



Smart Trip Schedule System Proposal

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2022-July

- 1** Key Finding & Executive Summary
- 2** Current Trip Schedule Process
- 3** Performance Analysis
- 4** Smart Trip Schedule System (Optimization Solution)
- 5** Next Step & Timeline



Executive Summary

Current offline and manual trip schedule process in local markets lead to high cost in outsourcing trips and high waste rates for in-house cars:

Topic	Key findings from common problems	Business Request
Current Trip Schedule Process	<ul style="list-style-type: none">Now, trips are scheduled manually and offline. Besides the process repeats thousands time monthly in ID market. <p>Detail on Page 4</p>	<ol style="list-style-type: none">A smart system automatically schedules trips deciding trips numbers, car type, vendor type and etc.Local operation team can edit, add and cancel scheduled trips for flexibility.
Performance & Optimization Solutions	<ul style="list-style-type: none">Low accuracy in forecasting demand (transition orders & parcel numbers)Low accuracy in estimating car capacityNo cost optimization in selecting outsourcing vendor <p>Detail on Page 5-6</p>	<ol style="list-style-type: none">Need forecast orders in a smarter way (by statistical machine learning models)Need update & maintain the car capacity for better schedule of tripsNeed selecting vendors for outsourcing cars in smarter way (by optimization method)



Current trip schedule process

Forecast orders

forecast daily orders = (Total orders in last 7 days) / 7

Set capacity

CDDL: 4.5 K parcels; CDEL: 2.5k-3K

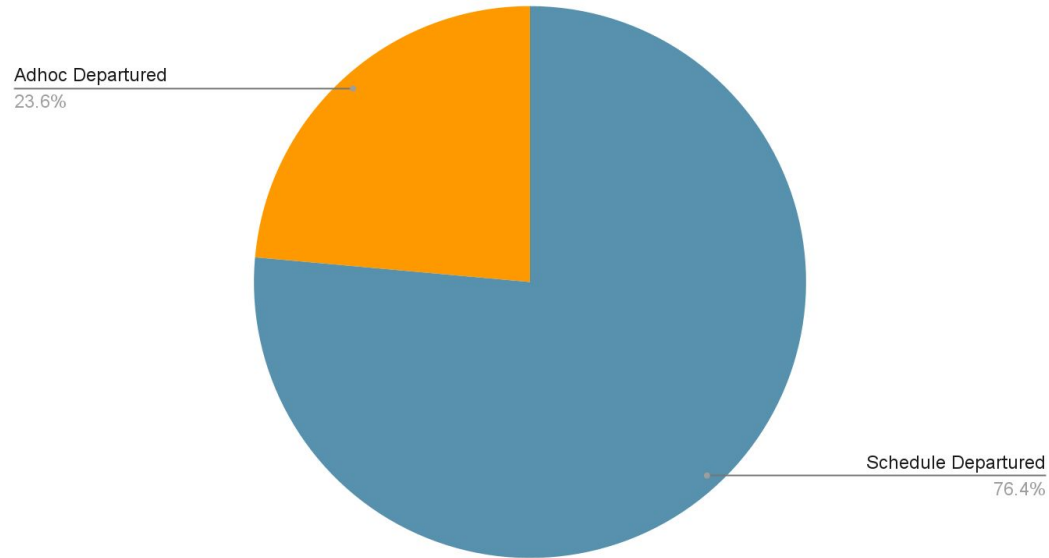
Decide trip numbers

trip numbers = forecast daily order / car capacity

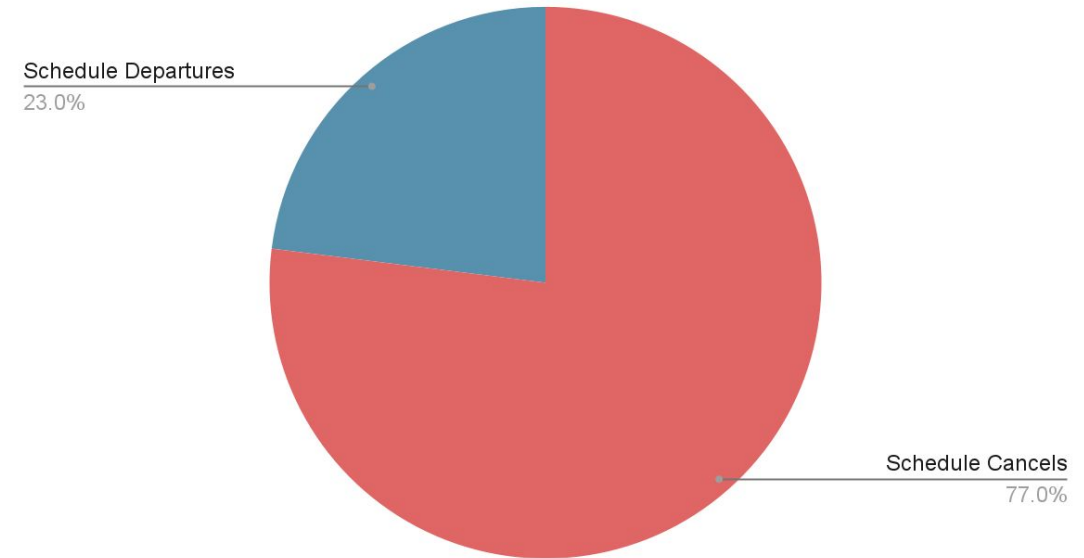


Performance Analysis

Scheduled vs Ad-hoc in ID Market (total 250,000 trips)



Cancel vs Departure in ID Market (total 840,000 trips)



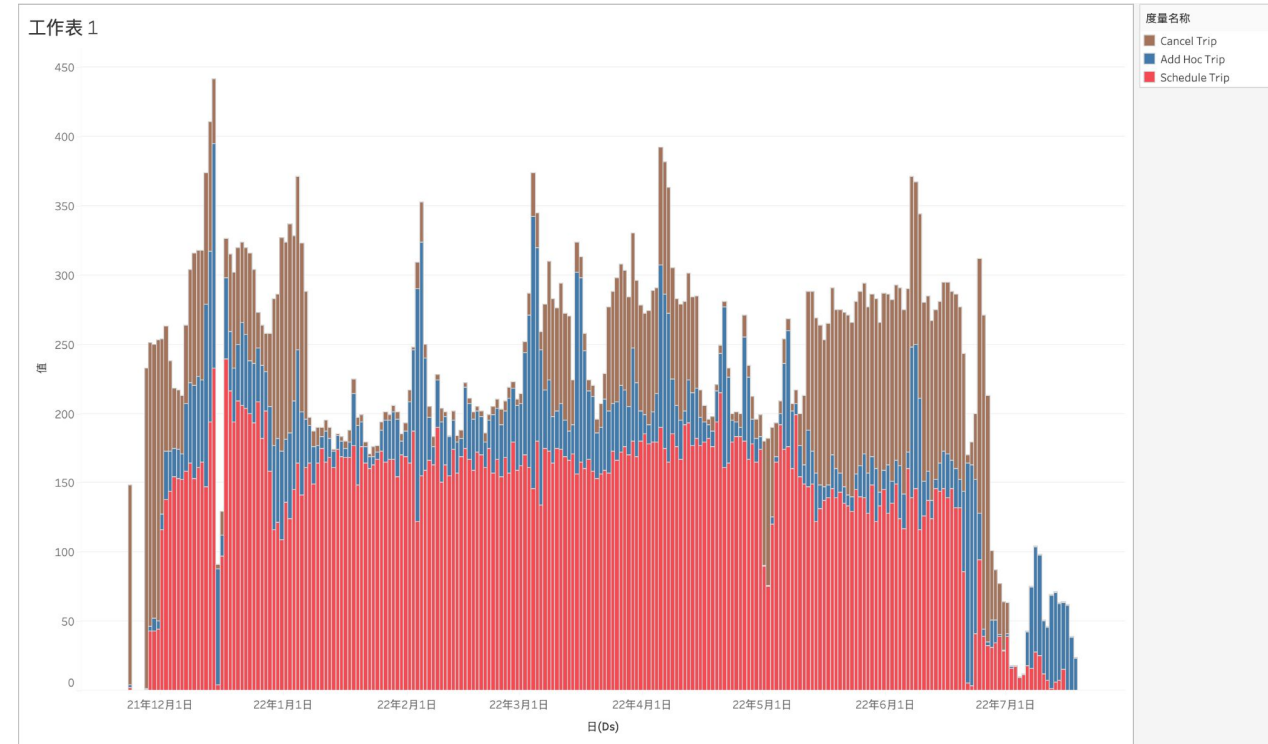
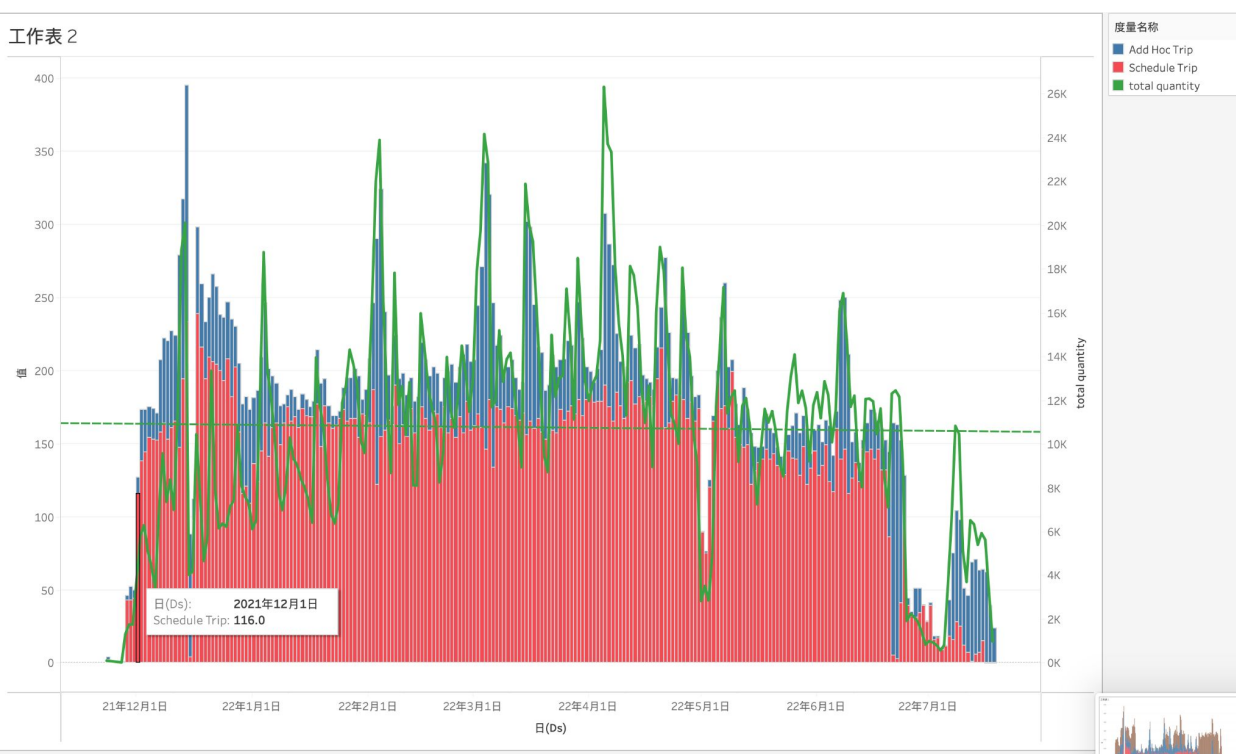
Observation:

- Sometimes scheduled too few trips than actually needed so ad-hoc trips takes around 23% in all departures
- Sometime scheduled too many trips than actually needed so cancel trips take 77% in all scheduled trips



Trips over time

Trips In Jakarta 2021-Nov to 2022-July



Observation:

- In left graph, actual **transition orders** fluctuate over time but current **schedule departures** keep stable so current forecast can not capture the fluctuation and need lots of add hoc to fill the gap between the demand (the green part) and supply (the red part)
- In the right graph, the **cancel trips** and **ad-hoc trips** keep around 30-50 percentage, so they are hard to optimize with current process.
- All in all, current logic does not respond to order quantity changes effectively so we need to a smarter order quantity forecast model.



Background (Load rate analysis in Jakarta)

Can avoid low load trips by smarter trip schedule system

	date	hour	station_r	station_name_arrive_station	a	sch	ad_h	schedule_departured_count	weight_sum	weight_median	quantity_sum	transport_quantity	transport_quantity_median	ad	schedule_parcel_quantity	vehicle_type
3621	2022/6/8		16	Jakarta DC Daan Mogot Hub	0	0	1	2	1321844	302406	60	11	1946		723	['4WH', '4WH', '4WH']
2916	2022/6/6		7	Jakarta DC Kembangan Hub	0	0	0	2	772492	386246	98	49	0		1279	['4WH', '4WH']
57	2022/5/23		3	Jakarta DC Jatiasih Hub	0	0	0	2	1122833	561416.5	102	51	0		1883	['4WH', '4WH']
5030	2022/6/15		3	Jakarta DC Pondok Gede Hub	0	0	0	2	1944858	972429	122	61	0		3336	['4WH', '4WH']
2453	2022/6/4		0	Jakarta DC Pancoran Hub	0	0	0	2	2571474	1285737	135	67.5	0		4613	['4WH', '4WH']
4774	2022/6/13		21	Jakarta DC Bekasi Barat Hub	0	0	0	2	2168551	1084275.5	155	77.5	0		3831	['4WH', '4WH']
557	2022/5/25		20	Jakarta DC Pancoran Hub	1	0	0	2	2159952	1079976	156	78	0		3988	['4WH', '4WH']
2670	2022/6/5		0	Jakarta DC Pancoran Hub	0	0	0	2	2695693	1347846.5	166	83	0		4333	['4WH', '4WH']
5368	2022/6/16		20	Jakarta DC Bekasi Barat Hub	0	0	0	2	2336400	1168200	166	83	0		4176	['4WH', '4WH']
1740	2022/5/31		16	Jakarta DC Pancoran Hub	0	0	0	2	3522679	1761339.5	172	86	0		6758	['4WH', '4WH']
1122	2022/5/28		12	Jakarta DC Pancoran Hub	0	0	0	2	2807227	1403613.5	173	86.5	0		6419	['4WH', '4WH']
4260	2022/6/11		1	Jakarta DC Kab. Sukabumi Hub	0	0	0	2	2334251	1167125.5	174	87	0		4780	['4WH', '4WH']
1205	2022/5/28		23	Jakarta DC Cirebon Hub	0	0	0	2	2862891	1431445.5	186	93	0		5948	['4WH', '4WH']
6922	2022/6/24		8	Jakarta DC Pulogadung Hub	0	0	0	2	2988973	1494486.5	186	93	0		5809	['4WH', '4WH']
1767	2022/5/31		19	Jakarta DC Rempoa Hub	0	0	0	2	3168666	1584333	210	105	0		5871	['4WH', '4WH']
2366	2022/6/3		16	Jakarta DC Kalideres Hub	0	0	0	2	5225330	2612665	258	129	0		11798	['4WH', '4WH']
5243	2022/6/16		3	Jakarta DC Cirebon Hub	0	0	0	2	4126187	2063093.5	292	146	0		8497	['4WH', '4WH']
3776	2022/6/9		3	Jakarta DC Kalideres Hub	0	0	0	2	5355892	2677946	296	148	0		10542	['4WH', '4WH']
5394	2022/6/16		22	Jakarta DC Cirebon Hub	0	0	0	2	4402962	2201481	308	154	0		8929	['4WH', '4WH']
7566	2022/7/1		13	Jakarta DC Pancoran Hub	0	0	1	1	11552	5776	3	1.5	7		0	['4WH', '4WH']
7368	2022/6/28		3	Jakarta DC Cimanggis Hub	0	0	1	1	14807	7403.5	5	2.5	0		6	['4WH', '4WH']
5908	2022/6/19		9	Jakarta DC Cipondoh Hub	0	0	1	1	22628	11314	8	4	7		3	['Car/Van (4WH)', 'Car/Van (4WH)']
7216	2022/6/26		7	Jakarta DC Cipondoh Hub	0	0	1	1	206588	103294	46	23	44		103	['Car/Van (4WH)', '4WH']
3632	2022/6/8		17	Jakarta DC Bekasi Barat Hub	0	0	1	1	931895	465947.5	49	24.5	1626		331	['4WH', '4WH']
4285	2022/6/11		3	Jakarta DC Penjaringan Hub	0	0	1	1	925154	462577	50	25	1578		300	['4WH', '4WH']
2065	2022/6/2		3	Jakarta DC Kemayoran Hub	0	0	1	1	978068	489034	59	29.5	4		1608	['4WH', '4WH']
1949	2022/6/1		15	Jakarta DC Bungursari Hub	0	0	1	1	769875	384937.5	60	30	723		869	['4WH', '4WH']

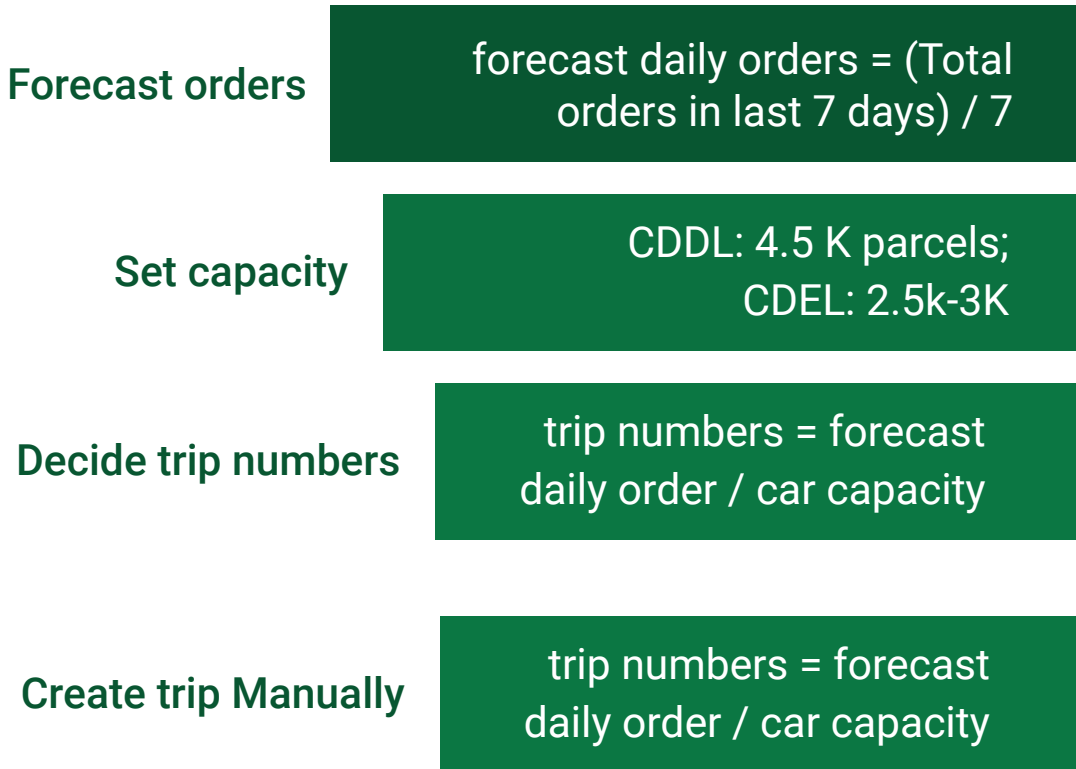
The Smart Trip Schedule System





Smart Trip Schedule System

Current Trip Schedule Process



Improve Forecast process

Adjust car capacity

Improve accuracy in trip numbers

Automate trip schedule process

Optimize Cost

Order Quantity

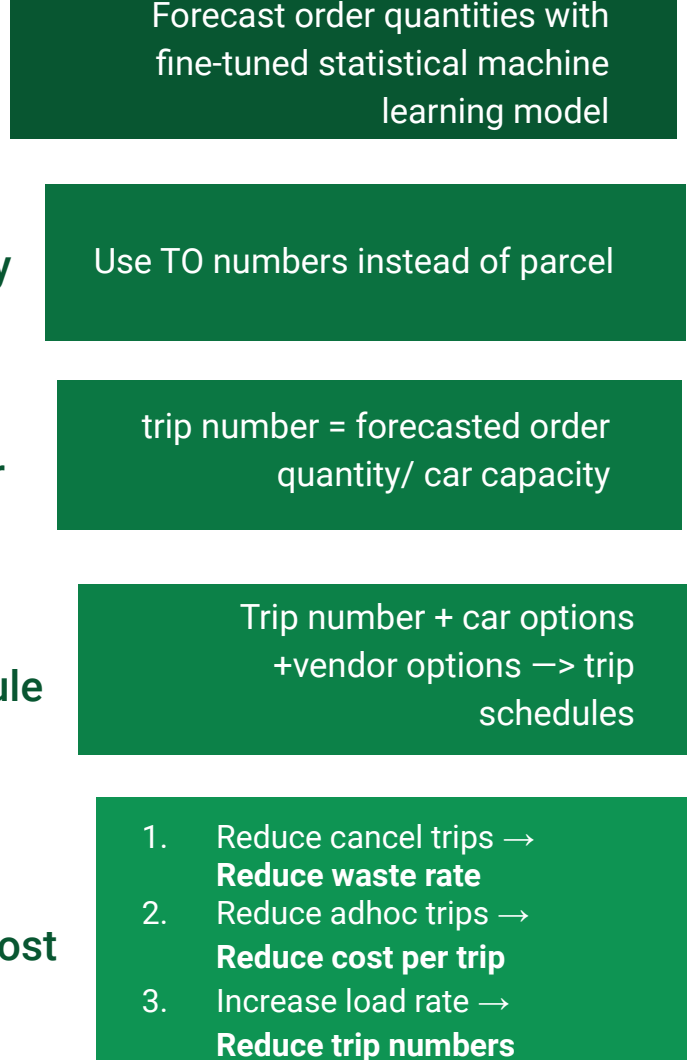
Car Capacity

Trip Number

Trip Schedule

Reduce Cost

Smart Trip Schedule System





Smart Trip Schedule System (Example)

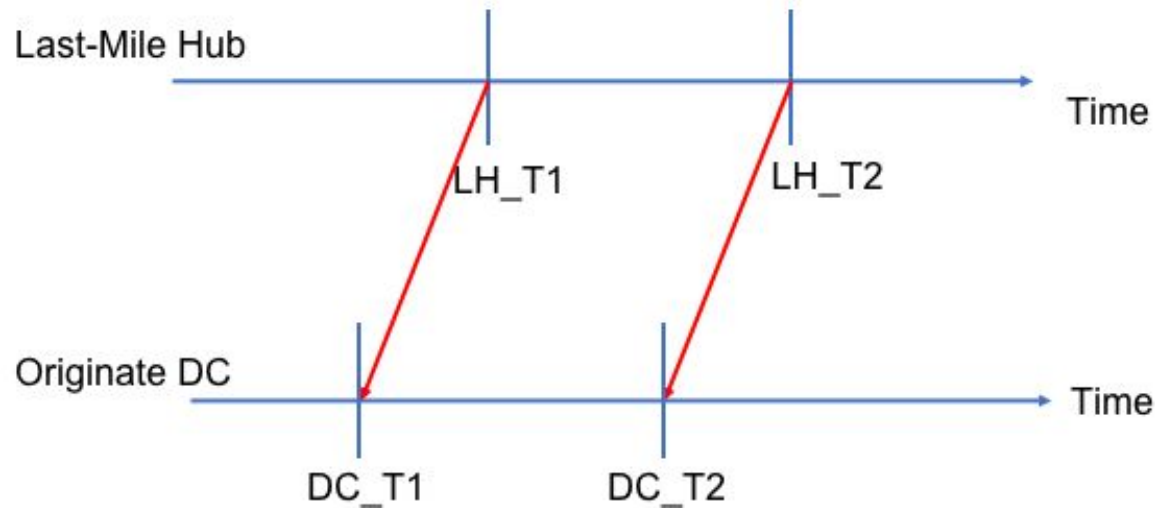
Given Status			System Output			
Departure Station	Arrive Station	Date	STD (Schedule Time to Departure)	car type	car number	car source (???)
Jarkata	Kapuk	2022-07-01	15:00	CDEL	3	in-house car (???)



Smart Trip Schedule System

How to define Scheduled Time of Departure(STD)

Only consider the cut-off time of the destination hub



If DC_T2 need 3 trucks, we can still schedule the departure time of these 3 trucks using DC_T2.

advantage:

The truck can load more parcels, because its STD is a deadline.

If we scheduled the STD of the 3 trucks as STD1, STD2, STD3 where $STD1 < STD2 < STD3 \leq DC_T2$. Truck 1 have to departure at time STD1 even though its load rate is low. If the truck3 is full, then we need to add an adhoc truck. Hence, it have to use 4 trucks. But if we scheduled the STD as DC_T2. Truck 1 can be fully loaded. The total number of truck can be 3.

e.g.

Case1: Truck 1,2,3,4 loaded rate : 20%, 60%, 100%, 60%

Case2(use same STD): Truck 1,2,3 loaded rate: 100%, 100%, 40%.

Disadvantage:

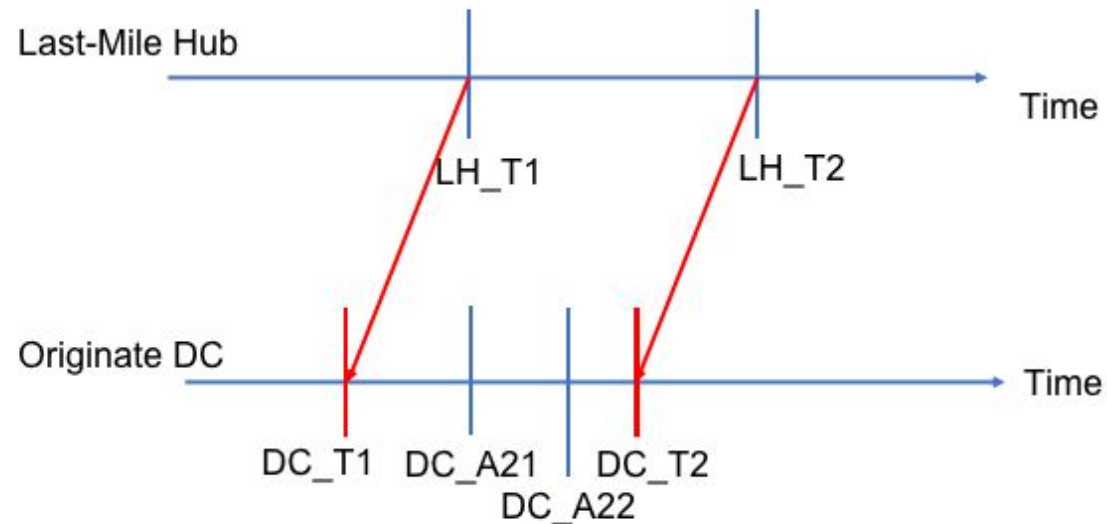
- (1) The actual departure will be variate because the STD is a deadline only. Truck can be departure when it is full.
- (2) The DC must have enough space to store parcels before the truck arrive at.



Smart Trip Schedule System (Example)

How to define Scheduled Time of Arrival(STA)

For the trucks have the same STD, just using the fixed interval time of two trucks.



Truck 1: STA=DC_A21, STD=DC_T2

Truck 2: STA=DC_A22, STD=DC_T2

Interval=DC_A22-DC_A21

Interval can be the constant loading time. Different car types can have different values

Next Steps & Timeline





Smart Trip Schedule System (Timeline)



▲ LOREM