

# Uncovering of an obfuscated public API

U-Zyn Chua  
[chua@uzyn.com](mailto:chua@uzyn.com) | Twitter: @uzyn

# Agenda

1. Background
2. The data obfuscation
3. Visualization & discovery
4. Serverless architecture

# Background

## Taxi-Taxi@SG

[View More by This Developer](#)

By Land Transport Authority (Singapore)

Open iTunes to buy and download apps.

[View in iTunes](#)

Free

Category: Travel

Updated: 03 April 2015

Version: 1.2

Size: 19.7 MB

Language: English

Developer: Land Transport Authority Singapore

© 2014 Land Transport Authority of Singapore

Rated 4+

Compatibility: Requires iOS 7.0 or later. Compatible with iPhone, iPad, and iPod touch.

### Customer Ratings

Current Version:

★★ 6 Ratings

All Versions:

★★★ 86 Ratings

### Description

Looking for a taxi? Taxi-Taxi@SG not only tells commuters the number of taxis available in their vicinity, commuters can also use the app to indicate their need for taxis.

Commuter locations will be displayed on an integrated map for taxi drivers to easily identify areas with potential

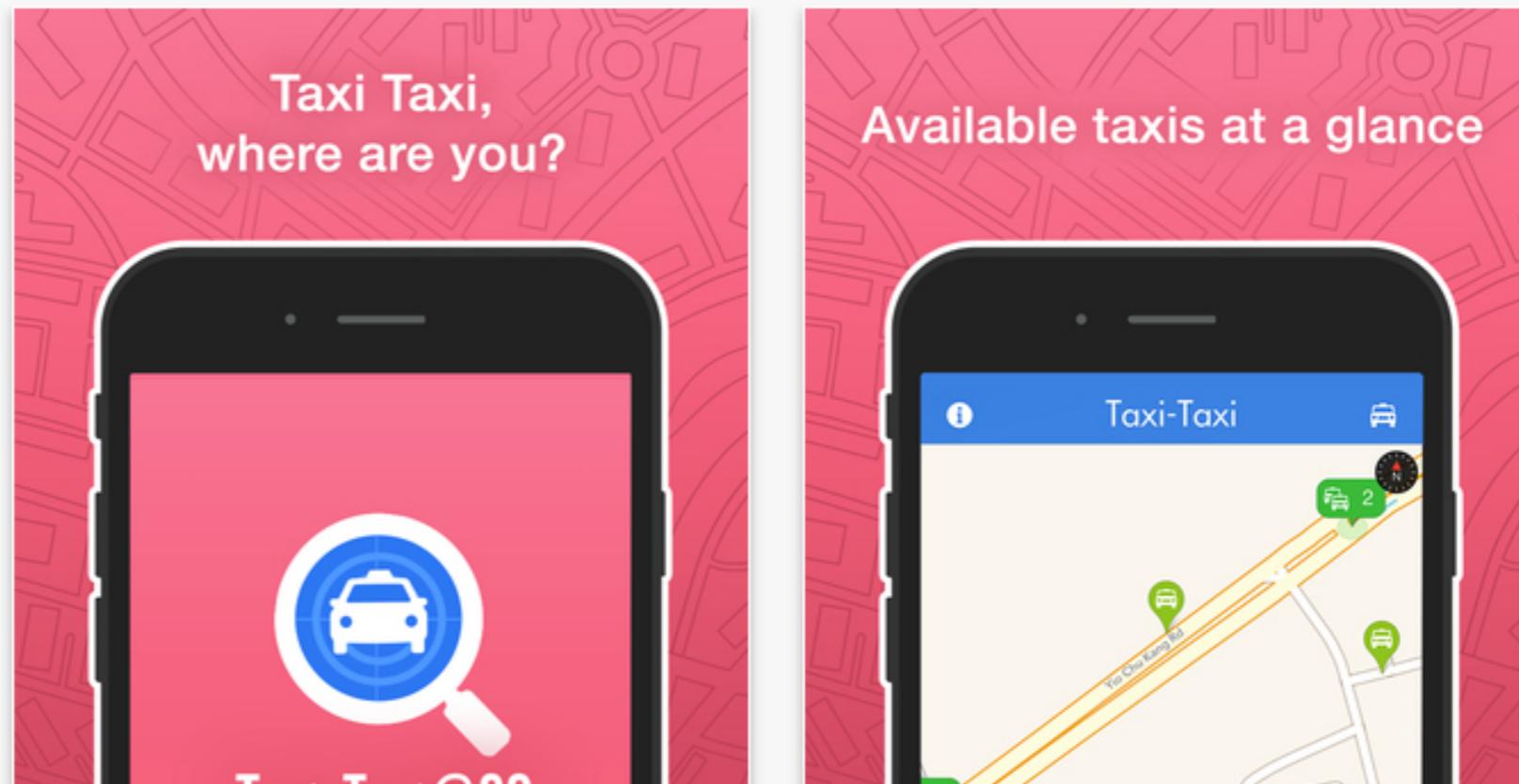
[Land Transport Authority \(Singapore\) Web Site](#) ▶ [Taxi-Taxi@SG Support](#) ▶

[...More](#)

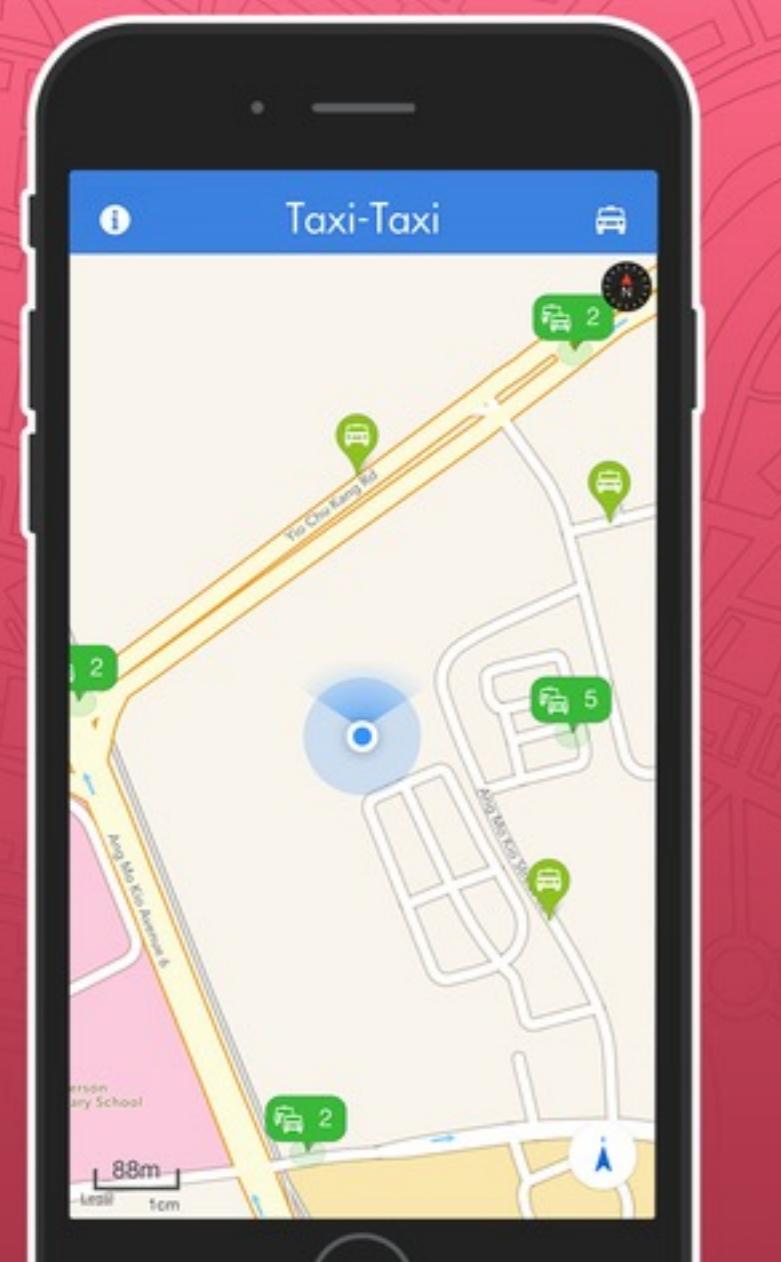
### What's New in Version 1.2

Enhanced usability display

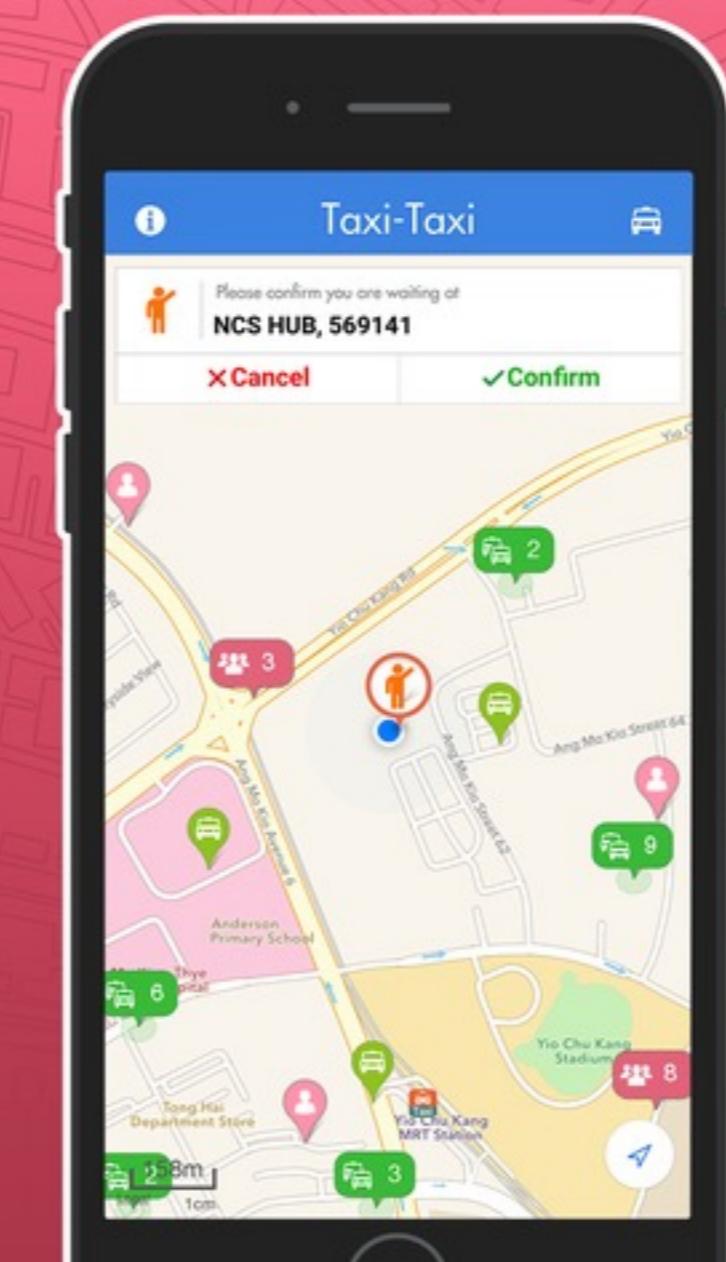
### iPhone Screenshot



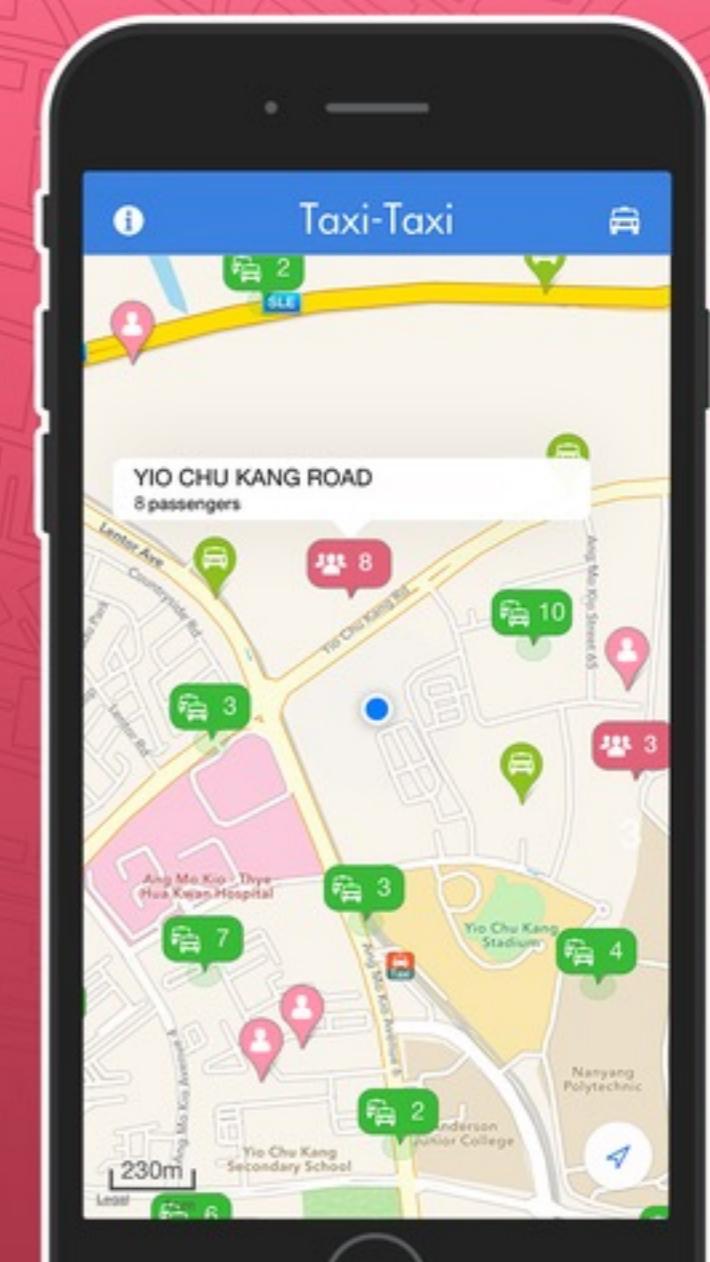
Available taxis at a glance



Let taxi drivers  
know where you are



Where are the  
street hail passengers?



# "No booking, no use. LTA cab app draws flak."

THE STRAITS TIMES



ARTICLES

DATABASE

EVENTS

ABOUT



Search Tech in A

Si

## This taxi app by Singapore's transport agency is stunningly pointless



Technology

Lifestyle

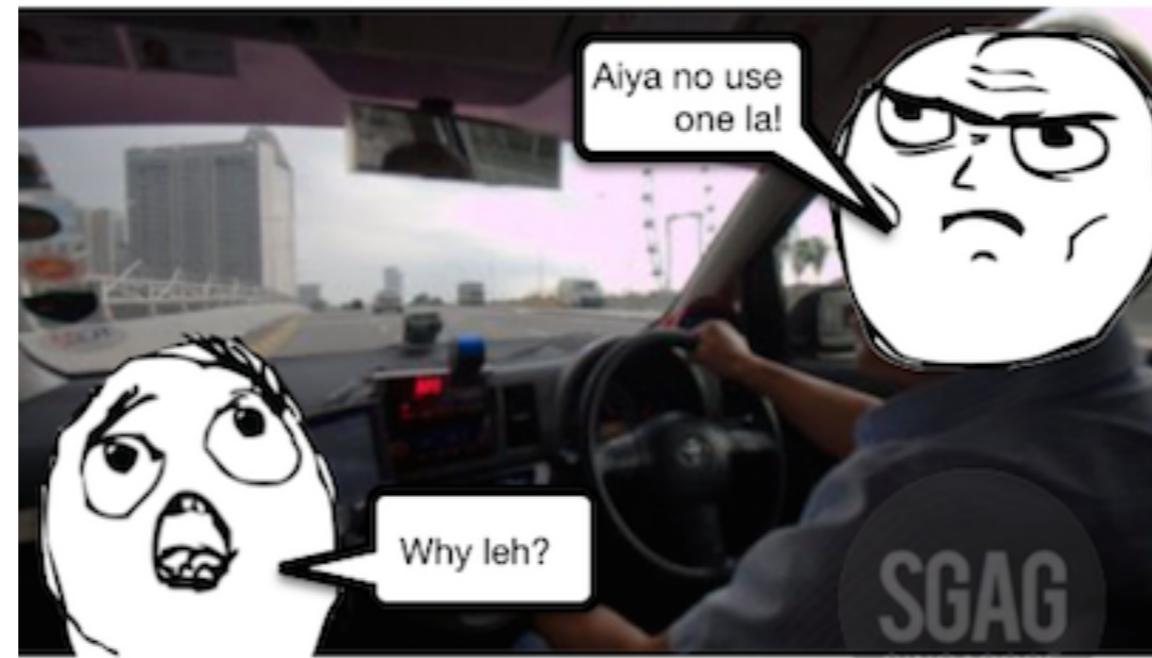
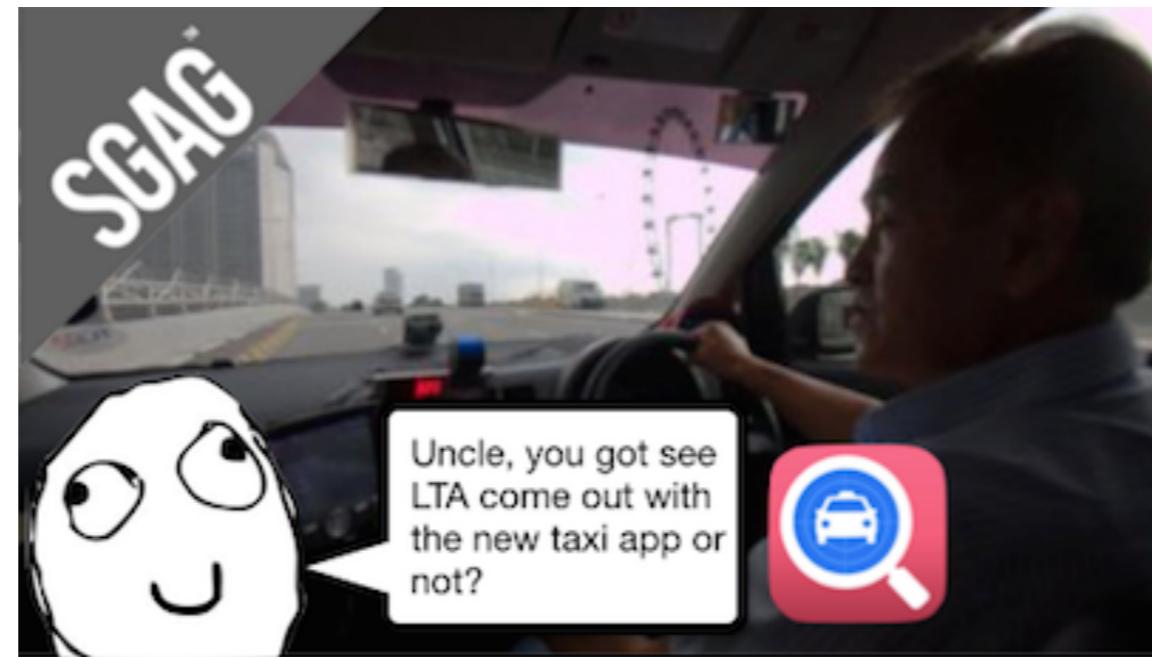
Branded Pages

Submit Story

Trending

NEWS READER

### LTA Has Probably Just Released The Most Useless Taxi App Ever



OMG

REAL TIME  
TAXI LOCATION API

# The hunt begins

On your laptop?  
Follow along!

# The hunt begins

Main API endpoints discovered

**taxi\_stands.csv**

[https://s3-ap-southeast-1.amazonaws.com/taxi-taxi/prod/  
share/taxi\\_stands.csv](https://s3-ap-southeast-1.amazonaws.com/taxi-taxi/prod/share/taxi_stands.csv)

<http://bit.ly/taxistands>

- Fetched once when app launches

CSV



AS API DATA  
FORMAT!?!?!

# The hunt begins

Main API endpoints discovered

**taxi\_location\_service.sgc.zip**

[https://s3-ap-southeast-1.amazonaws.com/taxi-taxi/prod/  
share/taxi\\_location\\_service.sgc.zip](https://s3-ap-southeast-1.amazonaws.com/taxi-taxi/prod/share/taxi_location_service.sgc.zip)

<http://bit.ly/taxizip>

- Fetched every 30 seconds

**ZIP**



**AS API DATA  
FORMAT!?!?!**

# WHAT!?!?



PASSWORD-  
PROTECTED?

# Password found

sgctaxi2014

# Tip of the day

**ZIP encryption  
is very strong!**

```
$ cat taxi_location_service.sgc
```

```
ldZ.TF  
bAPC\  
R  
_C'mZ2  
\,%N`F  
aP)(F  
\d1.dZ  
k.2%K  
^&-+F  
_$(9ZZ  
_ZF'  
aSZ,]d  
[82VZZ  
_SZ&MC  
l?P-  
_g' (
```

It's binary!

```
gB/>1F
```

NOW



WHAT THE  
F\*\*\* IS THIS!?!?

```
$ hexdump taxi_location_service.sgc
```

00000000	0d	60	0f	1e	24	4d	46	00	0d	5b	60	64	29	4e	3c	00
00000010	0d	5f	62	32	25	54	46	00	0d	6c	64	5a	2e	1a	0a	00
00000020	0d	62	41	50	28	5c	0a	00	0d	52	0c	32	2b	2d	64	00
00000030	0d	68	19	50	2f	0d	64	00	0d	6c	67	3c	2d	5f	50	00
00000040	0d	5e	25	3c	25	2e	46	00	0d	62	69	5a	27	41	5a	00
00000050	0d	5c	67	28	26	5a	5a	00	0d	65	39	46	32	25	32	00
00000060	0d	5e	59	1e	2c	2f	5a	00	0d	63	50	14	2a	34	1e	00
00000070	0d	6c	41	32	2d	29	14	00	0d	67	4a	3c	2c	4f	32	00
00000080	0d	6a	57	14	29	64	5a	00	0d	69	55	1e	2f	1a	5a	00
00000090	0d	5f	16	28	27	6d	0a	00	0d	6c	60	5a	2d	5a	64	00
000000a0	0d	5f	22	5a	27	60	46	00	0d	5c	2c	14	25	4e	0a	00
000000b0	0d	5f	0f	32	2b	29	46	00	0d	69	2e	14	2c	51	3c	00
000000c0	0d	5e	61	1e	25	6b	46	00	0d	5e	19	46	26	0f	28	00
000000d0	0d	61	11	50	29	11	0a	00	0d	58	3b	28	28	50	5a	00
000000e0	0d	61	63	28	29	16	64	00	0d	58	59	46	35	1f	64	00
000000f0	0d	5c	13	64	31	2e	0a	00	0d	5d	2e	32	25	4b	14	00
00000100	0d	6b	11	0a	2b	60	3c	00	0d	54	3a	14	31	2b	46	00
00000110	0d	5e	1f	1e	26	2d	0a	00	0d	62	1a	5a	29	28	5a	00
00000120	0d	6c	63	3c	2d	60	5a	00	0d	60	2b	14	28	39	5a	00
00000130	0d	5f	24	14	28	0b	50	00	0d	5f	5a	46	27	0c	50	00
00000140	0d	56	45	5a	34	62	3c	00	0d	6c	3c	50	2d	14	1e	00
00000150	0d	69	53	5a	2c	5d	64	00	0d	61	0b	28	29	0e	46	00

```
$ hexdump taxi_location_service.sgc
```

Ignore these.

Just location  
number

00000000	0d 60 0f 1e 24 4d 46 00 0d 5b 60 64 29 4e 3c 00
00000010	0d 5f 62 32 25 54 46 00 0d 6c 64 5a 2e 1a 0a 00
00000020	0d 62 41 50 28 5c 0a 00 0d 52 0c 32 2b 2d 64 00
00000030	0d 68 19 50 2f 0d 64 00 0d 6c 67 3c 2d 5f 50 00
00000040	0d 5e 25 3c 25 2e 46 00 0d 62 69 5a 27 41 5a 00
00000050	0d 5c 67 28 26 5a 5a 00 0d 65 39 46 32 25 32 00
00000060	0d 5e 59 1e 2c 2f 5a 00 0d 63 50 14 2a 34 1e 00
00000070	0d 6c 41 32 2d 29 14 00 0d 67 4a 3c 2c 4f 32 00
00000080	0d 6a 57 14 29 64 5a 00 0d 69 55 1e 2f 1a 5a 00
00000090	0d 5f 16 28 27 6d 0a 00 0d 6c 60 5a 2d 5a 64 00
000000a0	0d 5f 22 5a 27 60 46 00 0d 5c 2c 14 25 4e 0a 00
000000b0	0d 5f 0f 32 2b 29 46 00 0d 69 2e 14 2c 51 3c 00
000000c0	0d 5e 61 1e 25 6b 46 00 0d 5e 19 46 26 0f 28 00
000000d0	0d 61 11 50 29 11 0a 00 0d 58 3b 28 28 50 5a 00
000000e0	0d 61 63 28 29 16 64 00 0d 58 59 46 35 1f 64 00
000000f0	0d 5c 13 64 31 2e 0a 00 0d 5d 2e 32 25 4b 14 00
0000100	0d 6b 11 0a 2b 60 3c 00 0d 54 3a 14 31 2b 46 00
0000110	0d 5e 1f 1e 26 2d 0a 00 0d 62 1a 5a 29 28 5a 00
0000120	0d 6c 63 3c 2d 60 5a 00 0d 60 2b 14 28 39 5a 00
0000130	0d 5f 24 14 28 0b 50 00 0d 5f 5a 46 27 0c 50 00
0000140	0d 56 45 5a 34 62 3c 00 0d 6c 3c 50 2d 14 1e 00
0000150	0d 69 53 5a 2c 5d 64 00 0d 61 0b 28 29 0e 46 00



00000000	0d	60	0f	1e	24	4d	46	00	0d	5b	60	64	29	4e	3c	00
00000010	0d	5f	62	32	25	54	46	00	0d	6c	64	5a	2e	1a	0a	00
00000020	0d	62	41	50	28	5c	0a	00	0d	52	0c	32	2b	2d	64	00
00000030	0d	68	19	50	2f	0d	64	00	0d	6c	67	3c	2d	5f	50	00
00000040	0d	5e	25	3c	25	2e	46	00	0d	62	69	5a	27	41	5a	00
00000050	0d	5c	67	28	26	5a	5a	00	0d	65	39	46	32	25	32	00
00000060	0d	5e	59	1e	2c	2f	5a	00	0d	63	50	14	2a	34	1e	00
00000070	0d	6c	41	32	2d	29	14	00	0d	67	4a	3c	2c	4f	32	00

Every 8 bytes  
is a position (latitude longitude) of a taxi

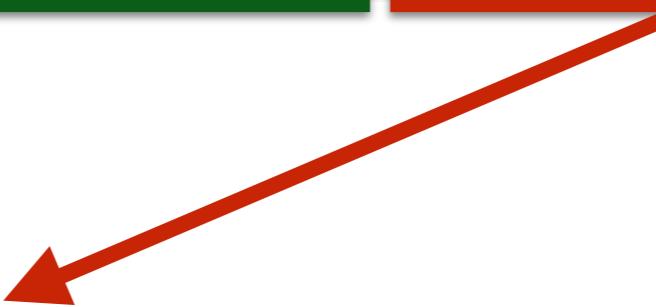
00000080	0d	5t	0t	52	2b	29	4b	00	0d	69	2e	14	2c	51	3c	00
000000c0	0d	5e	61	1e	25	6b	46	00	0d	5e	19	46	26	0f	28	00
000000d0	0d	61	11	50	29	11	0a	00	0d	58	3b	28	28	50	5a	00
000000e0	0d	61	63	28	29	16	64	00	0d	58	59	46	35	1f	64	00
000000f0	0d	5c	13	64	31	2e	0a	00	0d	5d	2e	32	25	4b	14	00
00000100	0d	6b	11	0a	2b	60	3c	00	0d	54	3a	14	31	2b	46	00
00000110	0d	5e	1f	1e	26	2d	0a	00	0d	62	1a	5a	29	28	5a	00
00000120	0d	6c	63	3c	2d	60	5a	00	0d	60	2b	14	28	39	5a	00
00000130	0d	5f	24	14	28	0b	50	00	0d	5f	5a	46	27	0c	50	00
00000140	0d	56	45	5a	34	62	3c	00	0d	6c	3c	50	2d	14	1e	00
00000150	0d	69	53	5a	2c	5d	64	00	0d	61	0b	28	29	0e	46	00

0d 60 0f 1e 24 4d 46 00

Latitude

Longitude

0d 60 0f 1e 24 4d 46 00



## Latitude

24 4d 46 00

To decimal:    36    77    70    ignore

Minus 10:      26    67    60

Add 1. and combine them:

**1.266760**

0d	60	0f	1e	24	4d	46	00
----	----	----	----	----	----	----	----



## Longitude

0d	60	0f	1e
----	----	----	----

To decimal:      13      96      15      30

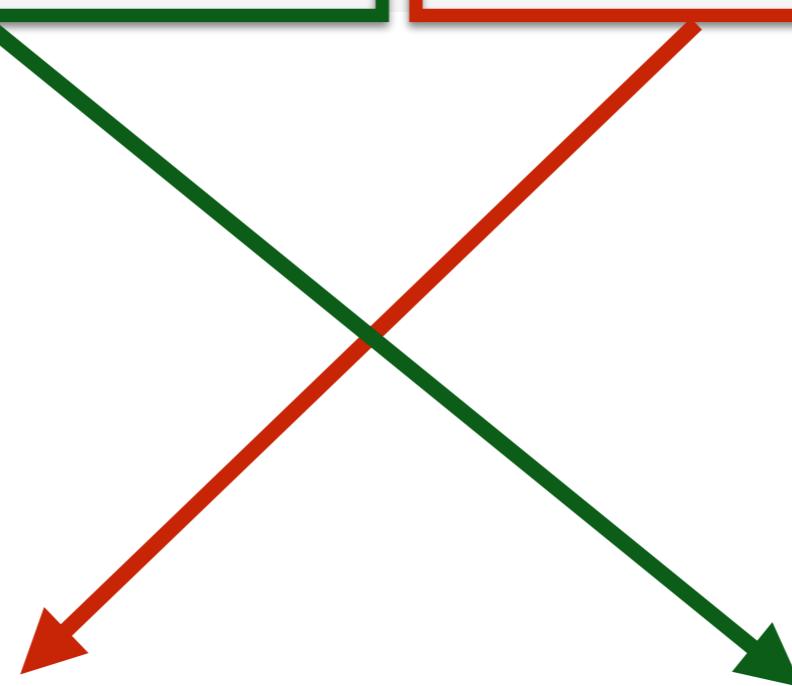
Minus 10:        03      86      05      20

Prefix with 1 and add decimal after the first byte

**103.860520**

0d 60 0f 1e

24 4d 46 00



Latitude

Longitude

1.266760, 103.86052

www.google.com/maps/place/1°16'00.3%22N+103°51'37.9%22E/@1.2675086,103.86052

1.266760, 103.86052

1°16'00.3"N 103°51'37.9"E

Directions

SAVE NEARBY SEND TO YOUR PHONE SHARE

Satellite

MCE

U-Zyn

Marina South Pier NS28

7-Eleven

MoneyGram (inside  
Cimb Bank Currency...)

Marina Bay Cruise  
Center Singapore

Marina Bay - St.John Island

Kusu Island - Marina Bay - Kusu Island

Google

Map data ©2016 Google Terms Privacy maps.google.com.sg Send feedback 100 m

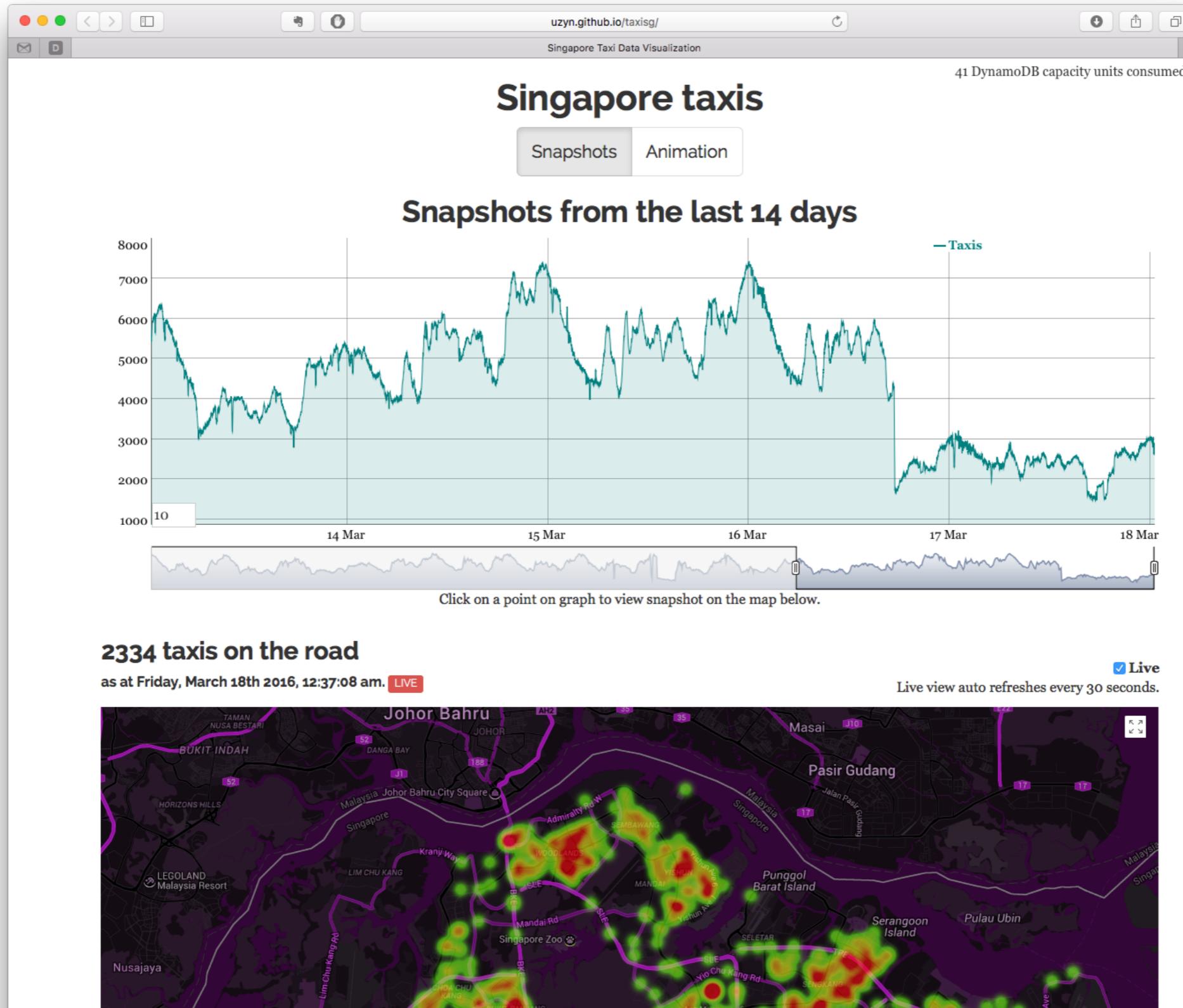


**WE DID IT!**

# Visualization

# <https://uzyn.github.io/taxisg>

Data available since February 2016



It's open source!

# Discovery



**TWO THINGS**

Taxi surcharge  
does not  
seem to work

Taxi surcharge  
does not  
seem to work

We might actually need to increase it

# WHAT!?!?!

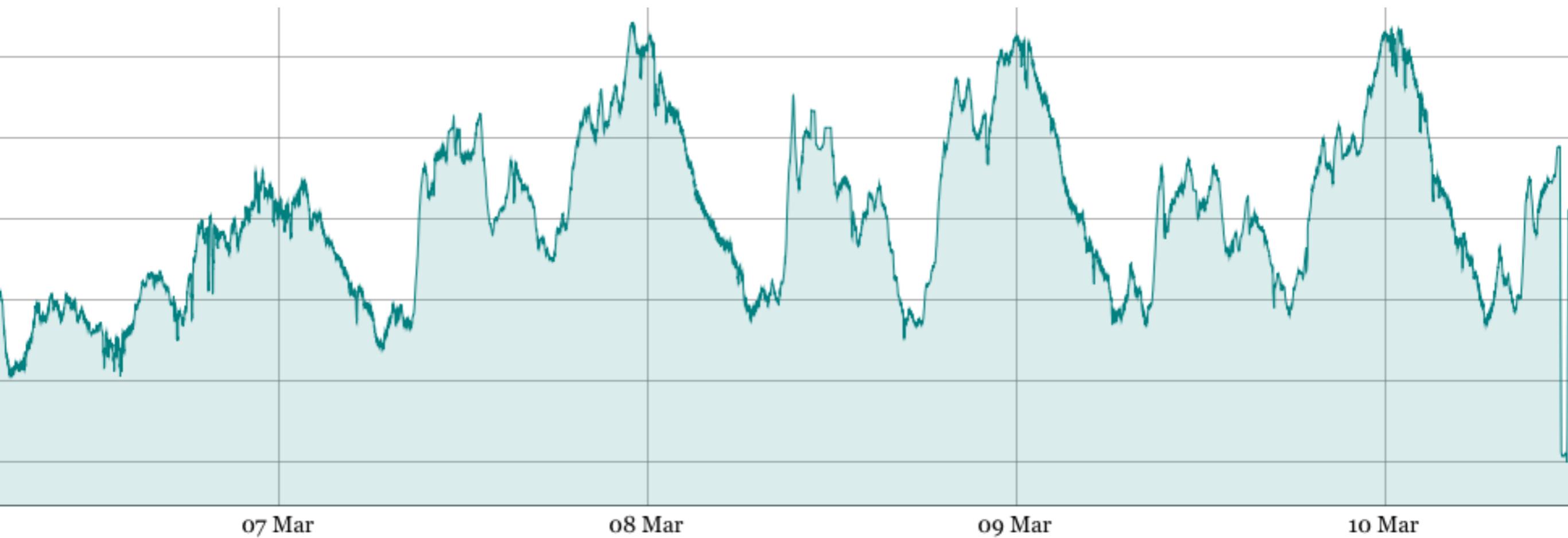


# Singapore taxi surcharge

6am – 9:30am      25%    (rush hours)

6pm – midnight    25%    (rush hours)

midnight – 6am    50%    (graveyard hours incentive)



# Observations

6am - 9am

Morning lowest points

9am - 2pm

Rising steadily and stay high

5pm-6pm

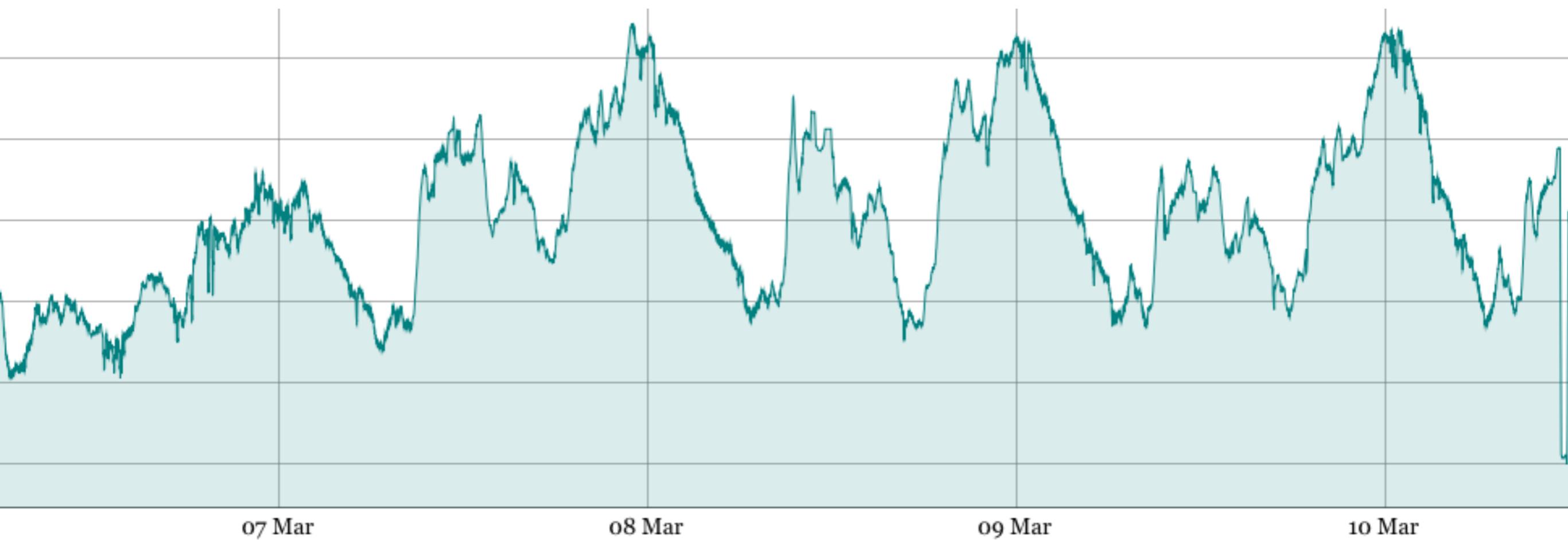
Lowest points of day

midnight

Peak

midnight - 6am

Declining, but among the highest points





WHY DO YOU  
NOT LIKE INCENTIVES?

# Fun random hotspot observations

- Airport is always packed
- Singapore Zoo (Night Safari) closes at midnight
- Graveyard hours (midnight to 5am) popular hotspots:
  - Geylang
  - Jalan Besar
- Utac Plant 2, AMK Street 63 is always packed. Why!??!
- Play around with it, maybe you can discover something interesting.

# Serverless

# Serverless

- AWS Lambda
- Direct parsing of LTA's obfuscated API is also available:
  - Served via Amazon API Gateway
  - Added CORS header and returns JSON
  - Taxi stands  
GET <https://di5wn01bz2.execute-api.us-west-2.amazonaws.com/alpha/stands>
  - Taxi locations  
GET <https://di5wn01bz2.execute-api.us-west-2.amazonaws.com/alpha/taxis>
- Data collector is triggered every 30 seconds.
- Lambda only supports time-based event every minute, so I had to use another server that fires an event every 30 seconds in order to trigger Lambda to collect data every 30 seconds.

# Visualization

- Viewer is a single-page app.
- Connects directly to DynamoDB with read-only access.
- All parsing and analysis is done client-side at the browser.

# Thank you

U-Zyn Chua

[chua@uzyn.com](mailto:chua@uzyn.com)

Twitter: @uzyn

GitHub: uzyn

