Multi-Modal Logistics Parks - India

IGSA UW-Madison SUPPLY CHAIN HACKATHON

Adhokshaja Achar Budihal Prasad

About Me

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Adhokshaja Achar Budihal Prasad

MBA Student – University of South Florida

- Hometown: Bengaluru, India
- Current City: Tampa, FL
- Interests: Web Application Development, Data Analytics, Project Management

Problem Statement

- India is trying to find the optimal transport network for freight from ports to cities through a network of Multi-Modal Logistics Parks
- 11 Ports – Source of Freight
- 20 Cities – Destination for Freight
- Optimize the cost of transportation of freight from Ports to Cities.

Problem Formulation

Objective

Reduce the Sum of transportation costs associated with movement of freight across the network

Constraints

Supply at a port is limited.
Total Freight out of a port cannot exceed the available supply

Demand at cities should be met.
Total Freight into a city cannot be lower than the demand.

Solving the problem

Assumptions

- Freight can be easily moved from a Port to City
- Movement between ports and cities is absent
- There is no time component to the supply – i.e. Freight is readily available for transport.
- There are no intermediary hubs
- There is no cost associated with the storage
- Storage space is not limited by demand (i.e. cities can store more freight than their demand)
- The cost incurred between different modes of transport is uniform (Rs. 35/km)

Approach

- Consider all routes from Ports to Cities
- Set the Flow as a variable parameter
- Set the Objective function as discussed
- Set the Supply and Demand Constraints
- Optimize network by varying the Flow, and minimizing the objective while obeying the constraints

Solution

OPTIMAL NETWORK FOUND.

₹4,46,85,000 OR $638,354

Future Work – Additional Considerations

- Adding a time component to the supply and demand
- Using cities and ports as hubs – Consider movement of freight from port-port and city-city
- Consider warehousing and other costs associated with the storage of freight at locations
- Consider the variety of freight being moved
- Consider the differences in cost associated with different modes of transport

Questions?

Problem Statement

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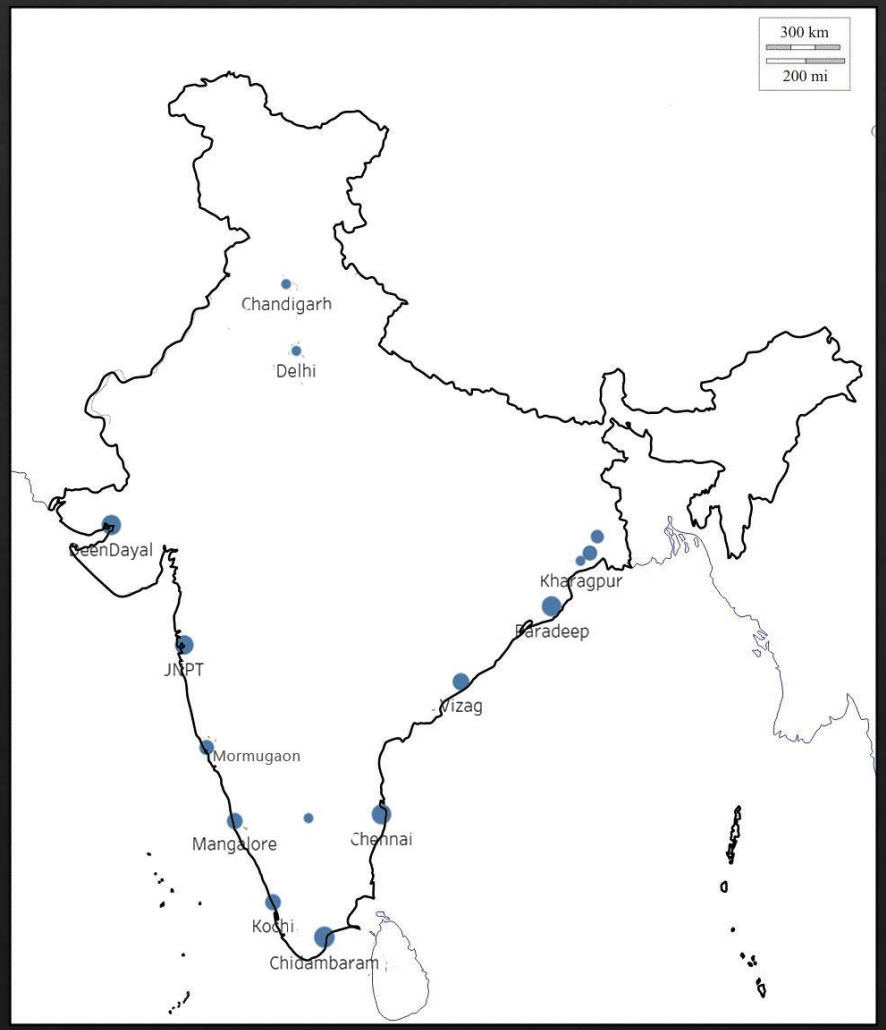
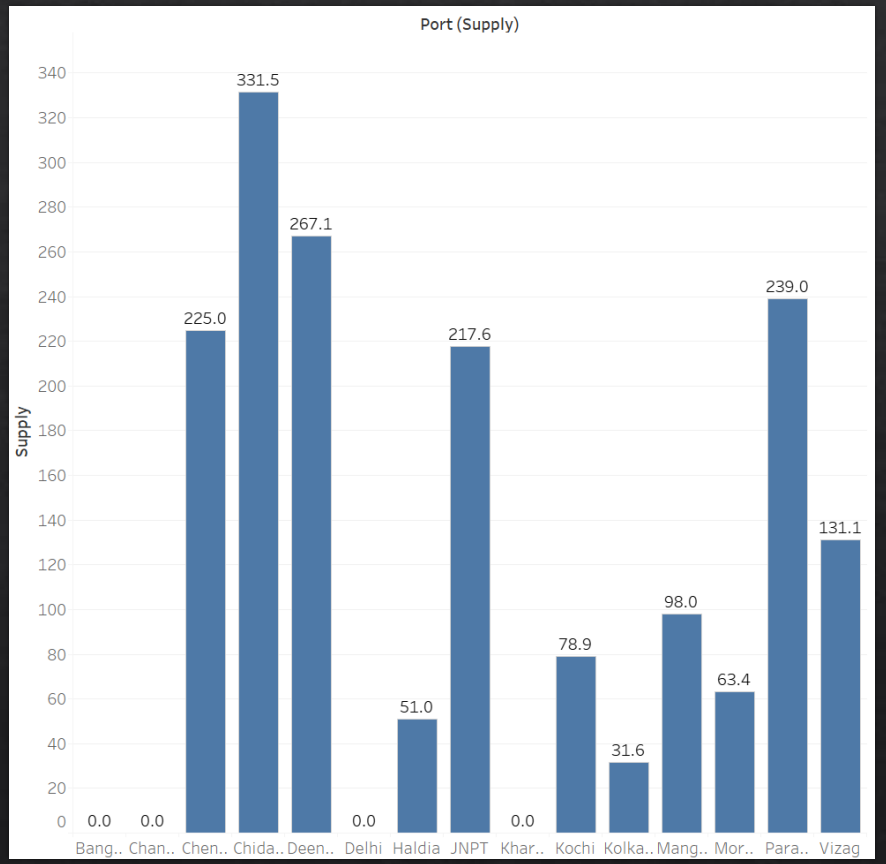
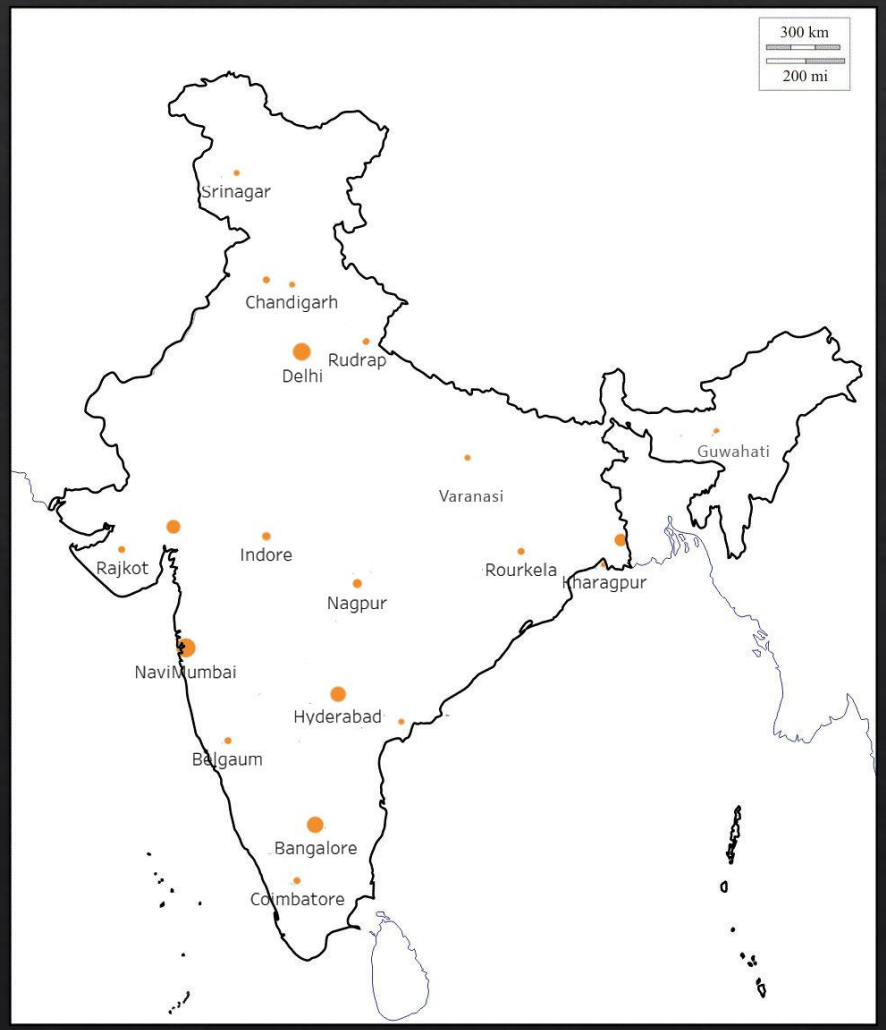
Optimize the cost of transportation of freight from Ports to Cities.

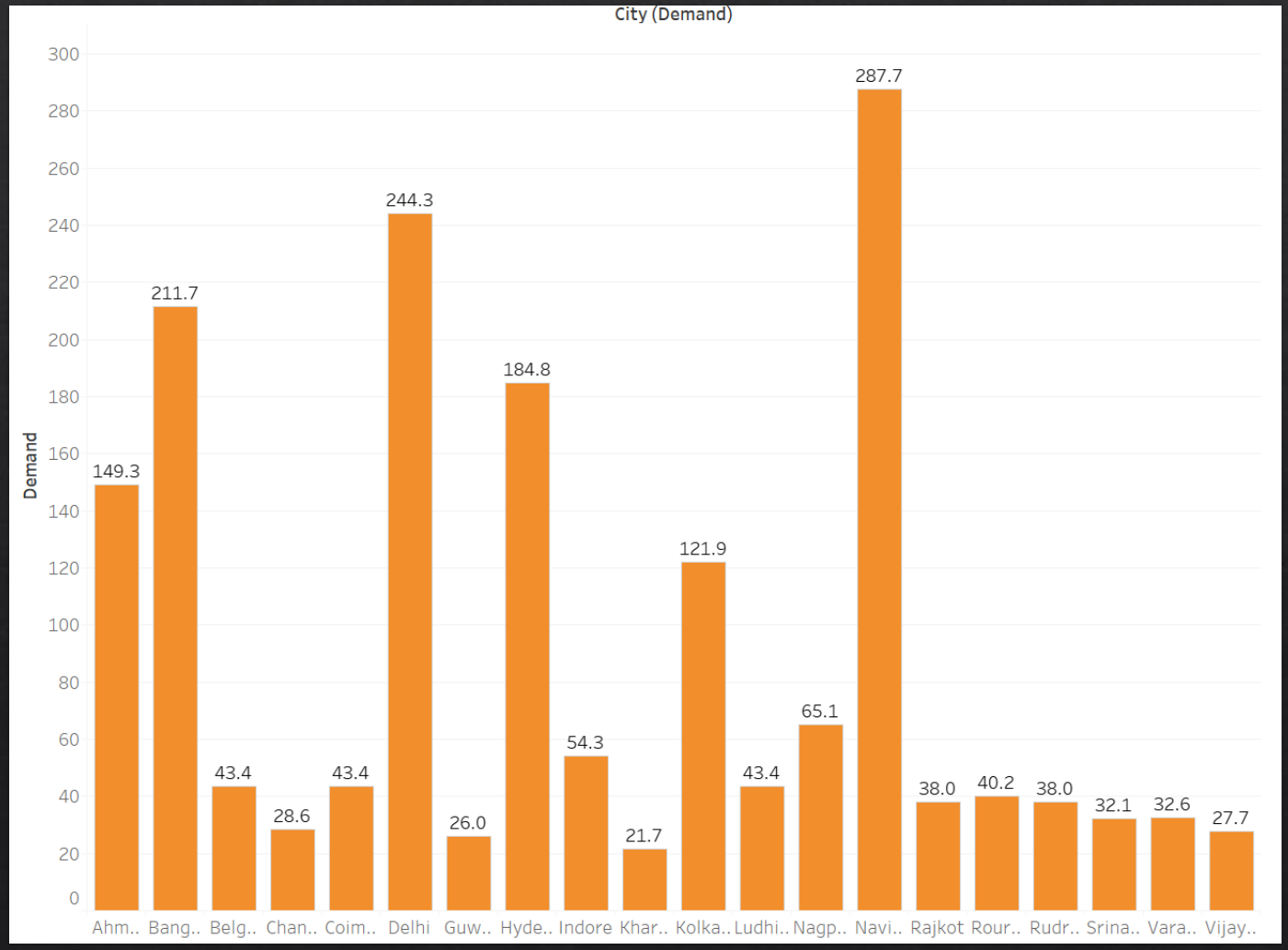
Sources - Ports





Destinations - Cities





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Mathematical Formulation of the problem

Cost of freight from a port to a city

= Distance between port & city * Number of pieces of freight moved(Flow) * Cost of transportation/piece of freight/km

Unit cost = ₹35/km

Objective: $min\left(\sum_{Ports}\sum_{Cities} C_{Port,City}\right)$

$C_{pc} = Dist_{pc} \times Flowpc \times UnitCost$

Supply Constraint: $\sum_{Cities} Flow_{Port,City} \leq Supply_{Port}$

Demand Constraint: $\sum_{Ports} Flow_{Port,City} \geq Demand_{City}$

Solving the problem

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Solving the problem

- Problem approached as a linear programming problem.
  - Methods/ Algorithms to solve this type of problem already exist and can be leveraged
  - This problem is simple enough to not require a lot of computation power

- Problem Solved using Python
  - Used package “pyomo” to define problem
  - Used solver “GLPK” to find the optimal network

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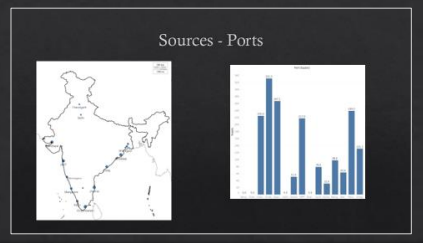
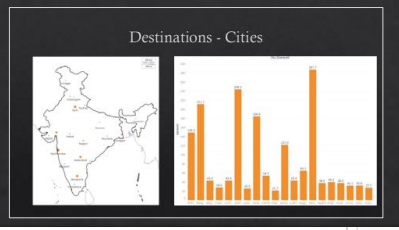
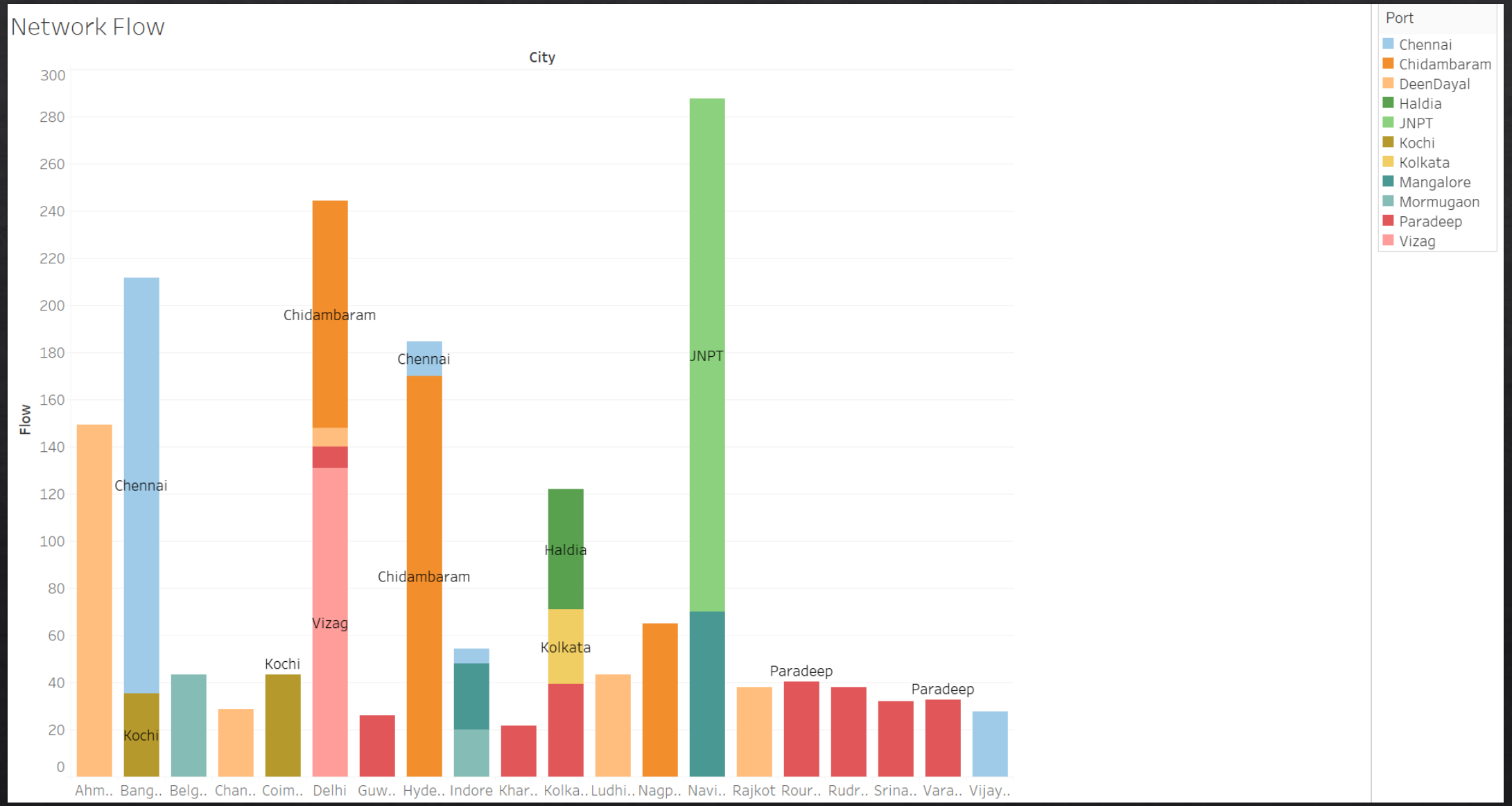


How is the demand met





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