Logistics Tracking and Synchronization Solution of CommaTech

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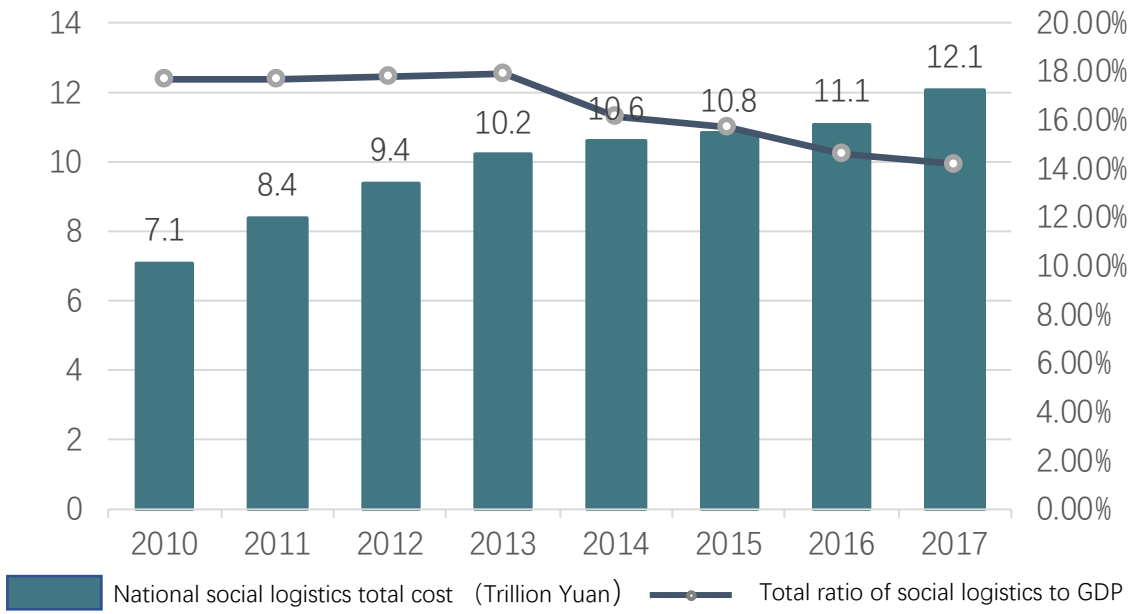
逗号科技
COMMATECH

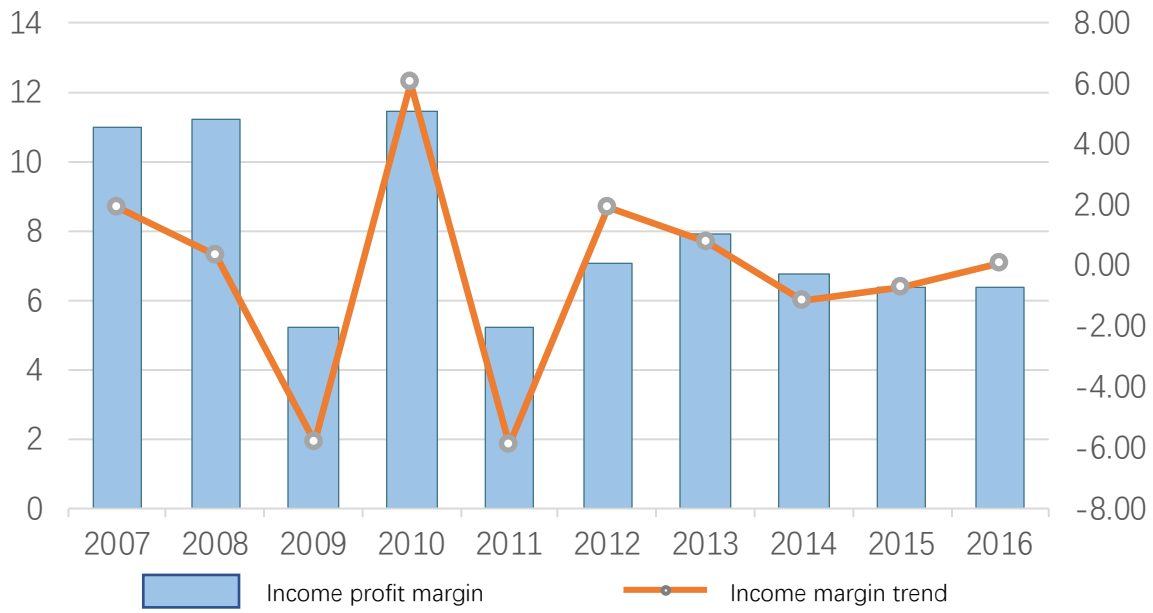
Part One

Background

01

Background





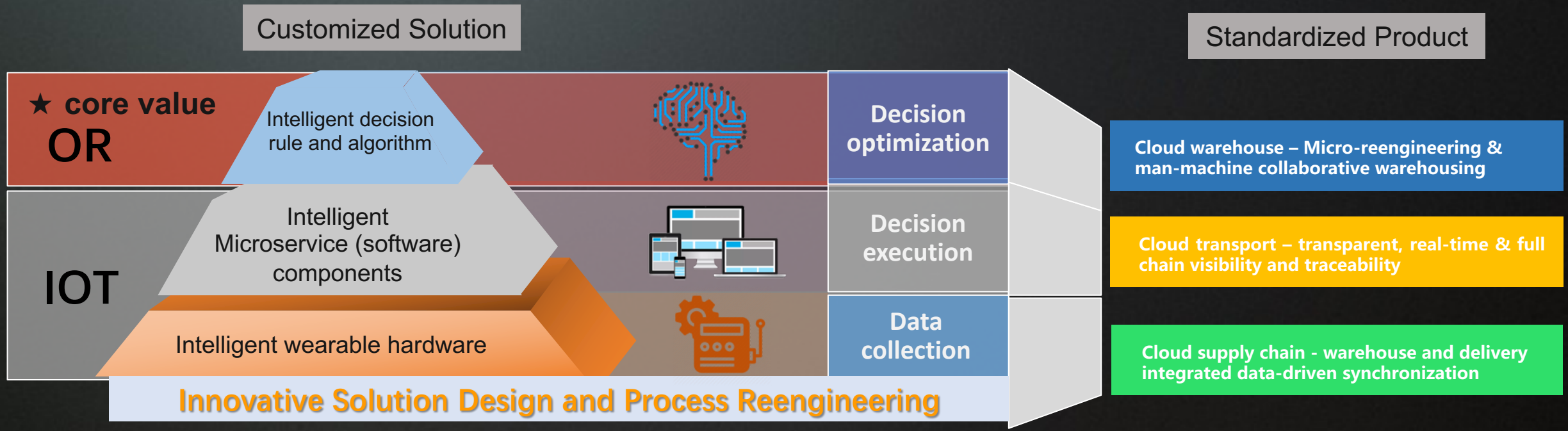
- **The China logistics market is huge. The total social logistics cost in 2017 was 12.1 trillion, with a compound growth rate of 7%.**
- **The maturity of the logistics industry needs to be improved, and the total logistics cost accounts for 14% of GDP, which is far from the countries of Europe, America and Japan (on average 8%-10%).**
- **The overall profit margin of the logistics industry is around 5%, and the cost reduction is urgently needed.**

Business Model

"Over the past three years, we have contacted and served more than 100 logistics supply chain companies, and almost all 2B companies need an integrated one-stop solution."

The core value of enterprise empowerment lies in the third layer (realizing cost reduction and efficiency increase), and with the abundant scenes and data, the decision is more precise and effective.

However, the current status is the lack of data or inaccurate, incomplete, and untimely data collection.



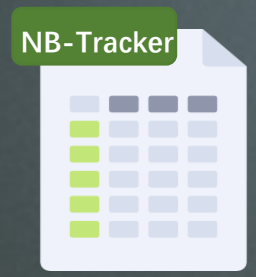
CommaTech core competitiveness: Algorithm-driven software and hardware integrated and innovative solution.

Part Two

Core Technology

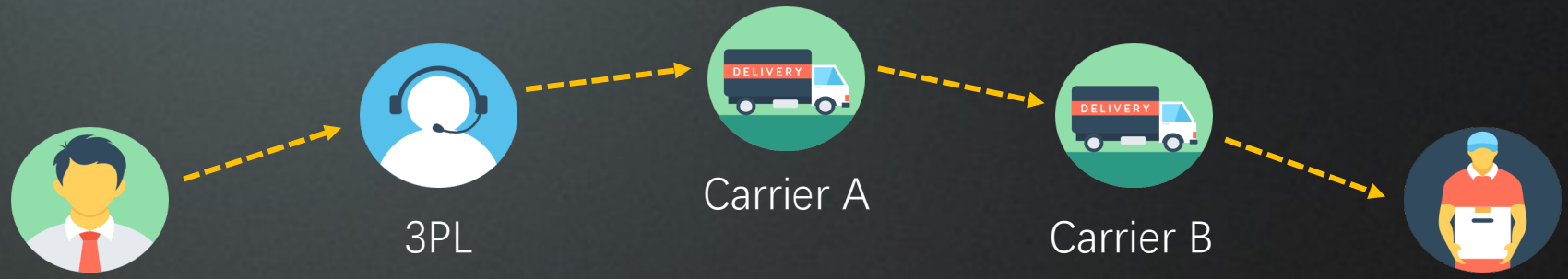
02

“Binding order”



“Binding goods”

“Binding vehicle”



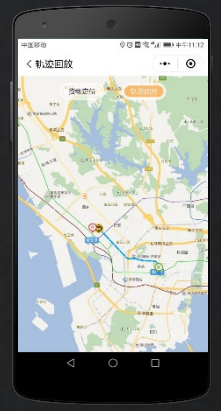
Owner 3PL Carrier A Carrier B Receiver

Only GPS is not enough!

Challenges in China’s transportation logistics market: **Small Scattered Disordered**

A Unified Platform Solution is Needed for Full-truckload Transport, Less-than-truckload Transport & City Logistics

NB-Tracker



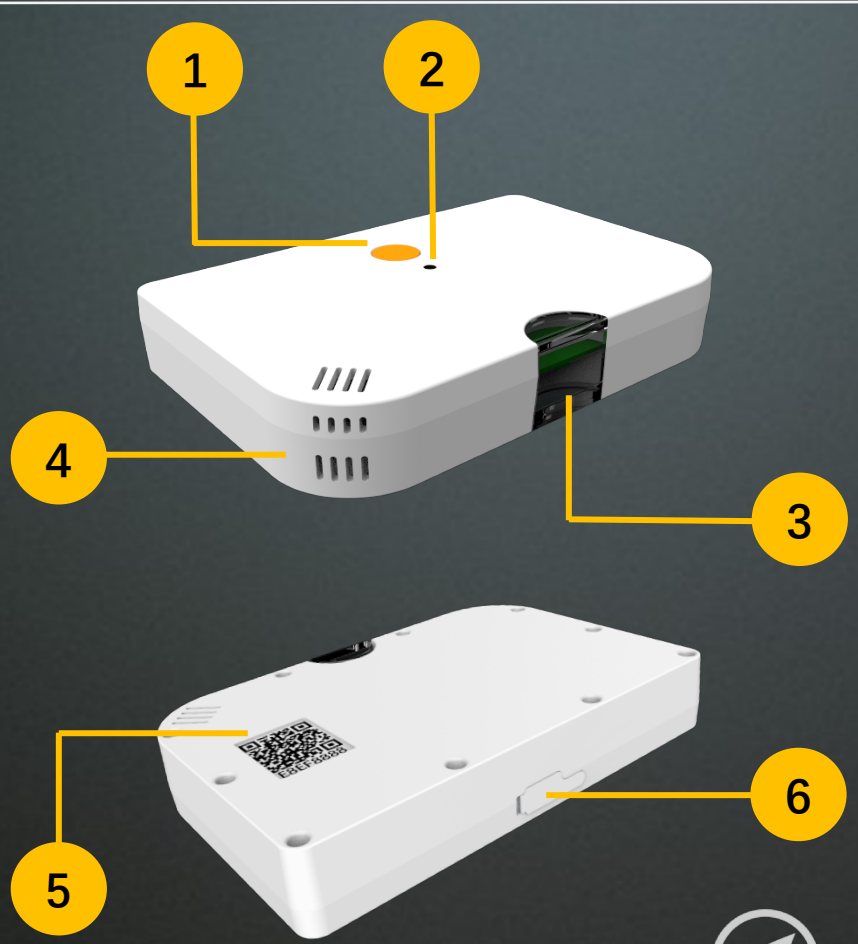
WeChat applet

Overall Solution

logistics cloud platform

data analysis and abnormal warning

CommaTracker Pro

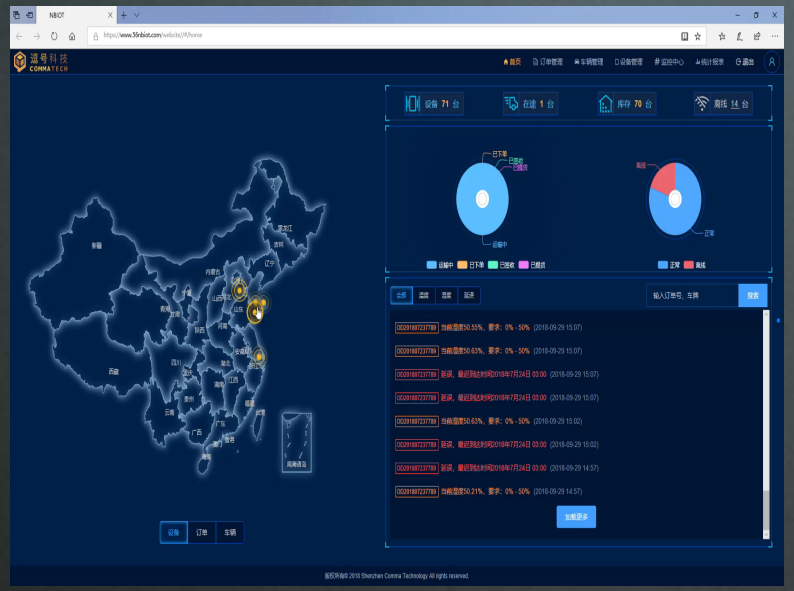


No.	Name	Description
①	power button	view battery status
②	LED flashing light	green, yellow, and red indicate that the device has sufficient, medium, and low battery levels.
③	light sensor	collect light data
④	temperature and humidity sensor	collect temperature and humidity data
⑤	devise serial number	device unique code
⑥	USB interface	for device charging and upgrading

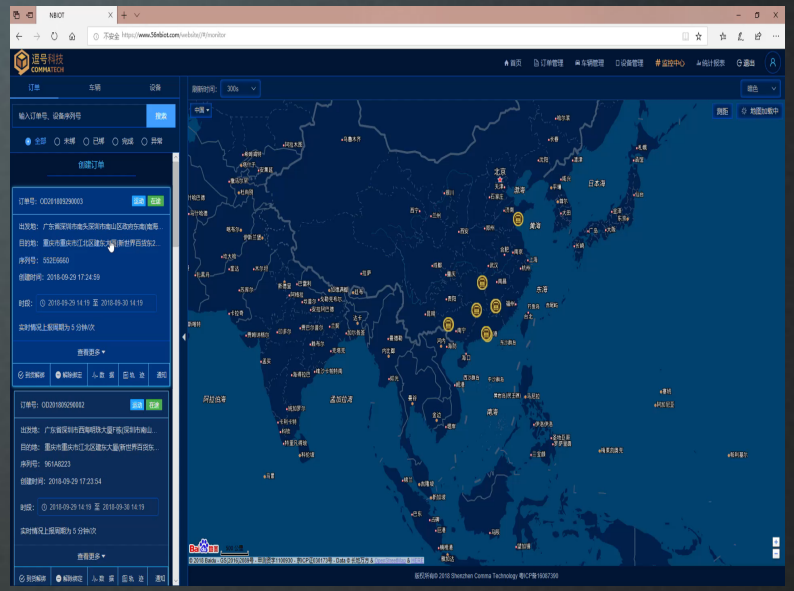
NB-IoT +

position temperature humidity light shock tilt

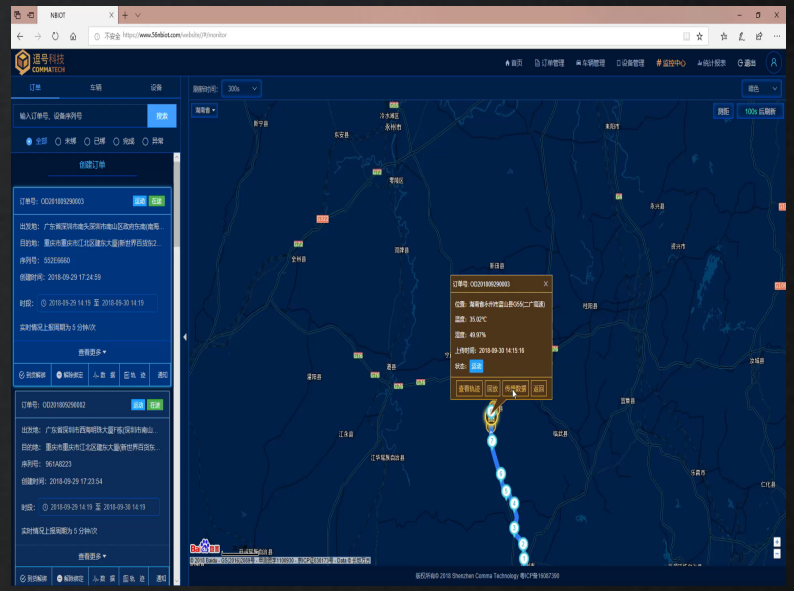
Smart Logistics cloud platform



- big data visualization
- understand the location distribution and usage of all devices
- master different types of abnormal alarm conditions (e.g., temperature, humidity, light, position, etc.)
- get real-time KPI information



- create orders, customize data upload content (including latest arrival time, temperature and humidity range, etc.)
- define users who receive abnormal alerts for each order across logistics chain



- query on the real-time location of orders, vehicles and equipment, and support trajectory playback
- display multi-dimensional data (including temperature and humidity, light, etc.) of orders and vehicles in transit

WeChat for Multi-Players in logistics ecosystem

Advantages:

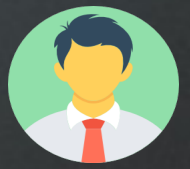
✓ **Free installation**
can be used inside WeChat, go away when you run out

✓ **Free registration**
share the order data to others for a one-time view by sharing

✓ **Mobile office**
real-time data update, abnormal warning information is known at the first time

3PL

driver



owner

receiver

Part three

Case of Urban Distribution for Intelligent Planning of CR Vanguard

03

China Resources (CR) Vanguard

- More than 10 RDC, 3000+ stores nationwide, covering 29 provinces in China, 242 cities, 2000+ cars per day;
- Logistics costs account for a high proportion of total operating expenses, with annual logistics costs of 1.5 billion;
- The inventory of urban stores is small, the frequency of replenishment is high, the demand for single stores cannot fill the vehicles, and carpooling is required;
- Shops in urban areas are densely distributed and delivery routes need to be properly designed.

1

High-rise shelf

2

Sorting

3

Stocking lane

4

Loading dock

5

Loading/closing

The Core Question: how to carpool the goods in multiple stores and design the driving route for each car?

Store 1:

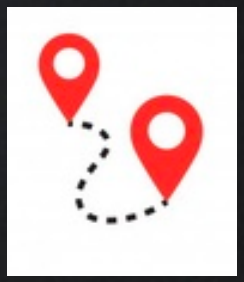
Store 2:

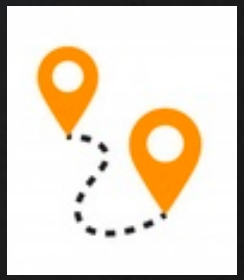
Store 3:

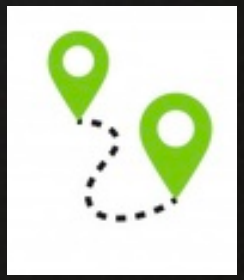
Store 4:

.
.
.

Store N:







Current Situation I: Based on experience, the stores are combined into a number of fixed routes, and will not be adjusted according to demand.

	明细数(个	配送点
5	6	宝源路分店,文汇分店,天骄世家便利店,骏丰园分店,滨海大厦便利店
7	7	东海国际便利店,华强电子便利店,盛唐大厦店,侨香村便利店,皇城广场分店,卓越便利店,经贸中心分店
7	11	东海国际便利店,华强电子便利店,盛唐大厦店,侨香村便利店,卓越便利店,皇城广场分店,经贸中心分店
6	7	汉京大厦便利店,美年广场店,中心路便利店,数码大厦分店,招商广场分店,南海便利店
6	6	汉京大厦便利店,美年广场店,中心路便利店,数码大厦分店,招商广场分店,南海便利店
6	6	汉京大厦便利店,中心路便利店,美年广场店,数码大厦分店,招商广场分店,南海便利店
6	9	汉京大厦便利店,中心路便利店,美年广场店,数码大厦分店,招商广场分店,南海便利店
7	7	华强电子便利店,东海国际便利店,盛唐大厦店,侨香村便利店,皇城广场分店,卓越便利店,经贸中心分店
7	7	华强电子便利店,东海国际便利店,盛唐大厦店,侨香村便利店,卓越便利店,皇城广场分店,经贸中心分店
5	5	锦绣分店,Ole深圳海上世界店,山海逸居分店,Ole深圳壹方城店,蔚蓝海岸分店
5	6	莲塘聚宝便利店,海山分店,壹海城三分店,君逸华府便利店,海轩广场便利店
5	5	六约二分店,万象汇分店,六约三分店,六约一分店,万象分店
5	5	六约二分店,万象汇分店,六约三分店,六约一分店,万象分店
5	5	六约二分店,万象汇分店,六约三分店,六约一分店,万象分店
5	5	龙岗天安数码,嘉宏湾花园便利店,东方沁园店,摩尔城便利店,益田假日天地二分店
6	6	龙岗天安数码,嘉宏湾花园便利店,摩尔城便利店,东方沁园店,益田假日天地二分店,天健城分店
5	5	前海便利店,三诺大厦便利店,浪琴半岛便利店,前海湾物流园便利店,汇景豪苑便利店
5	5	前海便利店,三诺大厦便利店,浪琴半岛便利店,前海湾物流园便利店,汇景豪苑便利店
5	8	前海便利店,三诺大厦便利店,浪琴半岛便利店,前海湾物流园便利店,汇景豪苑便利店
5	5	前海公馆分店,海运分店,新时代二分店,兰溪谷分店,桃花园分店
5	5	万科麓城分店,南方科技大学分店,清湖地铁2便利店,水木丹华分店,深圳龙胜地铁二店
6	6	粤商中心一分店,赛龙豪轩分店,龙华九方分店,卓越城分店,莱蒙春天分店,南方明珠
6	8	粤商中心一分店,赛龙豪轩分店,龙华九方分店,卓越城分店,莱蒙春天分店,南方明珠
6	6	粤商中心一分店,赛龙豪轩分店,龙华九方分店,卓越城分店,莱蒙春天分店,南方明珠

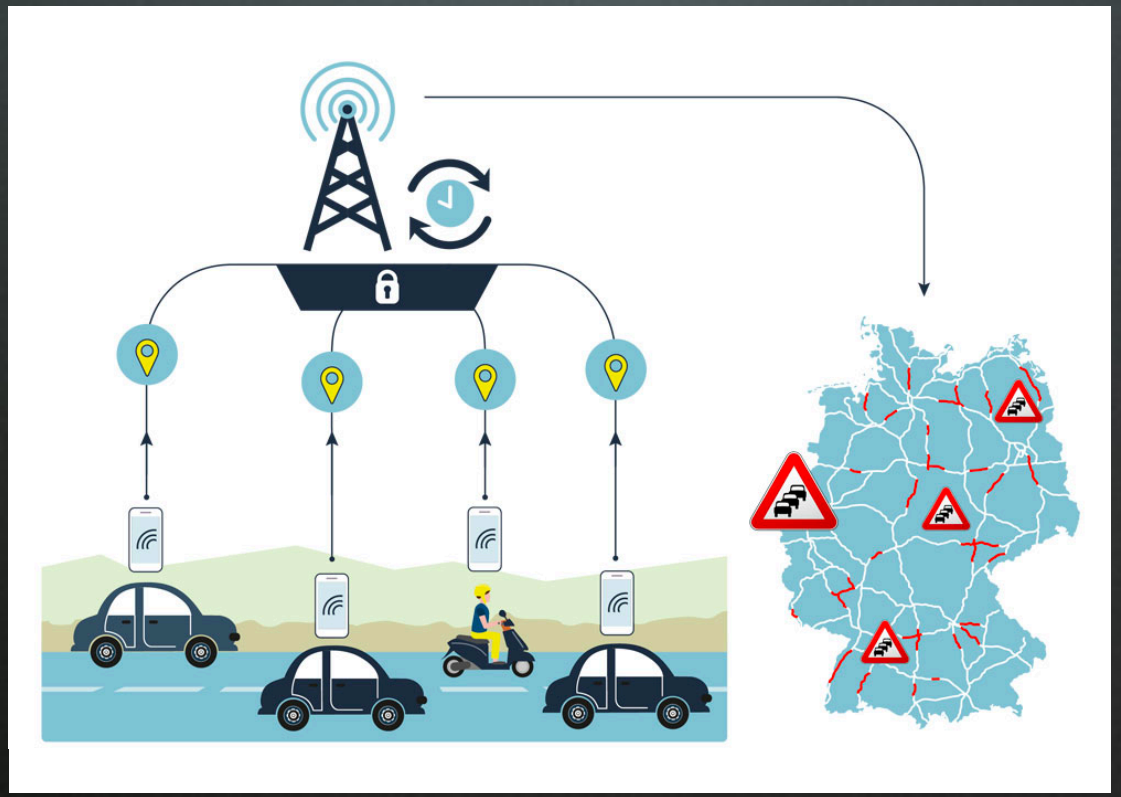
Current Situation II: Unable to take into account the time window of receipt, which may affect the operation of the store and receive complaints from the store everyday

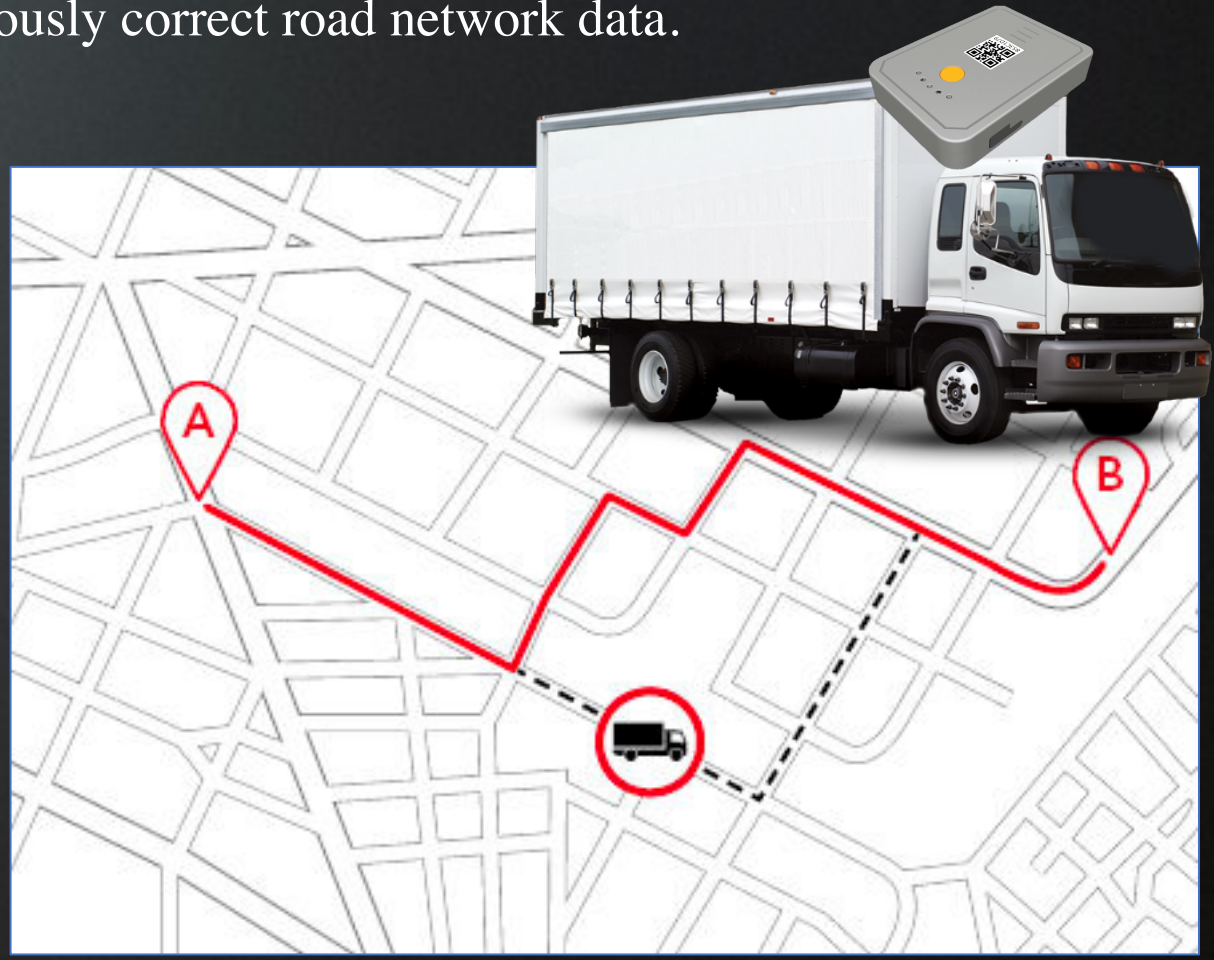
门店名称	当前车型报价(按车计算)	货量(箱)	到达时间	最早收货时间	最迟收货时间
云里智能园分店	249.26	29.93	15:36	06:00	07:30
壹海城二分店	299.24	11.46	09:21	06:00	07:30
创建大厦店	294.06	27.47	09:19	06:00	07:30
南方科技大学分店	304.93	11.45	09:04	06:00	07:30
优越时代分店	273.05	58.68	08:46	06:00	07:30
万象分店	297.22	41.62	08:45	06:00	07:30
太阳花	276.9	21.49	08:44	06:00	07:30
深圳龙胜地铁二店	272.04	11.03	08:42	06:00	07:30
连城新天地便利店	287.47	49.51	08:40	06:00	07:30
财富广场便利店	308.93	11.67	08:39	06:00	07:30
科学园分店	315.9	73.6	15:54	08:00	15:00
摩尔城便利店	296.84	19.8	08:04	06:00	07:30
红树绿洲分店	297.86	204.95	15:33	08:00	15:00
新时代二分店	338.84	19.42	07:33	06:00	07:30

门店名称	当前车型报价(按车计算)	货量(箱)	到达时间	最早收货时间	最迟收货时间
万象汇分店	225.95	1.37	11:02	06:00	07:30
清湖地铁2便利店	246.67	12.32	11:00	06:00	07:30
深圳北地铁二店	315.36	21.56	10:22	06:00	07:30
滨海大厦便利店	335.46	13.62	10:20	06:00	07:30
万象分店	297.22	19	10:11	06:00	07:30
壹海城二分店	299.24	20.94	10:04	06:00	07:30
嘉宏湾花园便利店	320.42	29.39	10:01	06:00	07:30
深圳龙胜地铁二店	272.04	23.39	09:28	06:00	07:30
金地便利店	305.83	0.79	09:22	06:00	07:30
蛇口人才公寓分店	330.2	15.34	08:53	06:00	07:30
宝源路分店	345.29	21.11	08:50	06:00	07:30
南方科技大学分店	304.93	38.61	08:38	06:00	07:30
八号仓分店	269.15	17.75	08:35	06:00	07:30

Challenge 1: How to improve the accuracy of the basic data?

- The initial data comes from an open platform such as Baidu / Gao De (Chinese Google Map).
- Track vehicles by intelligent hardware and continuously correct road network data.





Challenge 2: How to ensure delivery timelines under dynamic road conditions?

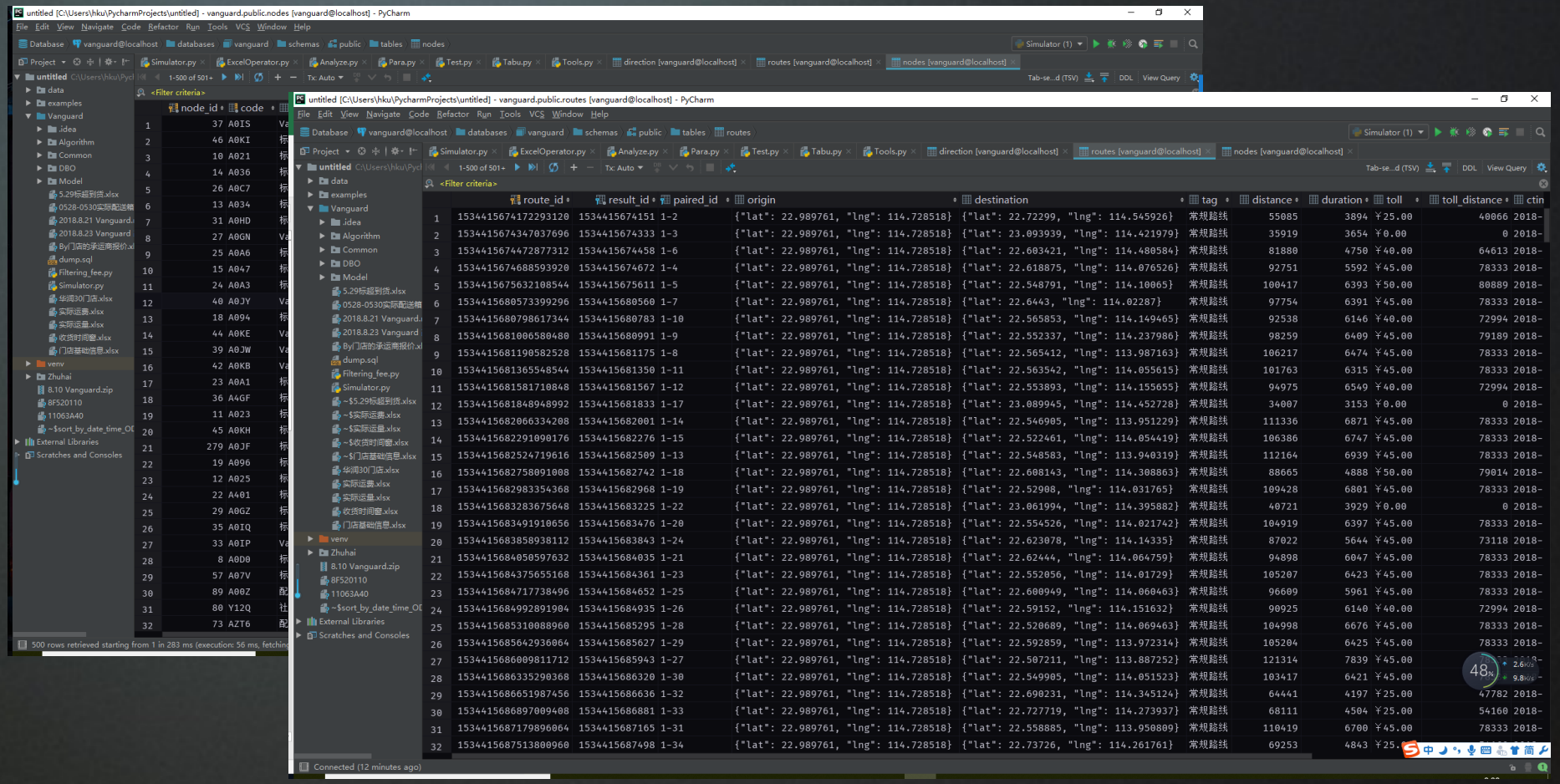
Leisure time road condition

Peak road condition

- Usually not blocked, blocked at peak
- The journey is not blocked, the return is blocked.
- Workday is not blocked, weekend blocking
- Dynamic road conditions have certain regularity
- Time series analysis based on historical data
- Predict future road conditions

Go through the congested roads during the non-congestion time period, arrange the trip reasonably

Challenge 3: How to improve the speed and quality of the solution?

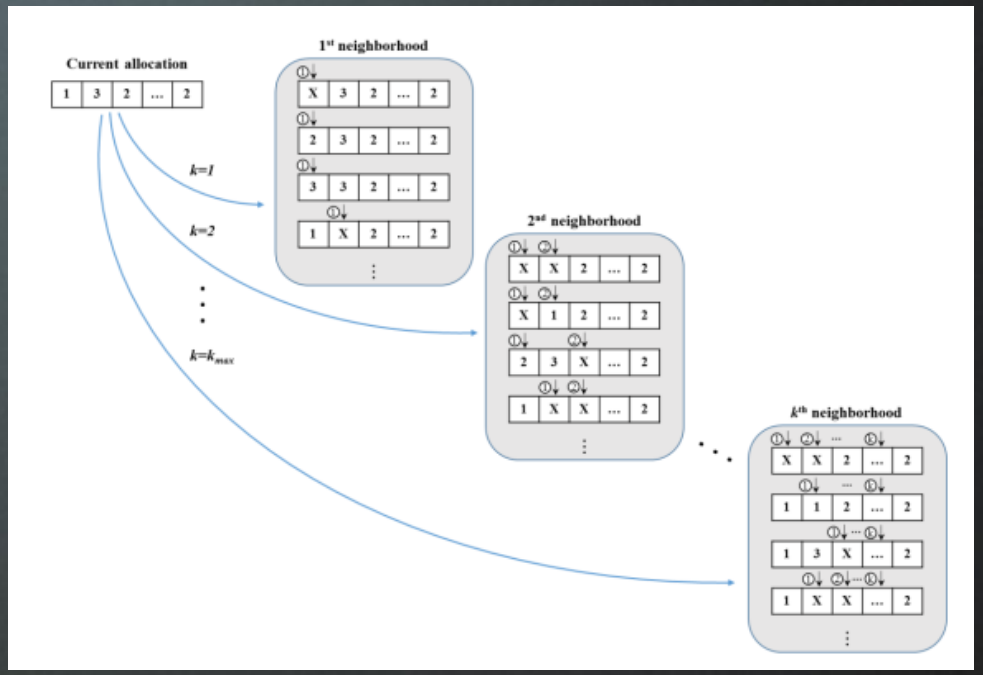


- Building an electronic road network: taking a certain city as an example, the data volume is about 25GB, and the working mode of "online update, offline operation" is realized.
- Based on the characteristics of the algorithm, the database is consolidated and optimized to speed up the database query.

Challenge 3: How to improve the speed and quality of the solution?

Using a mathematical language, describe:

- Various optimization goals
- "around the road"
- "corner"
- “Generally not splitting the order”
- “Not worthwhile”



One of the most advanced algorithmic architectures in the world of VRP： VNS + TS

- VNS（Variable Neighborhood Search）： Responsible for controlling search depth
- TS（Tabu Search）： Control search accuracy
- Introduce "matching set", "elite solution strategy", "perturbation strategy", etc. to improve search quality
- Self-learning adjustments to algorithms and operators based on actual customer data

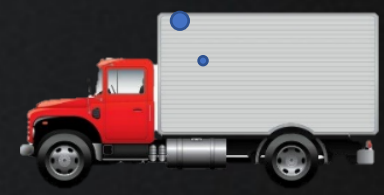
Algorithm 1: Overall Framework

```
A ← Choose a random allocation
S' ← Construct(A)
IF S' is feasible
    S* ← S'
END IF
k ← 1
REPEAT
    A' ← Shake(A, k)
    S' ← Construct(A')
    IF obj(S') > λ * obj(S*)
        S' ← TabuSearch(S')
            IF obj(S') > obj(S*)
                S* ← S'
                A ← A'
                k ← 1
                count ← 1
            ELSE
                count ← count + 1
            END IF
    ELSE
        count ← count + 1
        IF count = StepSize(k)
            k ← k + 1
            count ← 0
        END IF
    END IF
UNTIL k > k_max
```

Challenge 4: How to balance multi-stakeholder interests?

store have opinions

driver has opinions

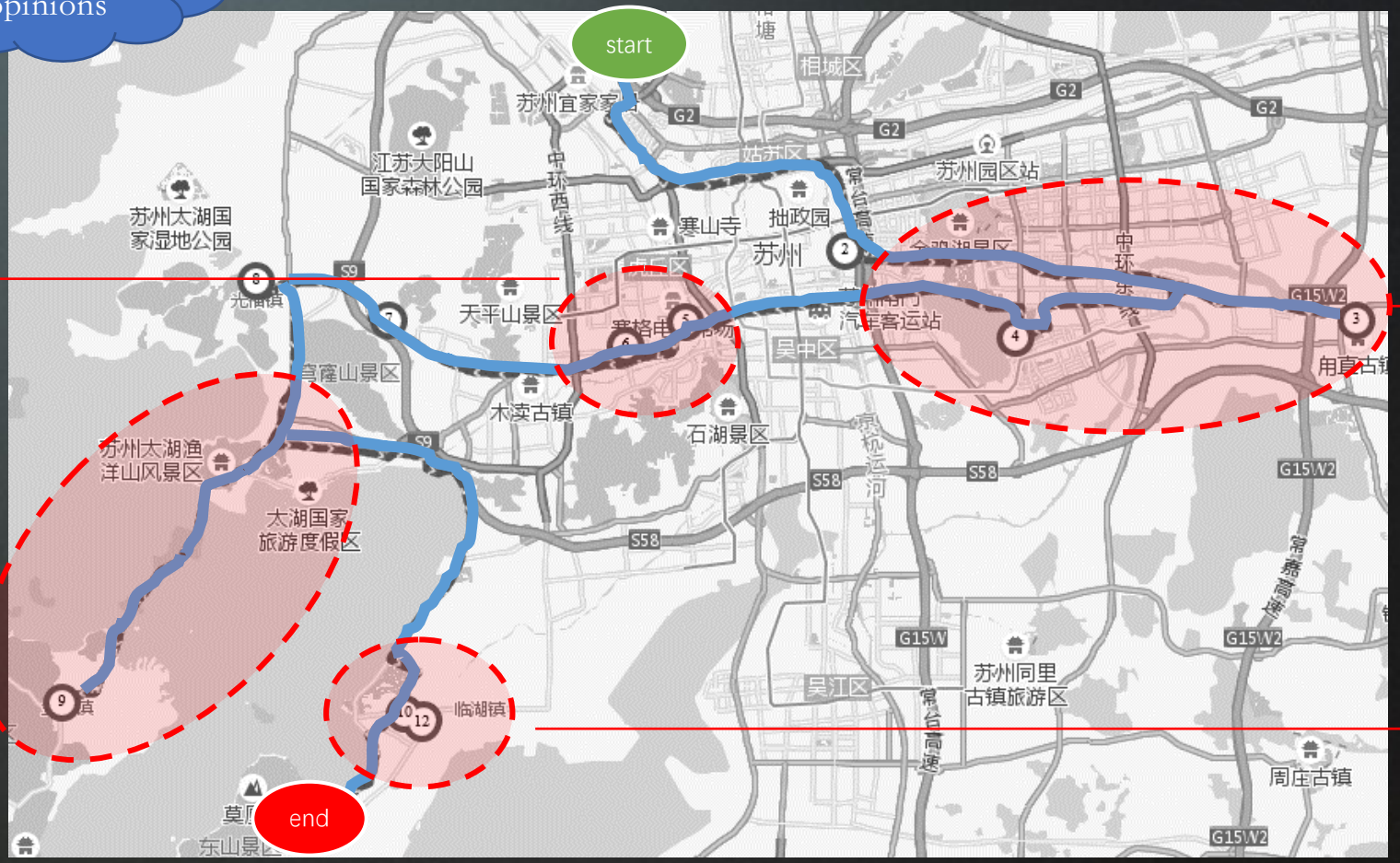


"It is best not to split the order"

"Route has a return"

"Round the road"

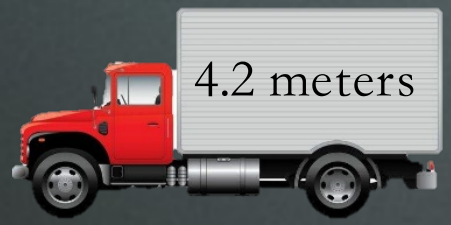
"Not worthwhile"



The algorithm needs to consider the complex game between the owner and the driver, the driver and the driver, and take care of the interests of all parties.

Challenge 5: Full consideration of various constraints in reality

- 1. Multiple types of vehicles,
  as well as limited travel policies (electric vehicles)



- 2. Multiple quotation methods :
  - Parcel-share valuation
    (by volume, by weight, number of boards)
  - Vehicle pricing
  - Loading/Unloading fee
  - Minimum cost...

- 3. driver :
  - Balance of income between drivers
  - Work intensity balance, fatigue assessment

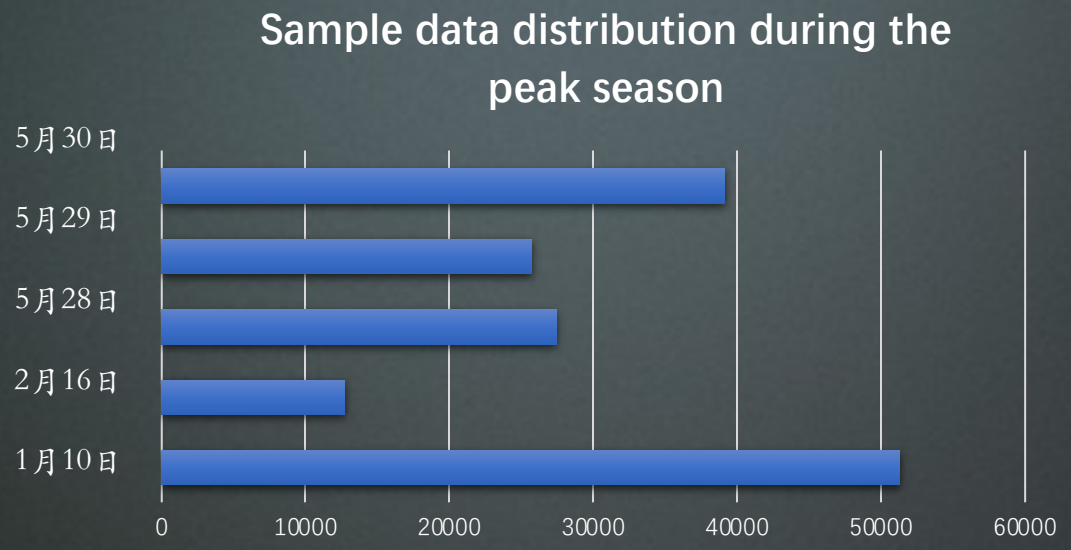
- 4. Multiple central warehouses
  - Dry goods
  - Fresh, vegetable and fruit warehouse
  - Frozen warehouse
  - Partial sharing between vehicles

Challenge 6: Support for manual intervention

For the "with comments" route, you can click X, after a round of evaluation, real-time recalculation, iterative improvement

Challenge 6: Support for manual intervention

Comparative Results ：



- The total cost is reduced by 25-30%, the driver's total driving mileage is reduced by about 30%, and the average driver's revenue per kilometer is increased by about 5%.

日期	人工			算法			对比		
	总费用（元）	总里程（KM）	费用/公里	总费用（元）	总里程（KM）	费用/公里	总费用（元）	总里程（KM）	费用/公里
1月10日	51283	4984	10.29	42139	3853	10.94	-18%	-23%	6.3%
2月16日	12726	1585	8.03	9729	1147	8.48	-24%	-28%	5.6%
5月28日	27438	3079	8.91	17828	1878	9.49	-35%	-39%	6.5%
5月29日	25704	2605	9.87	18859	1877	10.05	-27%	-28%	1.8%
5月30日	39132	3930	9.96	28785	2784	10.34	-26%	-29%	3.8%
均值	**31256.6**	**3236.6**	**9.41**	**23468**	**2307.8**	**9.86**	**-25%**	**-29%**	**4.8%**

THANKS

THANKS FOR YOUR ATTENTION

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COMMATECH

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