

# TRANSIT SCREEN



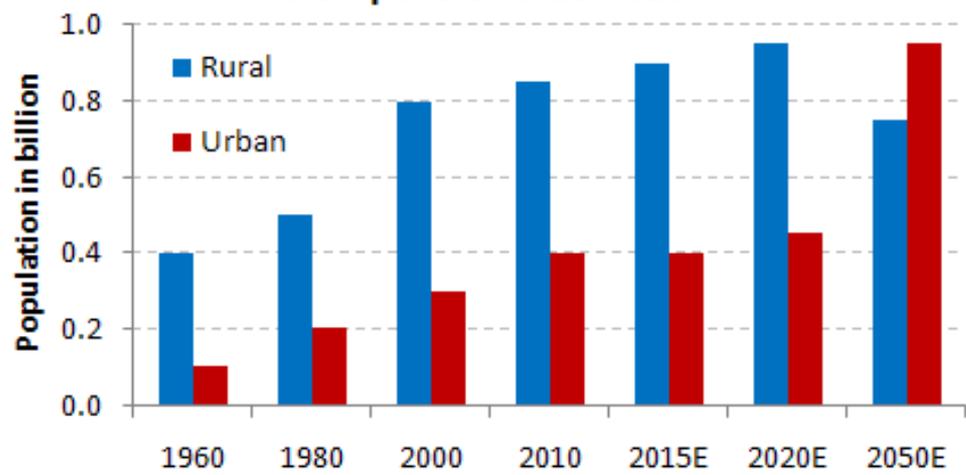
Smart cities data

Matt Caywood

CEO

TransitScreen

## India's pace of urbanisation



**There are more people living inside this circle than outside of it.**

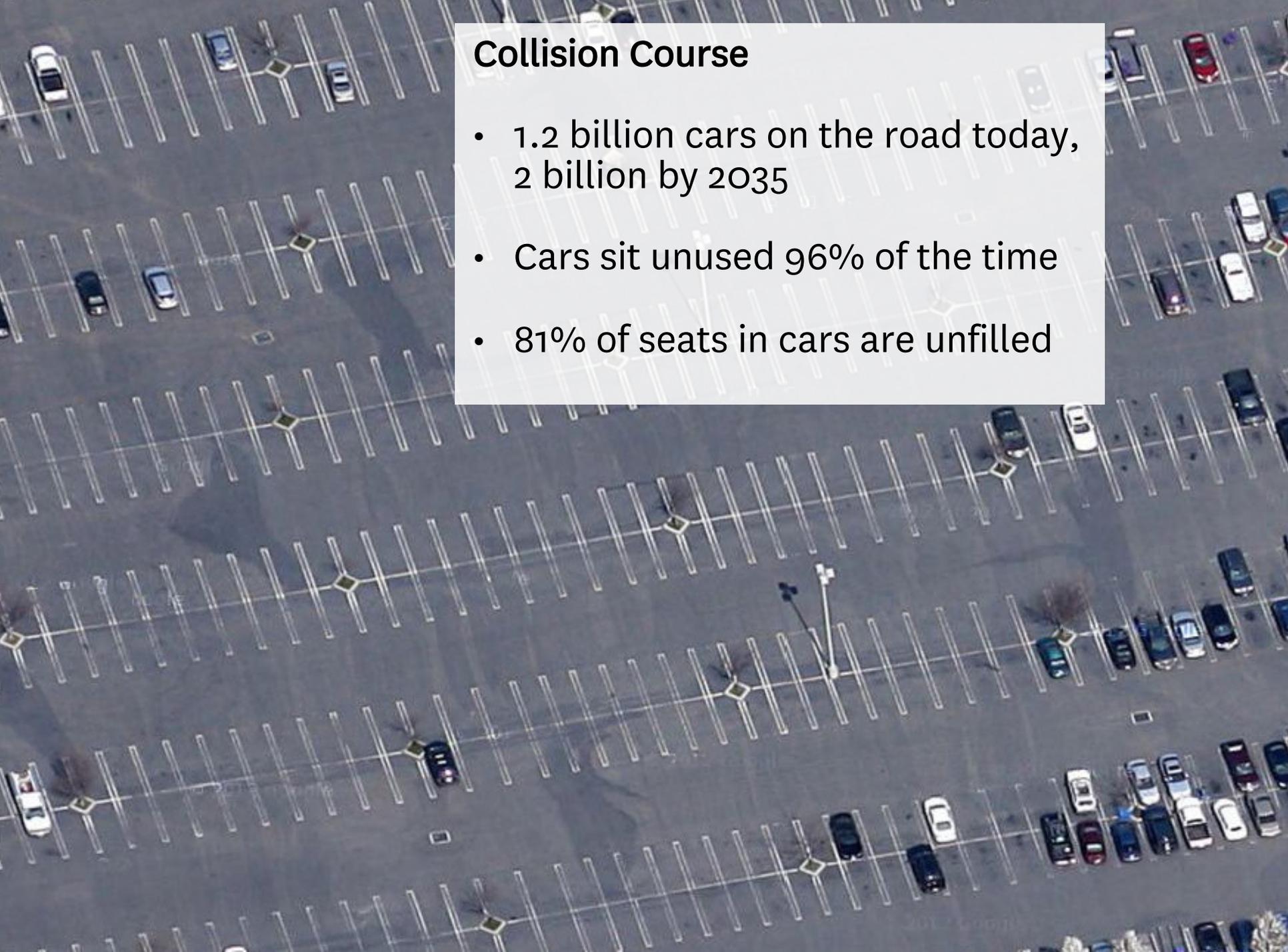


“The sign of an advanced society is not where poor drive cars, but where the rich ride transit”

-Bogota Mayor Enrique Penalosa

There isn't enough transportation



An aerial photograph of a large, mostly empty parking lot. The lot is divided into many rectangular parking spaces by white lines. Only a few cars are parked, scattered across the lot, highlighting the high percentage of unused capacity. A central light pole stands in the lower-middle part of the image.

## Collision Course

- 1.2 billion cars on the road today, 2 billion by 2035
- Cars sit unused 96% of the time
- 81% of seats in cars are unfilled

# New concrete no longer helps

World's largest freeway (Houston, 23 lanes)



In 2011, \$2.8 billion expansion and tolls ↑

In 2014, 33% slower than before

Why? Sprawl + Induced Demand brought even more cars

# A MOBILITY REVOLUTION IS UNDERWAY

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## Autonomous

26 companies are actively developing technology



## Bikeshare

1.5 billion rides in 2016



## Carshare

200 million trips in 2016



## Rideshare

4 billion rides in 2016



## Mass Transit

40 new urban metro systems opened in past decade

# MANY TECHNOLOGIES ARE INVOLVED

## THE SMART MOBILITY ECOSYSTEM

On-Demand Mobility

chariot  
BRIDJ  
sobi  
motivate  
Zagster  
Bandwagon

Traffic Flow

waze remix  
urban engines INRIX CISCO

Mobile Ticketing

SIEMENS CUBIC  
moovel xerox masabi

Curated by:

TRANSIT SCREEN

Sensors

placemeter SIGFOX  
BreezoMeter idax

Autonomous Vehicle Tech

MOBILEYE NAUTO CRUISE  
QUANERGY drive.ai

Mobility Apps

Citymapper moovit

Street Level Information/Ads

SIDE WALK LABS Clear Channel Outdoor  
LinkNYC JCDecaux CIVIQ  
OUTFRONT media Intersection

Beacons/Proximity

Radius Networks Blue Bite GIMBAL estimote

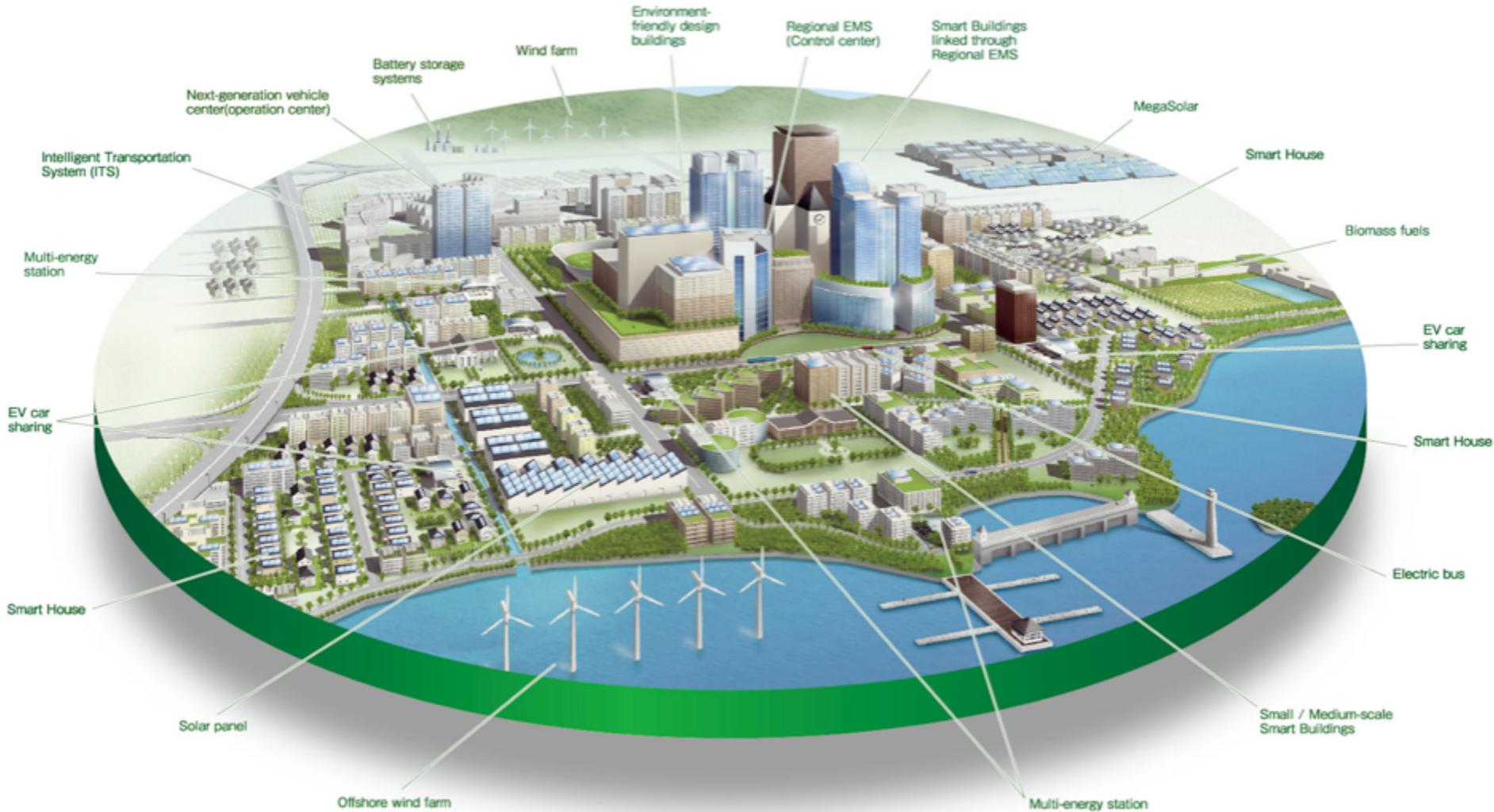
Self-driving Cars

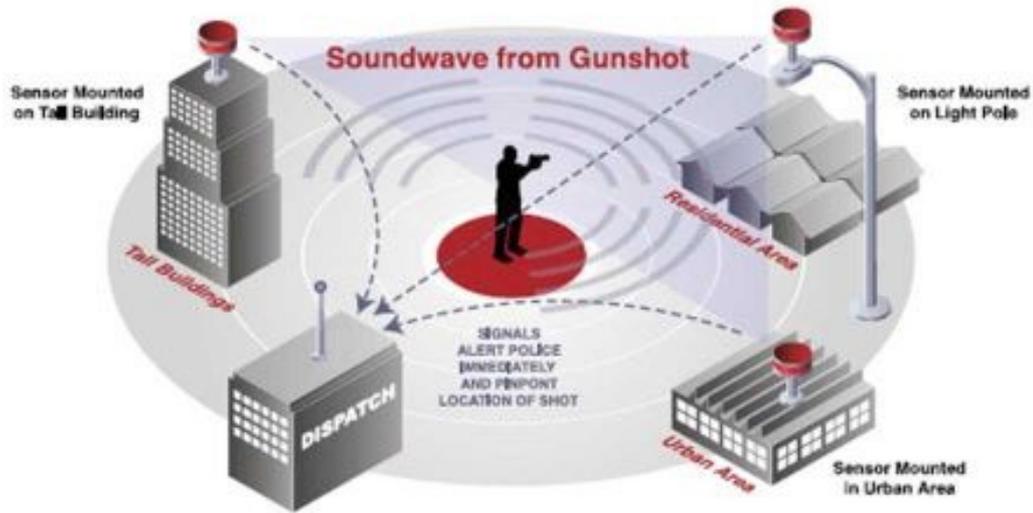
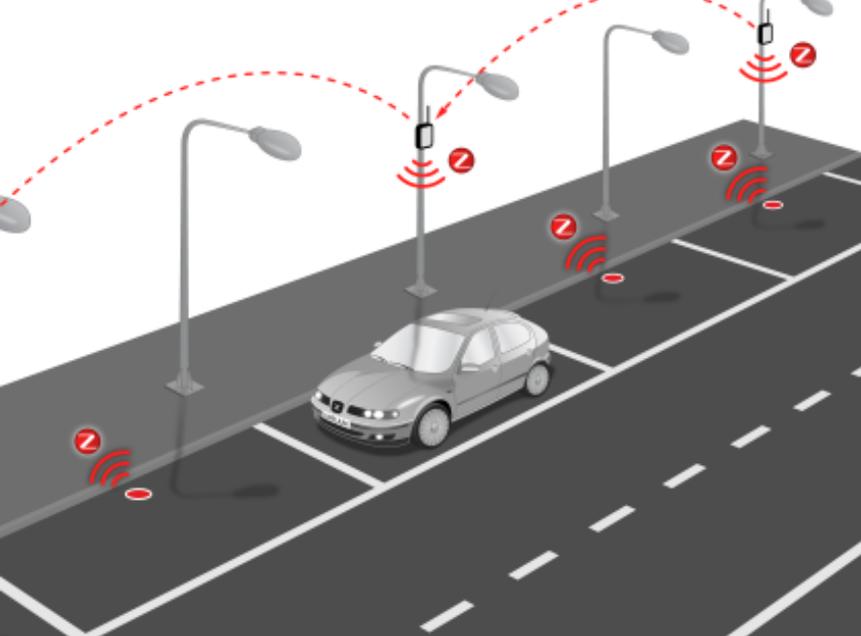
TESLA lyft Apple Faraday Future

Mapping

MAPZEN here MapBox CARTODB

# Who lives in a “Smart City”?





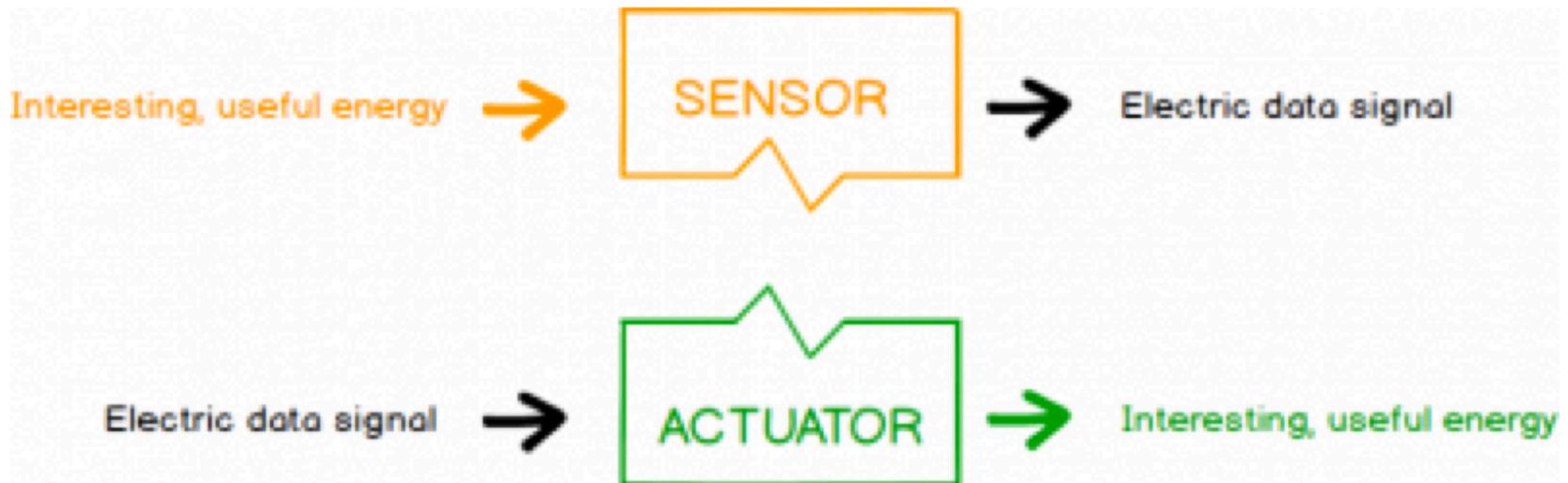
Sensor data: parking, ShotSpotter, mobiles

# Sensors and Activators

A metaphor from biology

**Sensors** transform changes into data

**Activators** transform data into changes



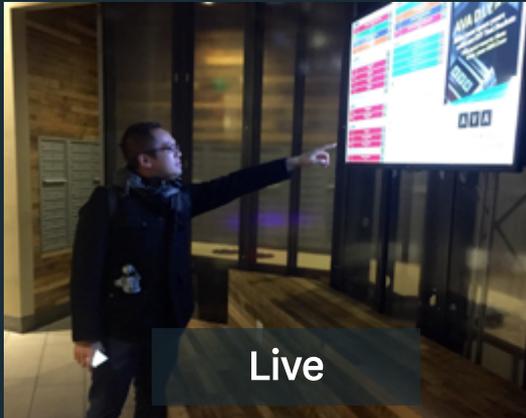


*People are the  
activators in Smart  
Cities*

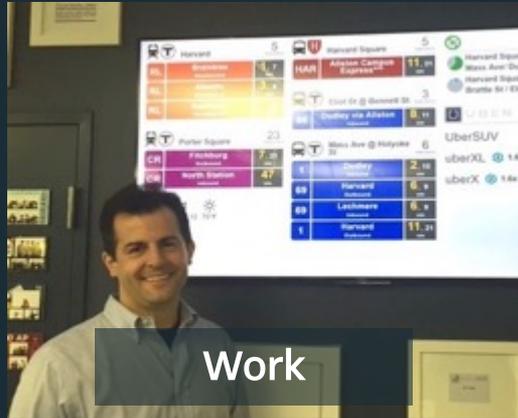
# TRANSITSCREEN

turning data into actions

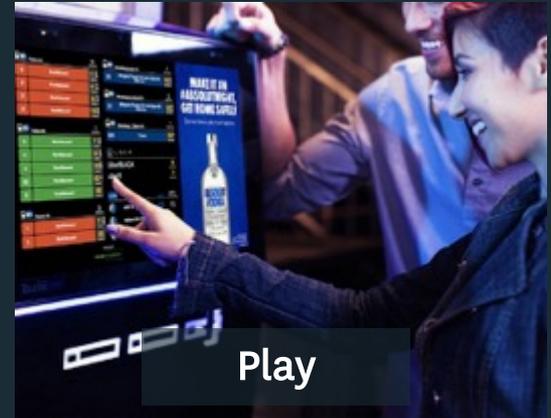
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Live



Work



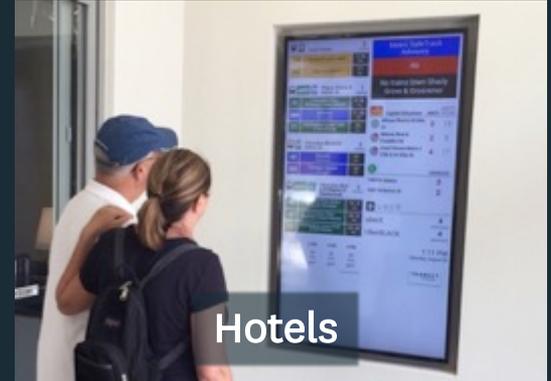
Play



City Hall



Street Level



Hotels

# Changing behavior at Harvard's Cabot House

TransitScreen GO BETA

  **Harvard** 14  
MIN WALK

<b>RL</b>	<b>Alewife</b> Northbound	<b>1, 8</b> MIN
<b>RL</b>	<b>Braintree</b> Southbound	<b>4, 16</b> MIN
<b>RL</b>	<b>Ashmont</b> Southbound	<b>9, 23</b> MIN

  **Concord Ave @ Bond St** 6  
MIN WALK

<b>74</b>	<b>Belmont Center</b> Outbound	<b>10</b> MIN
<b>72</b>	<b>Huron Ave</b> Outbound	<b>10</b> MIN
<b>78</b>	<b>Arlmont Village</b> Outbound	<b>30</b> MIN

  **Quad** 4  
MIN WALK

<b>HAR</b>	<b>Quad Express</b>	<b>11</b> MIN
------------	---------------------	------------------

 **UBER**

uberPOOL 7  
MINUTES AWAY

uberX  1.5x 7  
MINUTES AWAY

uberXL  1.5x 9  
MINUTES AWAY

 **BIKES** **EMPTY DOCKS**

 **Harvard Law School at Mass Ave / Jarvis St** **7** 12

 **Harvard University Radcliffe Quadrangle at Shepard St / Garden St** **2** 16

Similar Homes

Friend Rank

About Me

How I did in **October**

**Room for improvement**

Used 12% more than September

Used less than yearly average



**My home**

**\$43.00**  
340 kwh

All homes

**\$37.12**  
312 kwh

Efficient homes

**\$35.12**  
300 kwh

### An easy way to save:



Turn off lights when not needed

1,021 people do this

Show more tips



### Join a group, compete together!

Find people with similar interests to drive efficiency at home.

Search groups

You are being compared to to **214,827** homes with these characteristics:

0-500 sq ft

Central A/C

No fireplace

NE Climate

[Edit my home information](#)

# Opower's founders (Harvard CS graduates)



NYSE

NYSE KCG

Opower, Inc.  
OPWR 19.0000 0.00  
6,100,000  
19.00  
OPWR  
NYSE  
Market Stanley  
Gutman Sachs

REL	R	ROK	ROP	RRC
162.68	81.70	126.88	136.87	87.82
*12 Analysts Price (APC) Int. 101.00-104.00 Last 99.02				
*1 Connection to Mail-Start Credit Cards Article				
OHLC	5.00	VOLU	5.00	
OHLP	16,011.33	EVOL	5.00	
OHSD	5.00	EPVOL	5.00	
OHSA	16,006.48	TRIN	5.00	
UTR	5.00	TRIN	5.00	
YTD	86.44	-0.03	1,899.8	+7.00
COMP	4,280.24	5.00		
INDX	27.66	-0.24	1,686.77	5.00
COX	281.15	5.00		
TYM	123.07	0.00	181.32	+0.00
WAL	894.13	5.00		
YRLL	888.8	-0.01	1,386.3	13.00
WAL	73.68	5.00		
WAL	386.28	0.00	1,336.64	5.00
WAL	386.83	5.00		

Opower, Inc.  
OPWR 19.0000 0.00  
6,100,000  
19.00  
OPWR  
NYSE  
Market Stanley  
Gutman Sachs

Opower, Inc.  
OPWR 19.0000 0.00  
6,100,000  
19.00  
OPWR  
NYSE  
Market Stanley  
Gutman Sachs

Two men in suits, the founders of OPOWER, smiling and surrounded by photographers and bright digital screens.

Photographers and videographers capturing the event on the NYSE trading floor.

# What is Open Data?

Data that can be freely used, reused and redistributed by anyone

- **freely available for any purpose**, commercial or otherwise.
- **available in digital, machine-readable formats** so that it can be used in combination
- **available in its entirety** — and able to be downloaded “in bulk”

# Impact of Open Data

## Promotes new ideas and businesses

- Third party apps instead of government apps
- Small businesses (not just huge companies)
- Startup incubators specializing in open data businesses, like DC's 1776





Openness...strengthens our democracy, promotes the delivery of efficient and effective services to the public, and contributes to economic growth  
– President Barack Obama, 2013

# Open Data Examples

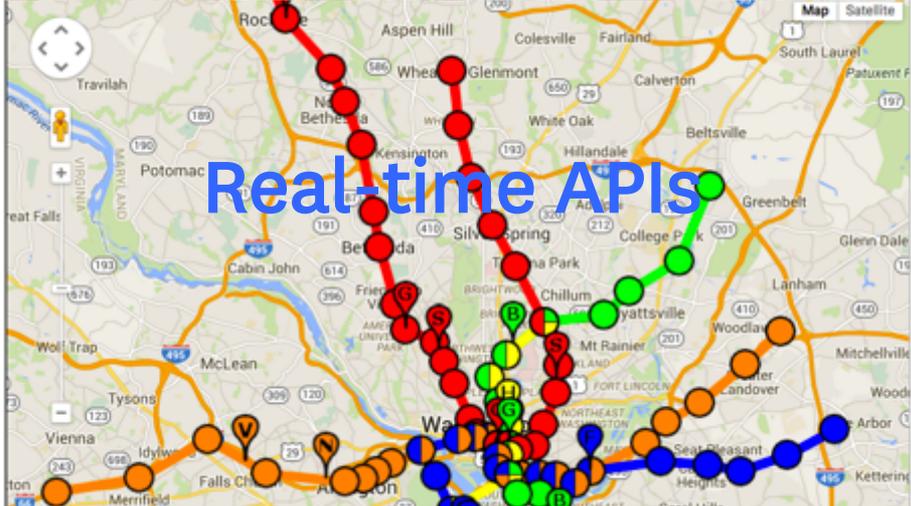
OpenStreetMap



GTFS



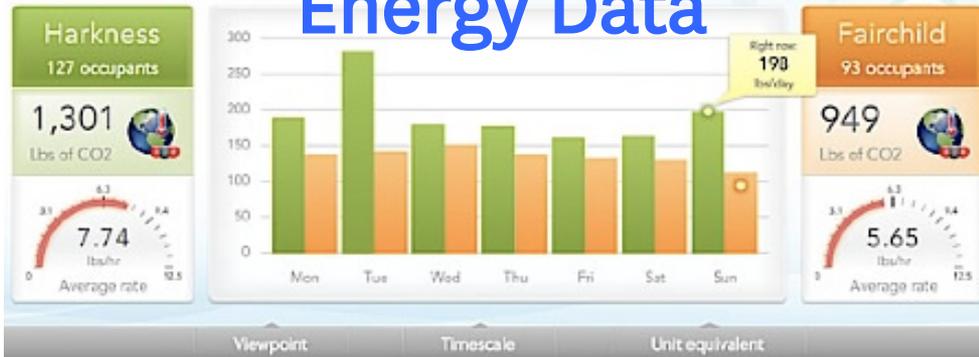
Real-time APIs



## Total Electricity Consumption

Equivalent pounds of carbon dioxide emitted into the atmosphere last week

Energy Data



# OpenStreetMap gold medaled over Google at the Sochi Olympics



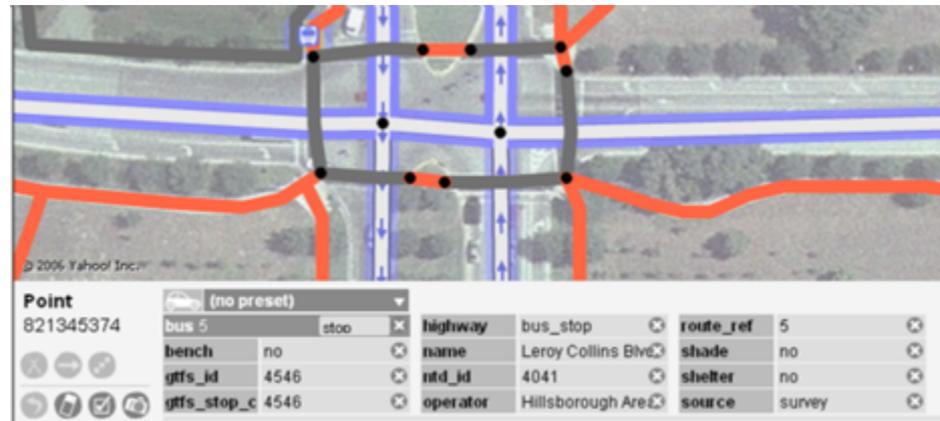
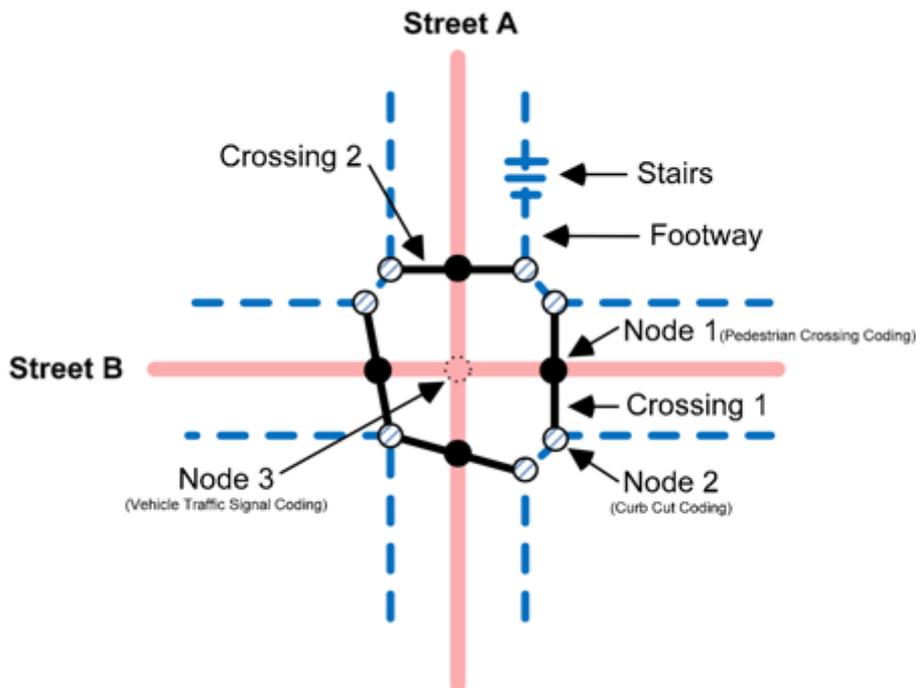


# Content edits to OpenStreetMap



# OSM can solve problems for all citizens

You can crowd-source sidewalk access information to help disabled people, elderly, children



Your High-Yield Solar Potential ?

60kW

.00 75 .98

1.03 k Trees Planted  
44.2 T Carbon Offset  
94 Homes Powered

Configure below or expand full metrics.

125 Mt Auburn St

Cambridge, MA 02138

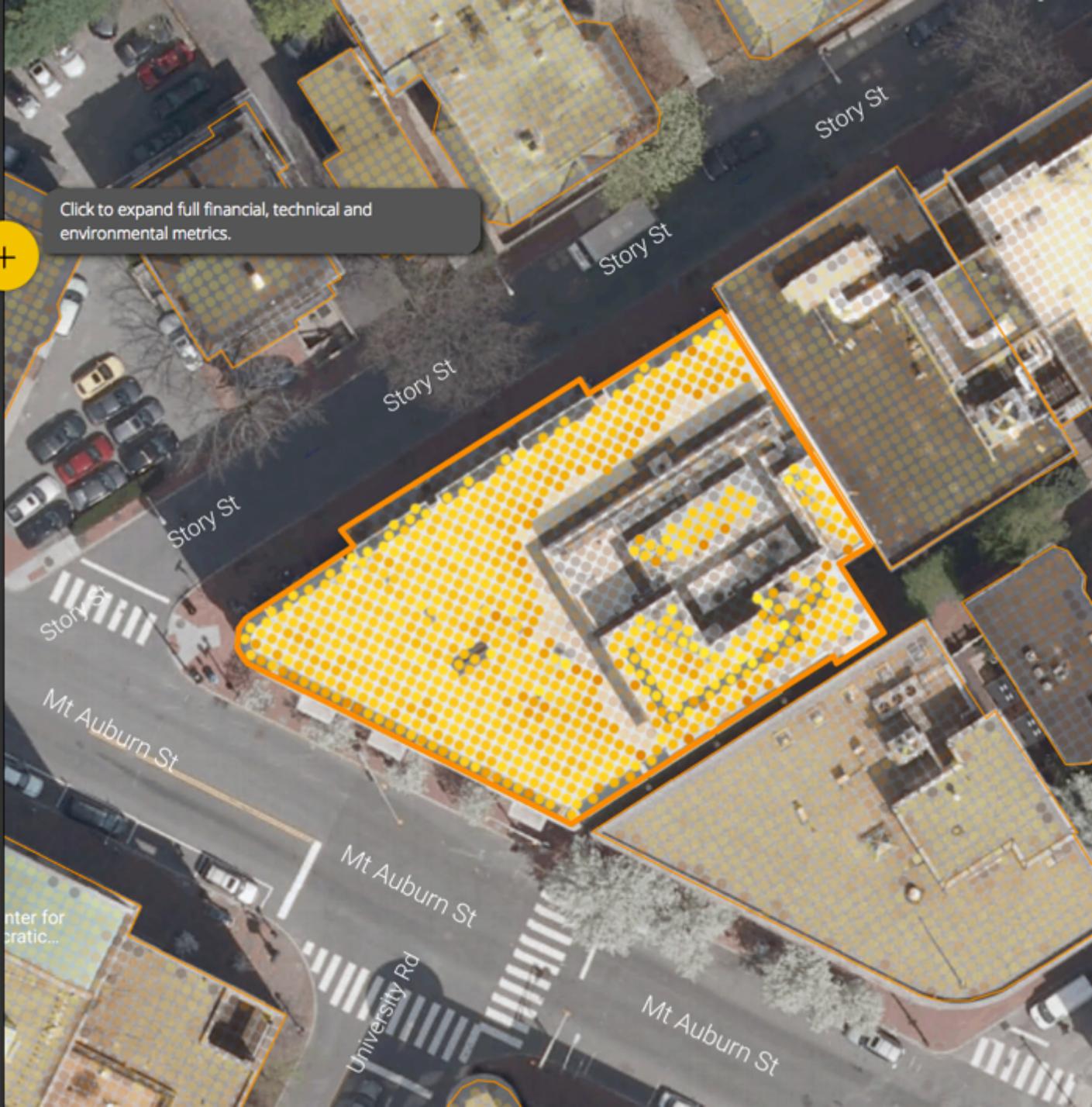
DEFAULT SAVE INVEST DRAW

Get Solar!



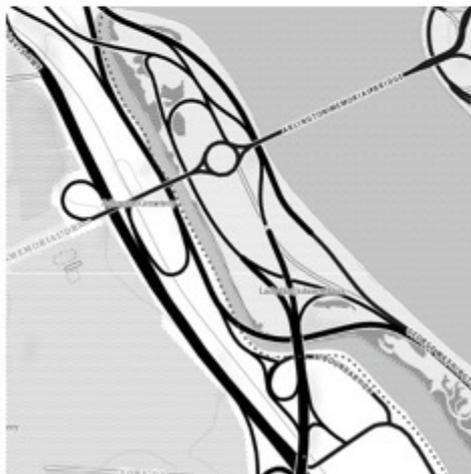
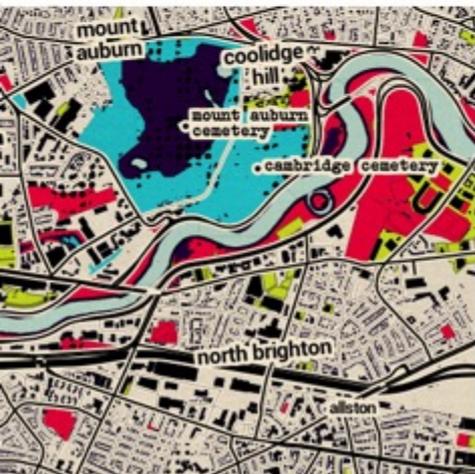
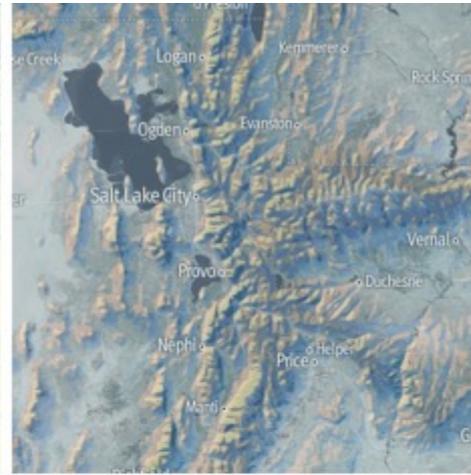
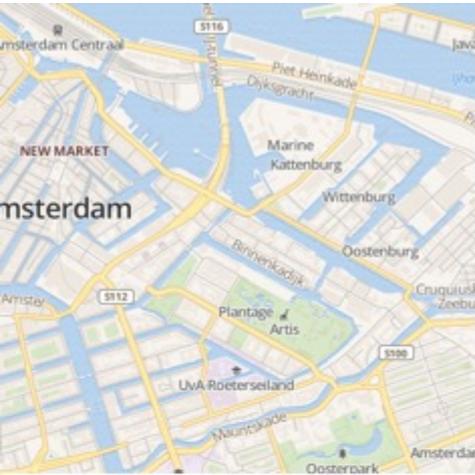
work with the sun®

Click to expand full financial, technical and environmental metrics.



Solar mapping of CS50 HQ

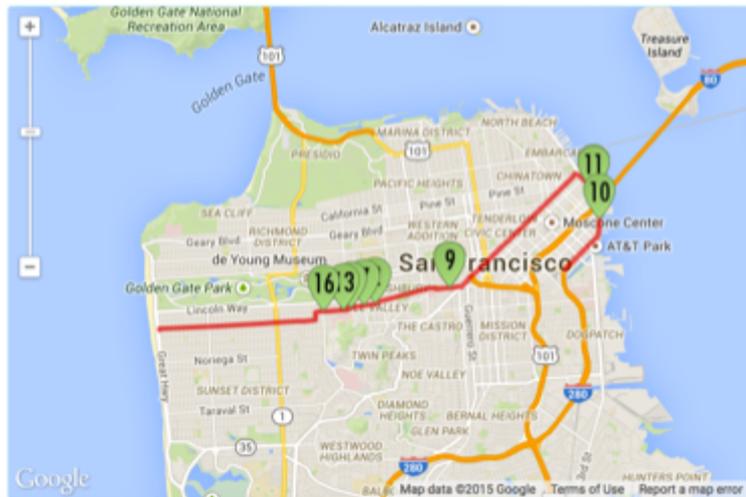
# Custom map styles (all generated from OSM data with Mapbox)



# Explore global transit with open data schedules (GTFS)

Home / ... / Muni GTFS / Latest (29 April 2015) / Routes / N. JUDAH / 12 Jan 2015

N JUDAH



HOME FEED REGISTRY PLAYGROUND DOCUMENTATION NEWS & UPDATES

SHOW ME ROUTES BY MAP VIEW

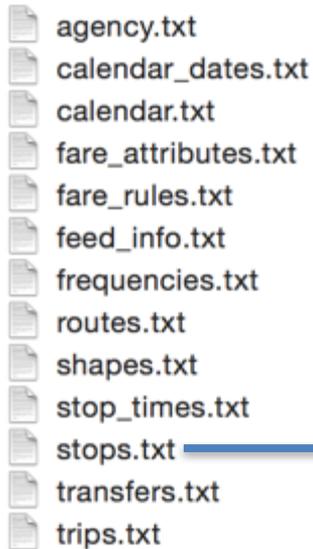
RUN QUERY



Transportation

How a National Transit Map could connect 'transit deserts' to the grid

# GTFS is really simple to get started with



[Go here and click “download latest”](#)

It’s a database, but it’s plain text spreadsheets – just open it up

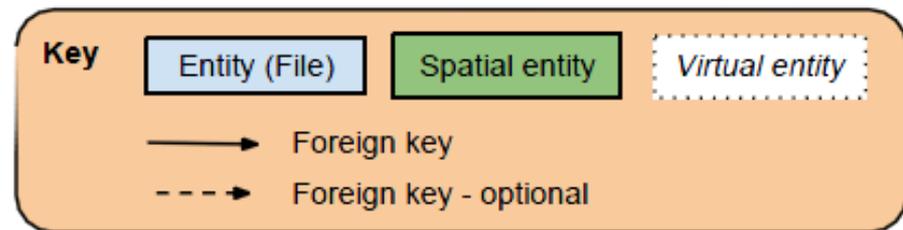
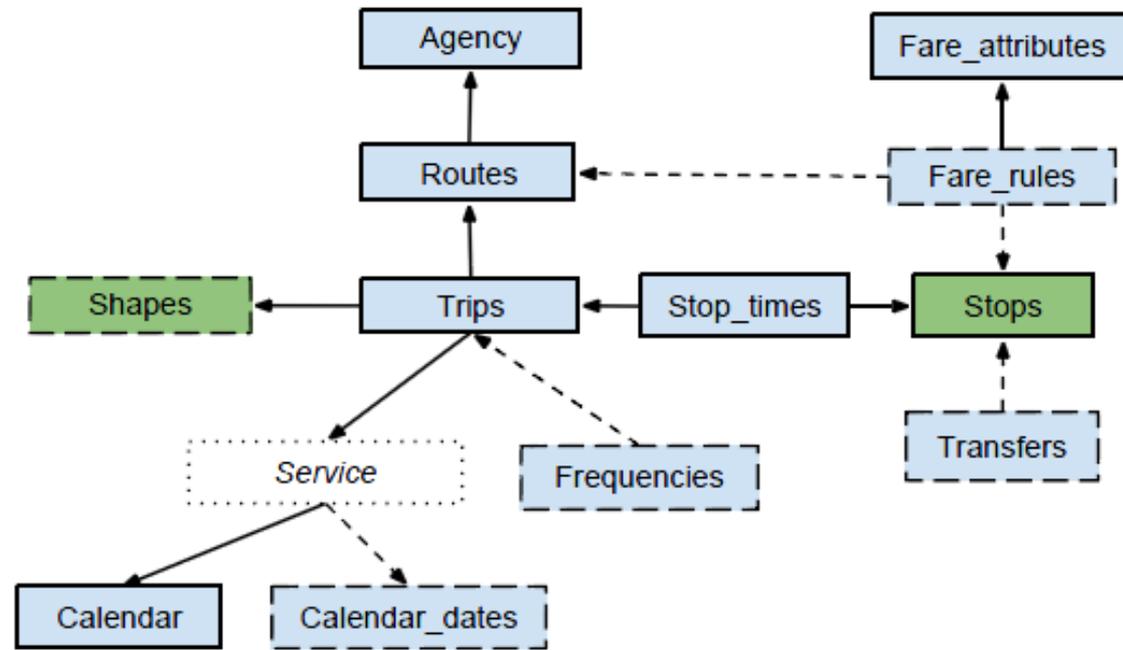
stop_id	stop_code	stop_name	stop_desc	stop_lat	stop_lon	zone_id	stop_url	location_type
2523		Center Street		37.8702946	-122.26851			0
2524		Sproul Hall: Bancroft Way @ Barrow Lane		37.868811	-122.25899			0
2525		Banway Building: Bancroft Way @ Shattuck Avenue		37.867679	-122.2675			0
2526		Buchanon Street @ Jackson Street		37.88774	-122.30079	0		0
2530		Downtown Berkeley BART Station: Shattuck Avenue @ Addison Street		37.871038	-122.26764	0		0
2532		Evans Hall: Hearst Mining Circle Side		37.873403	-122.25737	0		0
2533		Gayley @ Stadium Rimway		37.872685	-122.25395	0		0
2534		Haas School of Business: Piedmont Avenue Side		37.871106	-122.2528			0

# GTFS is complex enough to be complete

It's a formal specification with

- [Creation tools](#)
- [Validator](#)

Database schema is relatively simple



# Boston bikeshare open data powered a visualization contest

## A Network Analysis of Hubway

How does Hubway complement MBTA services?

Bike-sharing service, like [Hubway](#), can provide better access to transit hubs and additional options for trips beyond those provided by public transit -- reducing the number of transfers, wait times, and travel time variability due to traffic. In order to quantify the impact of Hubway, we compare durations of trips in the historical data with the corresponding expected travel times by public transit (and/or walking) obtained using service information from the [GTFS](#) feed provided by [MBTA](#). The travel time savings are then calculated and visualized here. We can see that most trips made by Hubway users would take longer on the MBTA network. As of September 2012, Hubway has helped its members save over 45,000 hours of travel time.

Filter by station:

[See commuting patterns](#)

No. of Trips

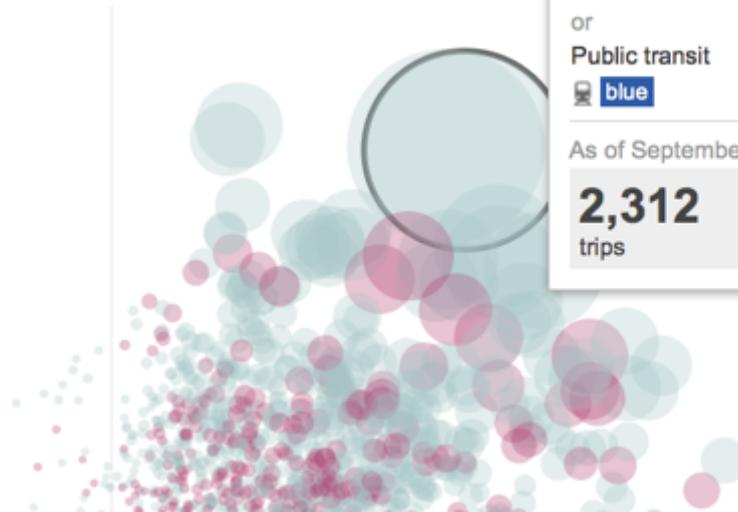
3,200 -

1,600 -

800 -

400 -

200 -



From:  
South Station - 700 Atlantic Ave.  
To:  
Lewis Wharf - Atlantic Ave.  
0.84 mi

<b>Travel time savings</b>	<b>12 mins</b>
Bike	7 mins
or	
Public transit	19 mins

 blue

---

As of September 2012

<b>2,312</b>	<b>425</b> hrs
trips	saved

**total one-way trips made**  
**513,733**  
**total travel time saved**  
**45,218 hours**  
as of september 2012

service available in

- 2011
- 2012

# Open APIs talk to remote databases

APIs are easy for your code to read (not just free form text)

```
{  
  "RouteID": 33,  
  "RouteStopID": 235,  
  "StopTimes": [  
    {  
      "ArrivalTime": "/Date(1413497700000)/",  
      "DepartureTime": "/Date(1413497700000)/",  
      "EstimateTime": "/Date(-62135571600000-0700)/",  
      "SecondsToStop": 0,  
      "StopTime": "/Date(1413497700000)/"  
    },  
    ...  
  ]  
}
```



APIs can be bulk (entire data set) or single-serving (just one bit)



 16th & M (northbound)

S1	16th & Colorado Northbound	0 MINUTES
S9	Silver Spring Station Northbound	1 MINUTE
S4	Silver Spring Station Northbound	6 7 14 MINUTES
S2	Silver Spring Station Northbound	7 8 23 MINUTES

# Open energy datasets from Green Button

**Green Button**



**Helping You Find and Use Your Energy Data**

## Some places to find inspiring APIs / data

US national data at [data.gov](https://data.gov)

Developer portals like Boston [MBTA](https://www.mbta.com/developers)

New API directory [PublicAPIs.com](https://publicapis.com)

Venerable API directory [programmableweb.com](https://programmableweb.com)

TRANSIT  
SCREEN

OUR TEAM

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## OUR MISSION

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- **Make cities more sustainable**

  - Reduce CO2 emissions and traffic congestion

  - Promote walkability and public health

- **TransitScreen Green**

  - Our operations are carbon neutral

  - Zero employees commute by car

**In a smart city, technology is used to improve the lives  
of *all* citizens: janitor to CEO**

# My years as a CS student...and today

