Also, between A, B and C, the delivery person P1 would want to find an **optimal route** to travel and deliver the orders.

Multi-Agent Route Optimization API



Demo of Multi-Agent Route Optimization API

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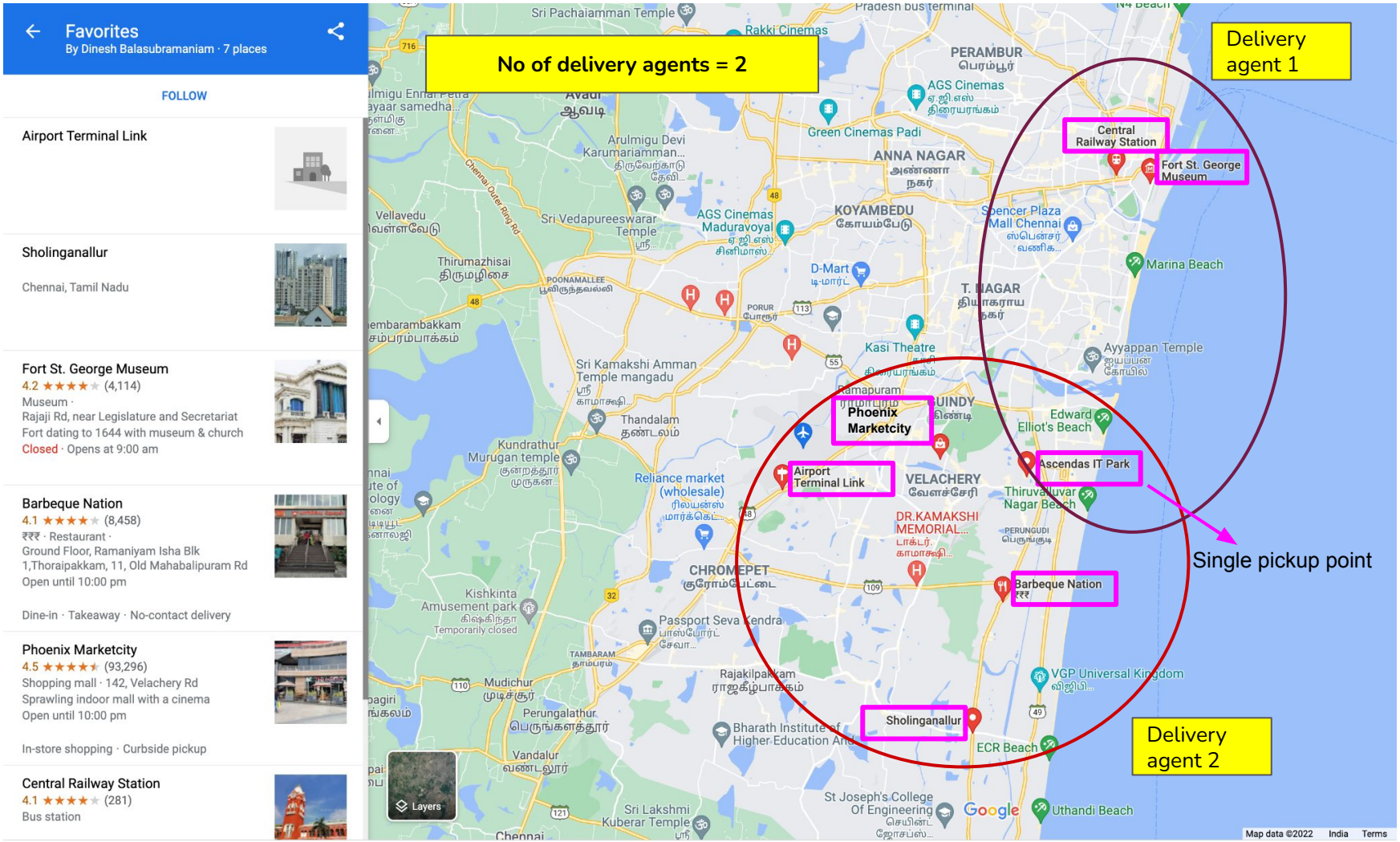
Bus station

Input locations

Single pickup point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Bus station
No of delivery agents = 2
Delivery agent 1
Delivery agent 2
Single pickup point
Central Railway Station
Fort St. George Museum
Marina Beach
Ayyappan Temple
Edward Elliot's Beach
Ascendas IT Park
Thiruvanmiyur Nagar Beach
Phoenix Marketcity
Airport Terminal Link
Barbeque Nation
Sholinganallur
ECR Beach
VGP Universal Kingdom
Uthandi Beach
Sri Pachaiamman Temple
Rakki Cinemas
PERAMBUR
AGS Cinemas
Green Cinemas Padi
ANNA NAGAR
KOYAMBEDU
AGS Cinemas Maduravoyal
Spencer Plaza Mall Chennai
D-Mart
T. NAGAR
Kasi Theatre
Sri Kamakshi Amman Temple mangadu
Thandalam
Kundrathur Murugan temple
Reliance market (wholesale)
VELACHERY
DR.KAMAKSHI MEMORIAL...
CHROMEPET
Kishkinta Amusement park
Temporarily closed
Passport Seva Kendra
Rajakilpakkam
Perungalathur
Bharath Institute of Higher Education And...
Vandalur
Sri Lakshmi Kuberar Temple
St Joseph's College Of Engineering
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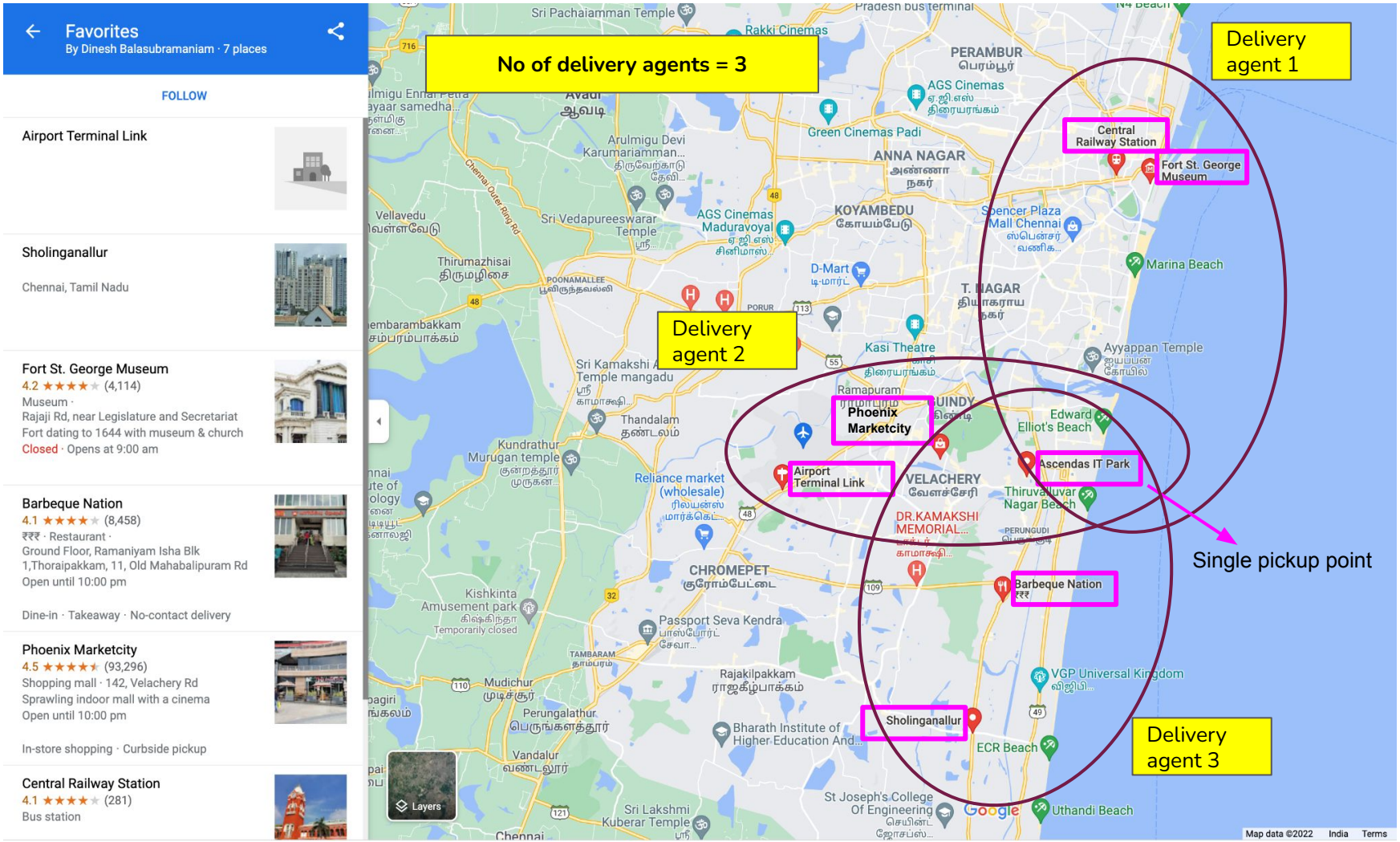
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Bus station
No of delivery agents = 3
Delivery agent 1
Delivery agent 2
Delivery agent 3
Single pickup point
Central Railway Station
Fort St. George Museum
Marina Beach
Phoenix Marketcity
Airport Terminal Link
Ascendas IT Park
Barbeque Nation
Sholinganallur
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User Persona 3

I-Delivery, is a **logistics provider**, who picks up orders from various retailers and delivers them doorstep to their respective customers.

Any delivery person working in I-Delivery would want to find an optimal route to pick up orders from various shops and deliver them to their customers.

This use case is - **single delivery agent, multiple pickup points, multiple delivery points**

Example of User Persona 3

Given (pickup_1, drop_1), (pickup_2, drop_2), (pickup_3, drop_3),

An optimal route could be - a delivery person picking up an order from pickup_1 and then proceeding to, say, pickup_2 which is nearer to pickup_1.

pickup_1 -> pickup_2

Then the person finds drop_2 to be closer and hence delivers at drop_2.

pickup_1 -> pickup_2 -> drop_2

The next closest stop is pickup_3 and hence the person picks up order and finds out that drop_1 is nearer to pickup_3.

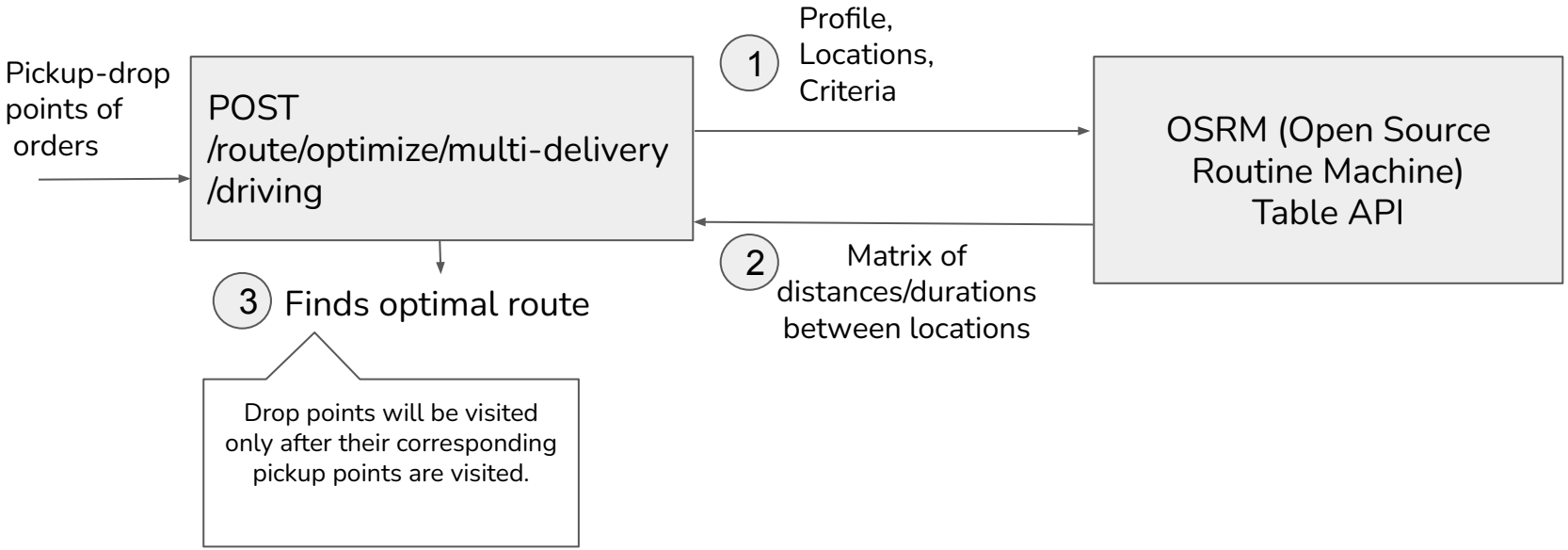
pickup_1 -> pickup_2 -> drop_2 -> pickup_3

Example of User Persona 3 Contd.

Now after delivering to drop_1, the person finally arrives at drop_3 to deliver.

pickup_1 -> pickup_2 -> drop_2 -> pickup_3 -> drop_1 -> drop_3.

Multi-Point Delivery Route Optimization API



Demo of Multi-Point Delivery Route Optimization API

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Bus station

Input locations

DROP 1

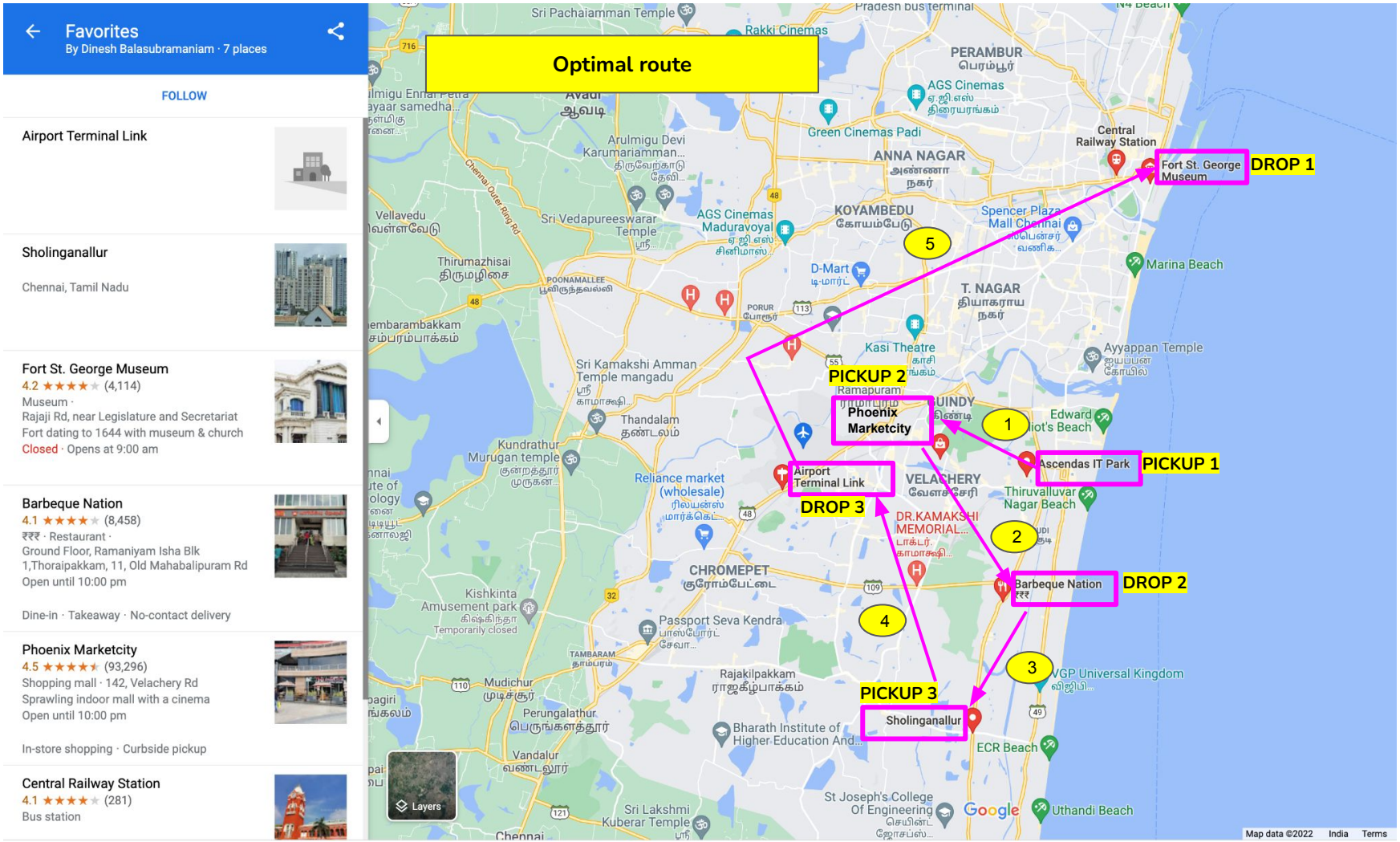
PICKUP 2

PICKUP 1

DROP 3

DROP 2

PICKUP 3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Bus station
Optimal route
DROP 1
PICKUP 2
PICKUP 1
DROP 3
DROP 2
PICKUP 3
1
2
3
4
5
Fort St. George Museum
Ascendas IT Park
Airport Terminal Link
Barbeque Nation
Sholinganallur
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Uthandi Beach
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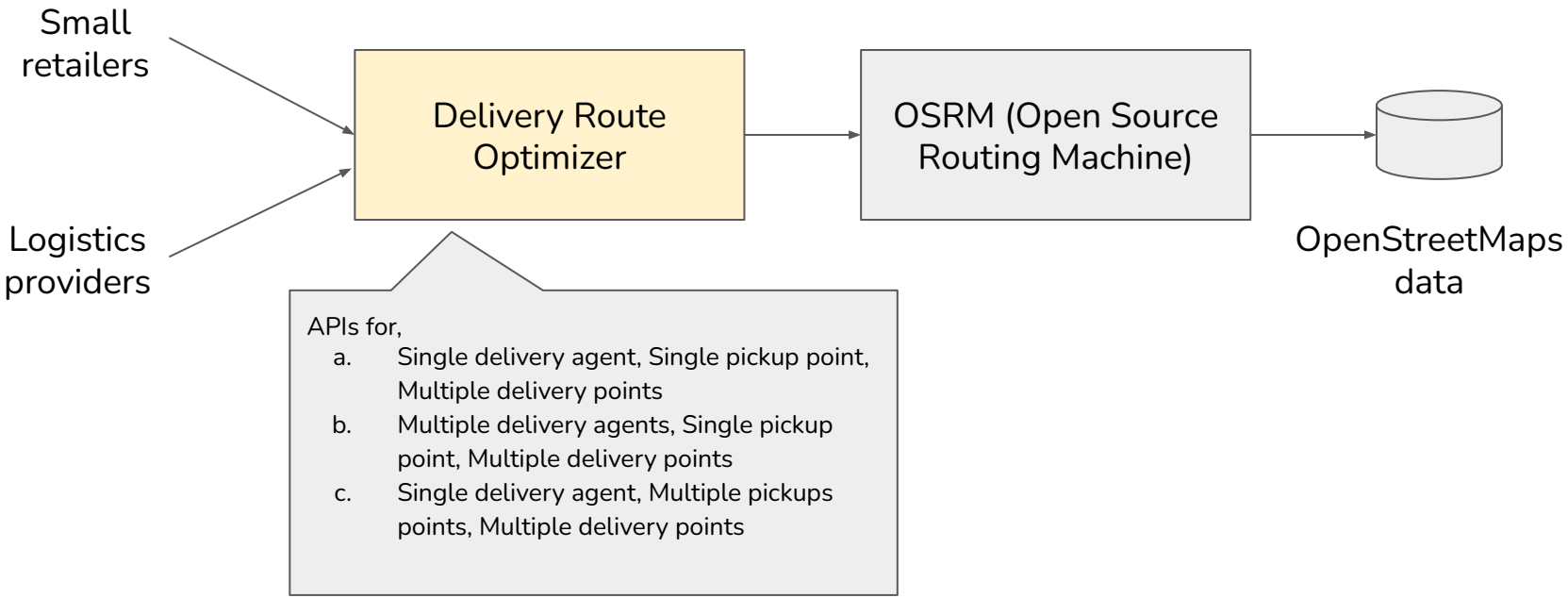
Algorithms Used

- Traveling salesman problem
- K - Spanning tree
- Multi-Level Dijkstra *(internally by OSRM)*

Language used: Java

Architecture Diagram



Future Enhancements

- To support multiple delivery agents picking up from multiple pickup points and delivering to their respective drop points.
- To extract the route optimization algorithms as a Java library that is pluggable by other applications
- Mobile app SDK for small-retailers' and logistics providers' applications, if any, to communicate with our APIs.
- To display the optimized route with driving directions/steps.
- To consider factors such as road closures, water logging etc. while finding optimal routes.

Thank you