

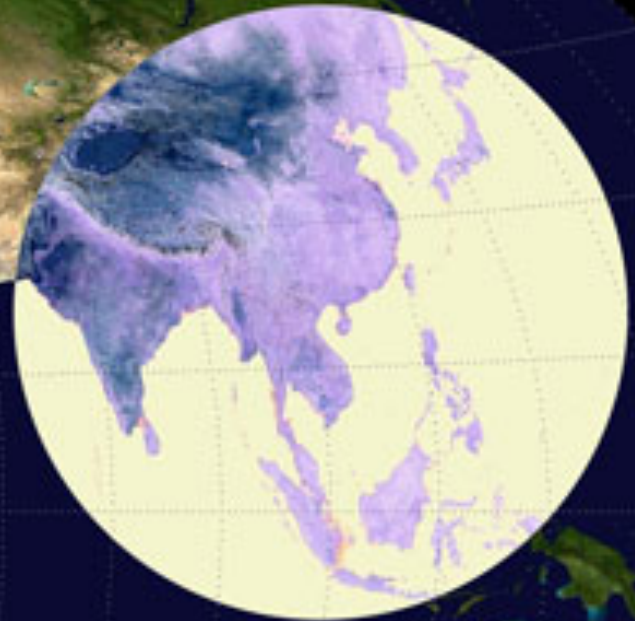
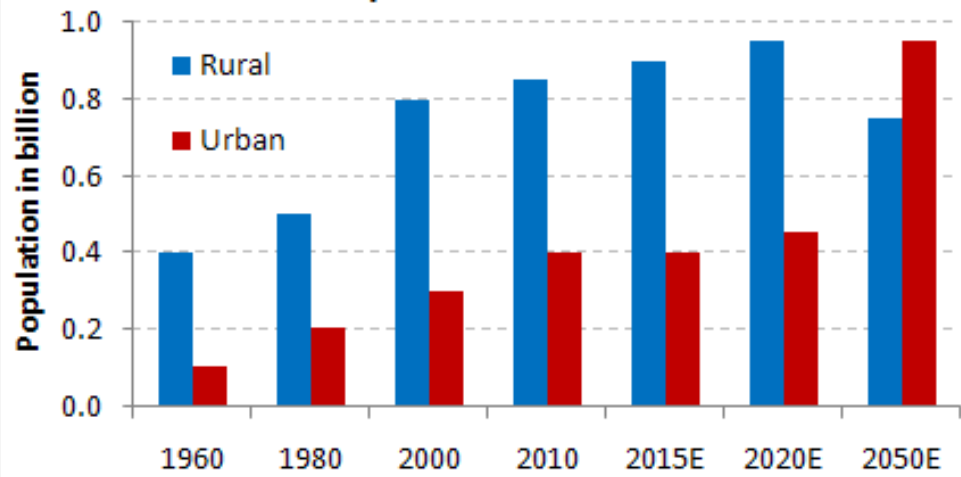
TRANSIT
SCREEN



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 filled with rows of empty parking spaces, marked with white lines. A few cars are scattered throughout, mostly along the edges and in some central rows. The background shows a road and some greenery.

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



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



motivate
get going

Zagster



Curated by:

TRANSIT SCREEN

Sensors



Street Level Information/Ads



LinkNYC

JCDecaux



Beacons/Proximity



Blue Bite

GIMBAL

Self-driving Cars

TESLA

lyft



Faraday Future

Traffic Flow



INRIX



Mobile Ticketing

SIEMENS



xerox



masabi

Autonomous Vehicle Tech



QUANERGY

drive.ai

Mobility Apps



Citymapper



moovit

Mapping



MAPZEN

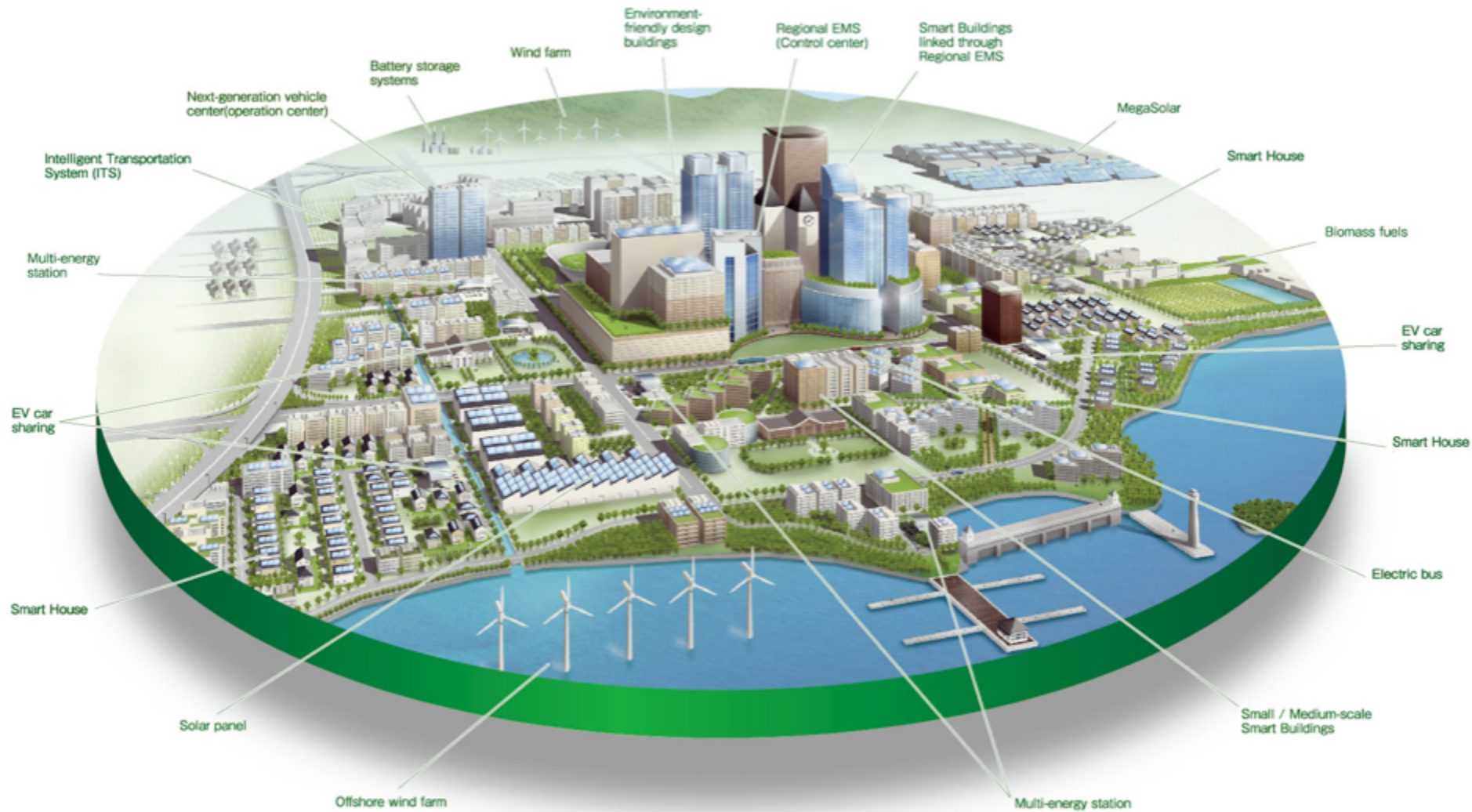


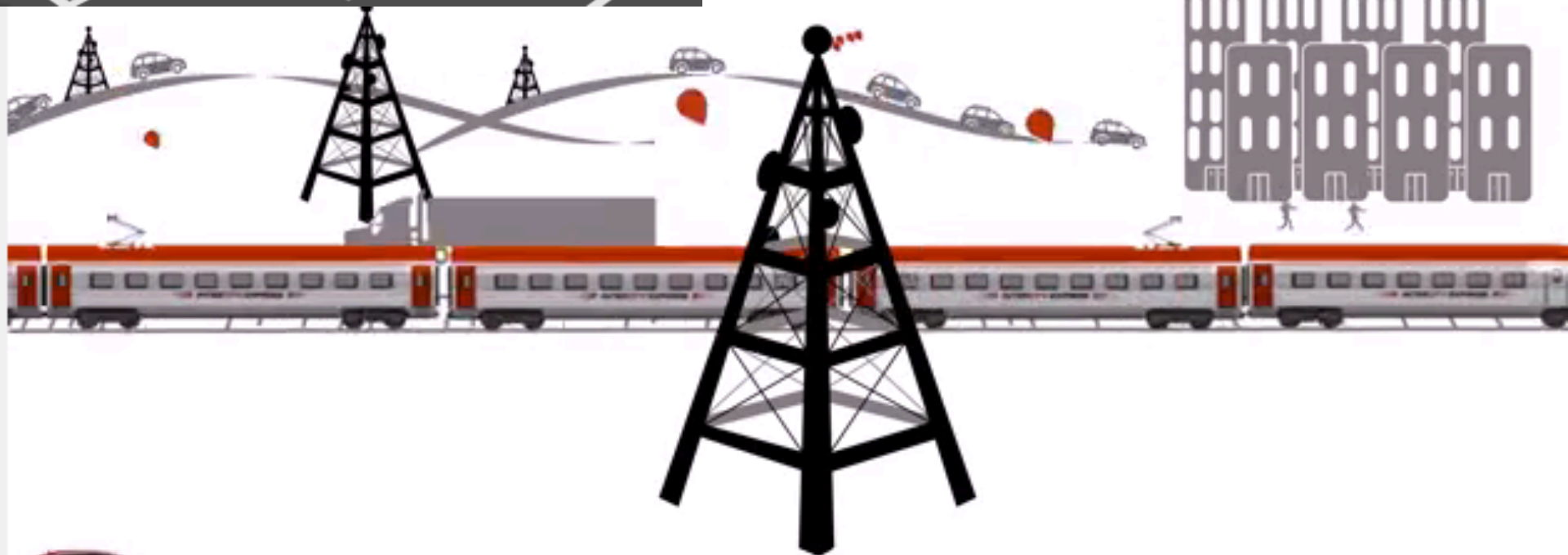
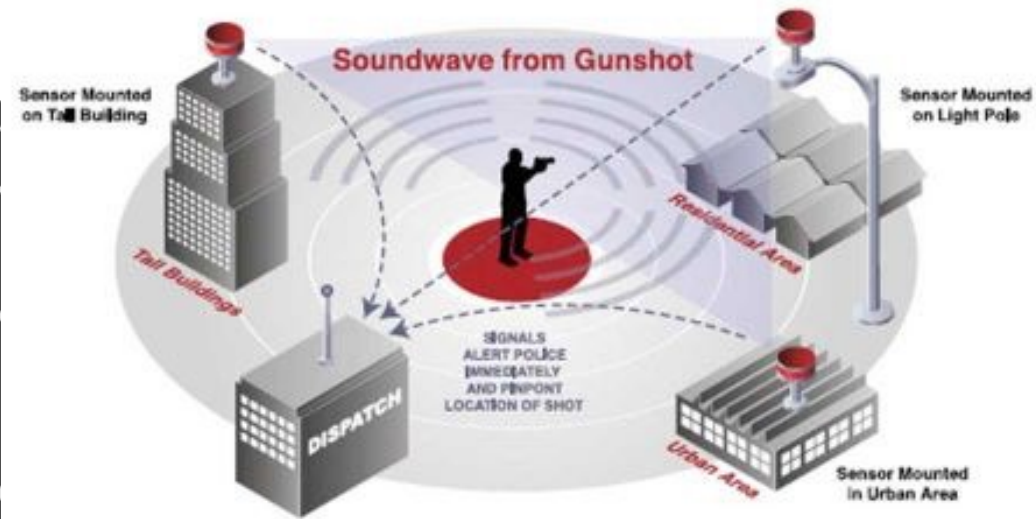
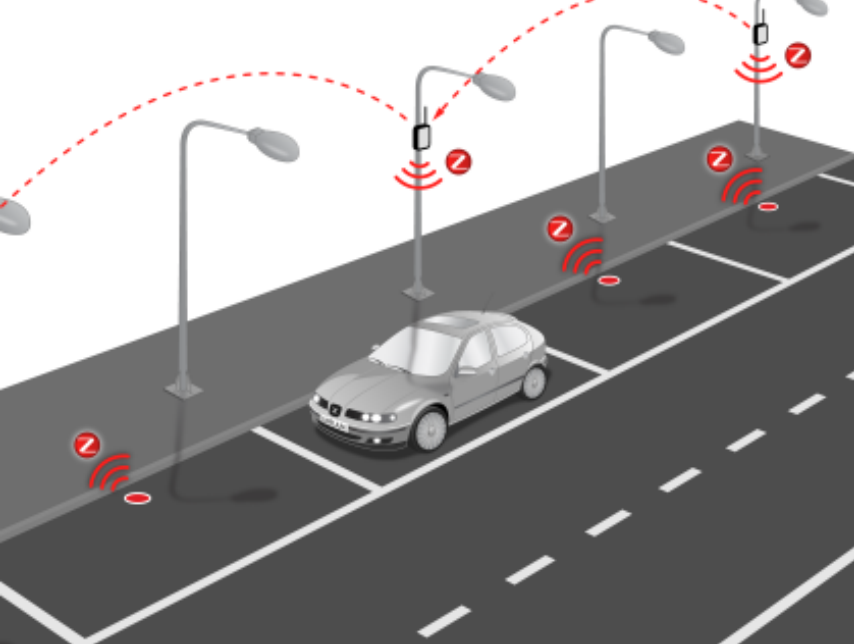
MapBox



CARTO
Geospatial on the cloud

Who lives in a “Smart City”?





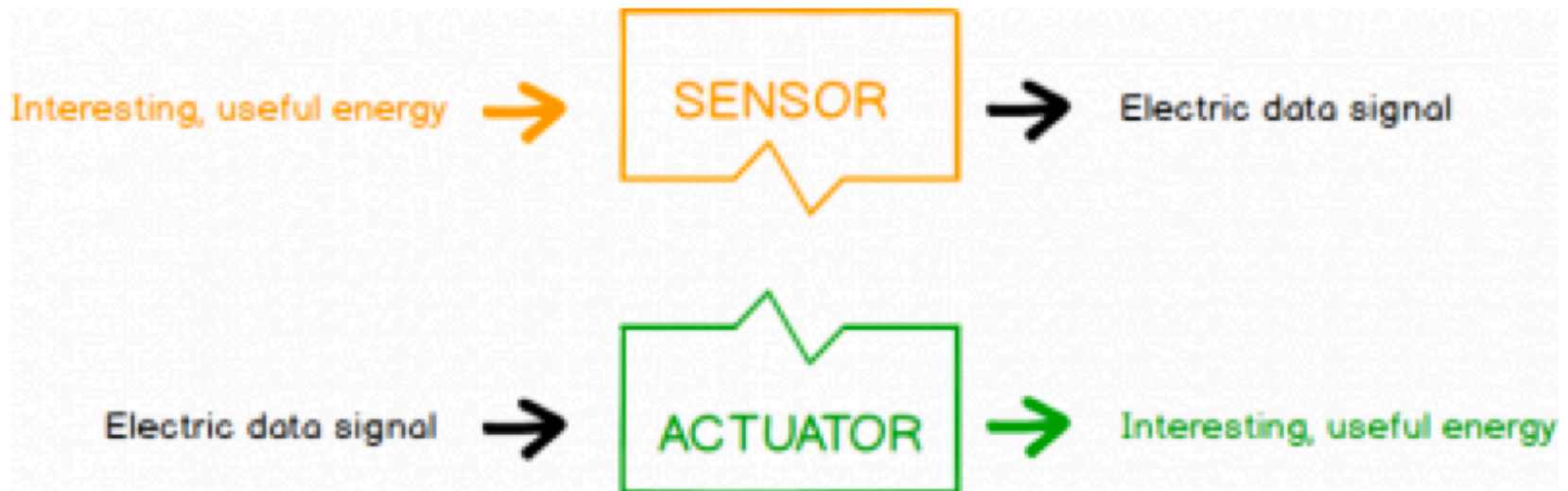
Sensor data: parking, ShotSpotter, mobiles

Sensors and Activators

A metaphor from biology

Sensors transform changes into data

Activators transform data into changes

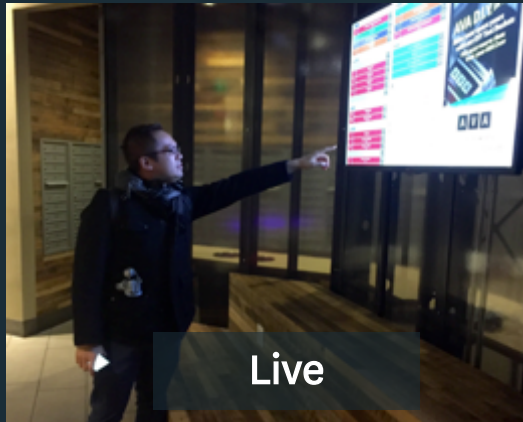


A vibrant city street scene, likely in New York City, featuring yellow taxis and historic brick buildings. In the foreground, a woman with long dark hair, wearing a white cardigan and a blue and white striped skirt, walks while drinking from a large coffee cup and carrying a pink handbag. In the center, a man in a black jacket and pants is looking at his phone. To his right, a group of three young people are gathered, looking at a phone together. Further right, a woman in a pink shirt is also looking at her phone. On the sidewalk in the foreground, a large, detailed transit map is laid out, showing various subway lines and stations. The map includes labels for 'TRANSIT', 'Lap View', 'Armenia-Spring', 'New Canaan', 'Lap View Center', and 'Armenia Square'. It also features a weather forecast at the bottom with icons for clouds and sun, and temperature readings for 3:00 pm (82°F), 2:00 pm (82°F), and 1:00 pm (82°F).

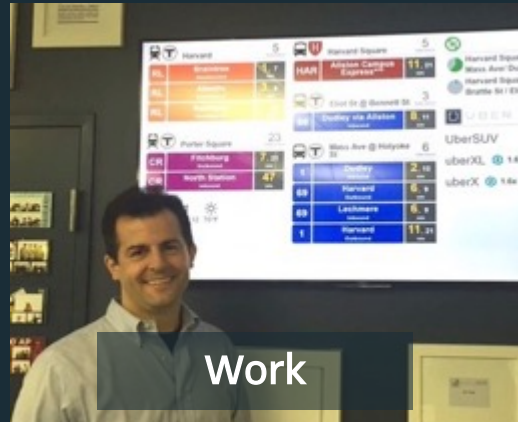
*People are the
activators in Smart
Cities*

TRANSITSCREEN

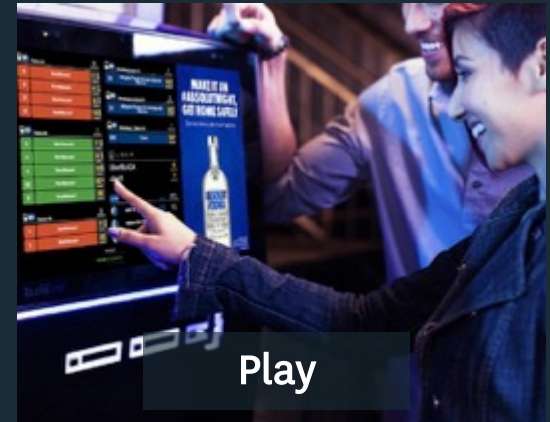
turning data into actions



Live



Work



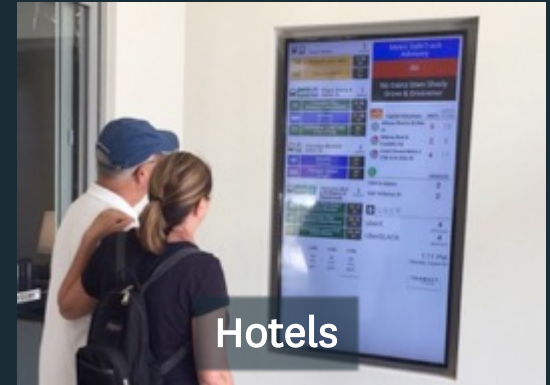
Play



City Hall



Street Level



Hotels

Changing behavior at Harvard's Cabot House

TransitScreen GO BETA



Harvard

14
MIN WALK

RL	Alewife Northbound	1, 8 MIN
RL	Braintree Southbound	4, 16 MIN
RL	Ashmont Southbound	9, 23 MIN



Concord Ave @ Bond St

6
MIN WALK

74	Belmont Center Outbound	10 MIN
72	Huron Ave Outbound	10 MIN
78	Arlmont Village Outbound	30 MIN



Quad

4
MIN WALK

HAR	Quad Express	11 MIN
-----	--------------	-----------



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

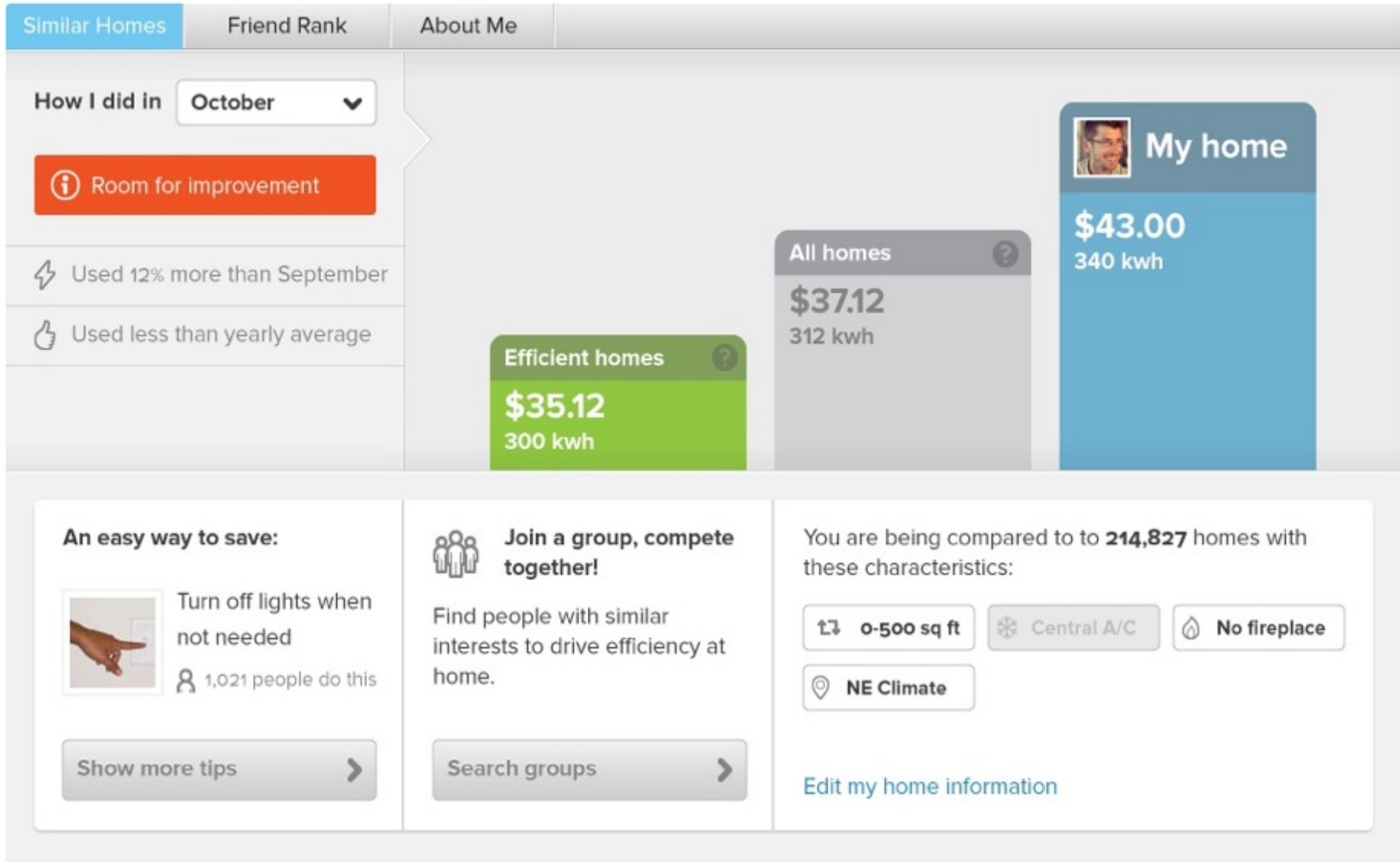
12



Harvard University
Radcliffe Quadrangle at
Shepard St / Garden St

2

16



Opower's founders (Harvard CS graduates)



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

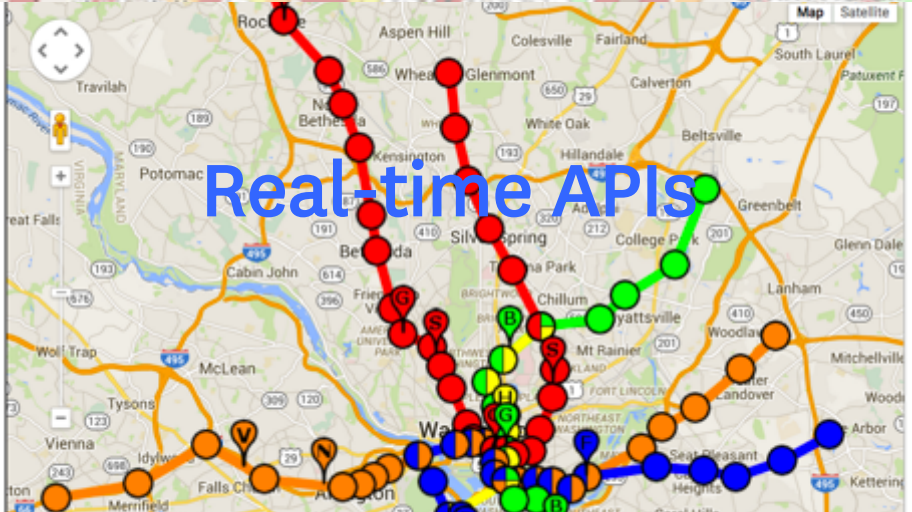
OpenStreetMap



GTFS



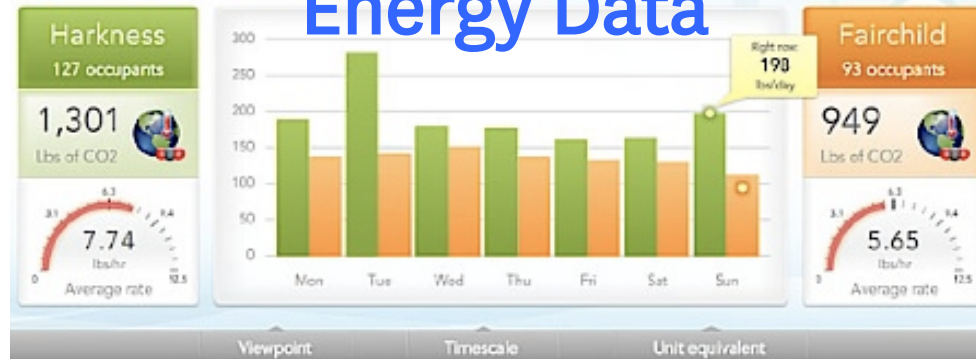
Real-time APIs



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



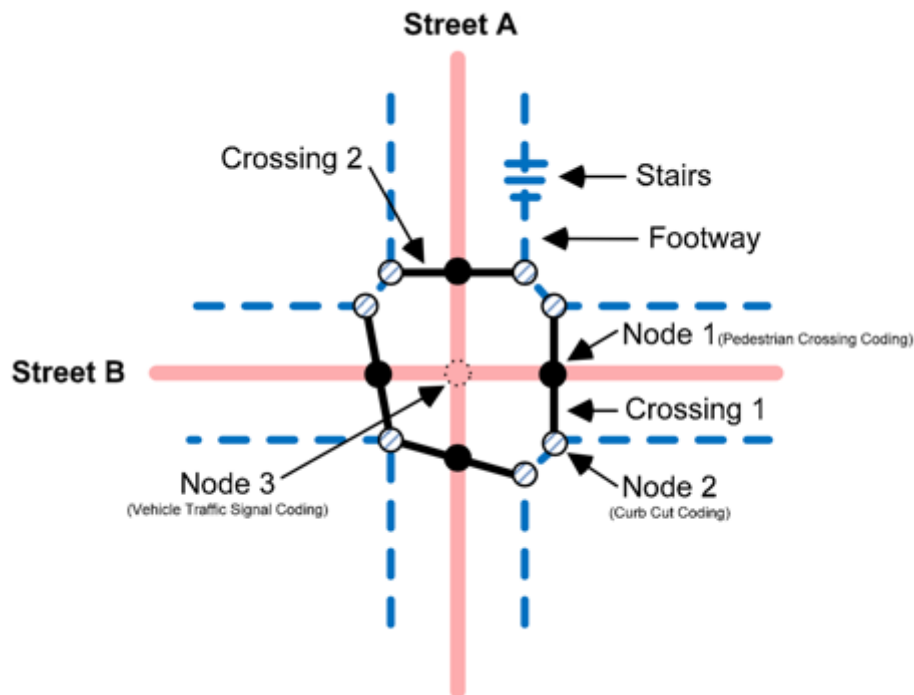


Content edits to OpenStreetMap



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



Get Solar!



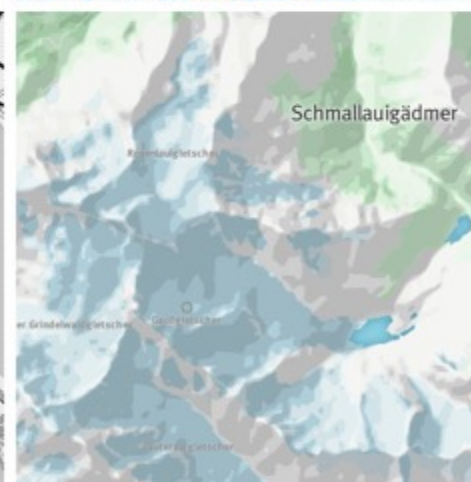
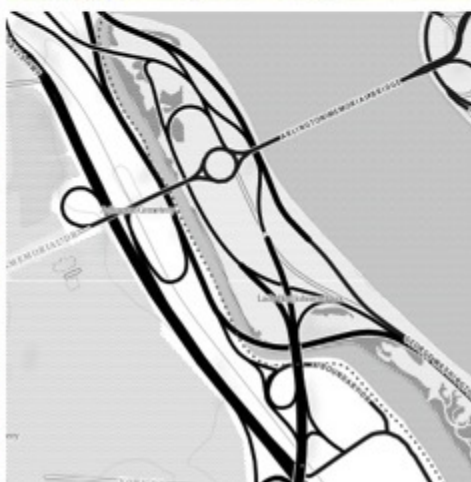
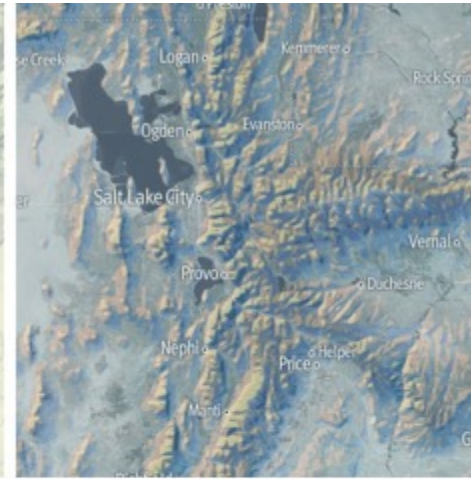
work with the sun®

Solar
mapping of
CS50 HQ

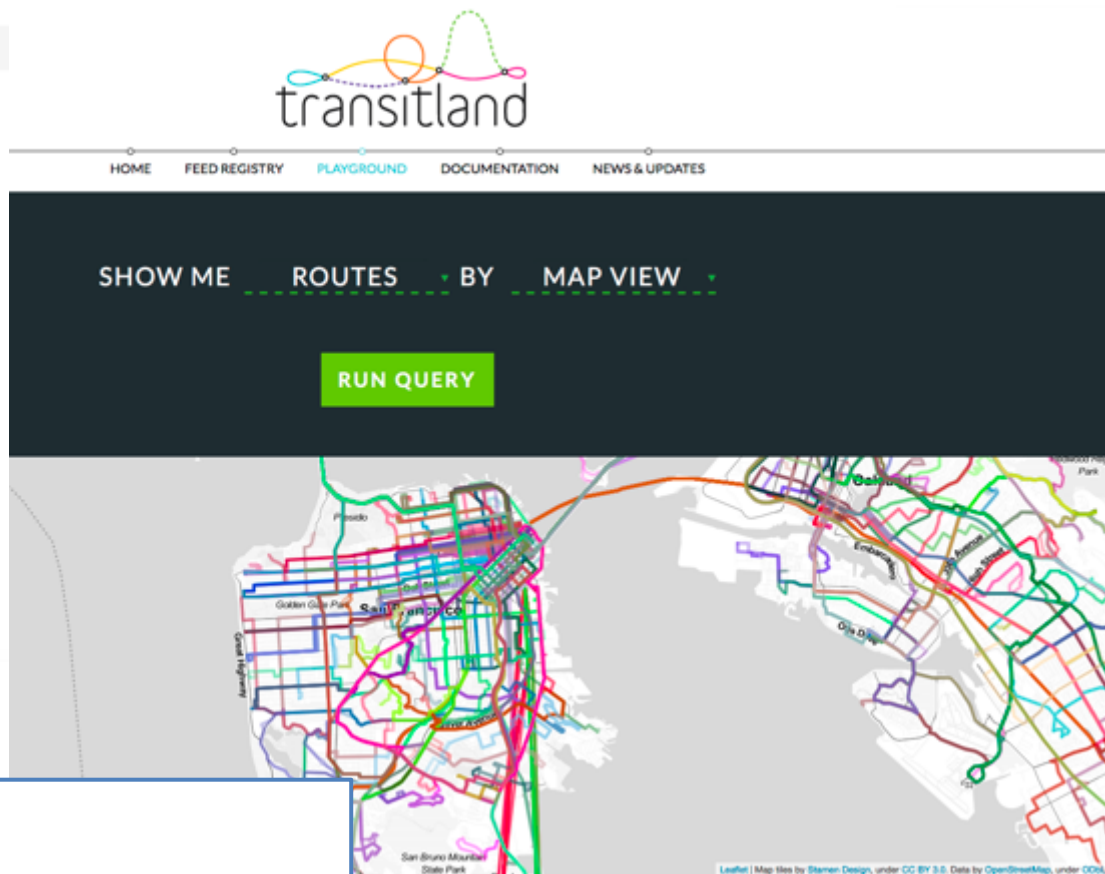
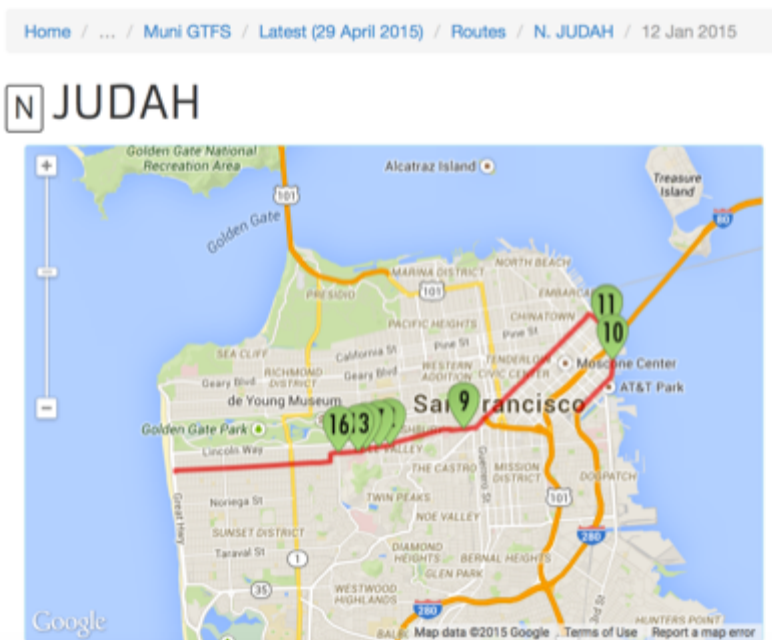
Click to expand full financial, technical and
environmental metrics.



(all generated from OSM data with Mapbox)



Explore global transit with open data schedules (GTFS)



Transportation

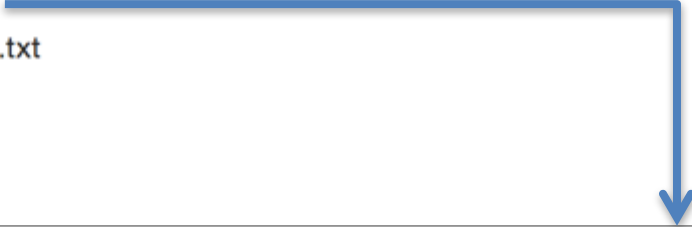
**How a National Transit Map could connect
'transit deserts' to the grid**

GTFS is really simple to get started with

- agency.txt
- calendar_dates.txt
- calendar.txt
- fare_attributes.txt
- fare_rules.txt
- feed_info.txt
- frequencies.txt
- routes.txt
- shapes.txt
- stop_times.txt
- stops.txt
- transfers.txt
- trips.txt

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

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



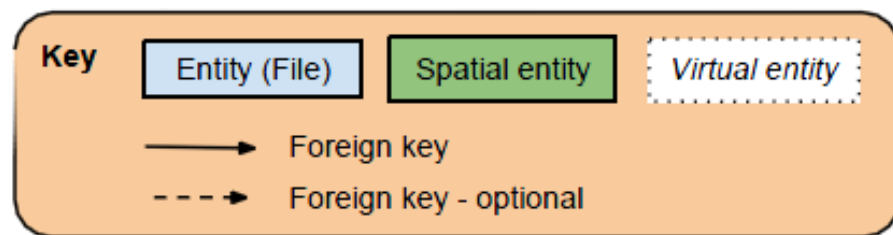
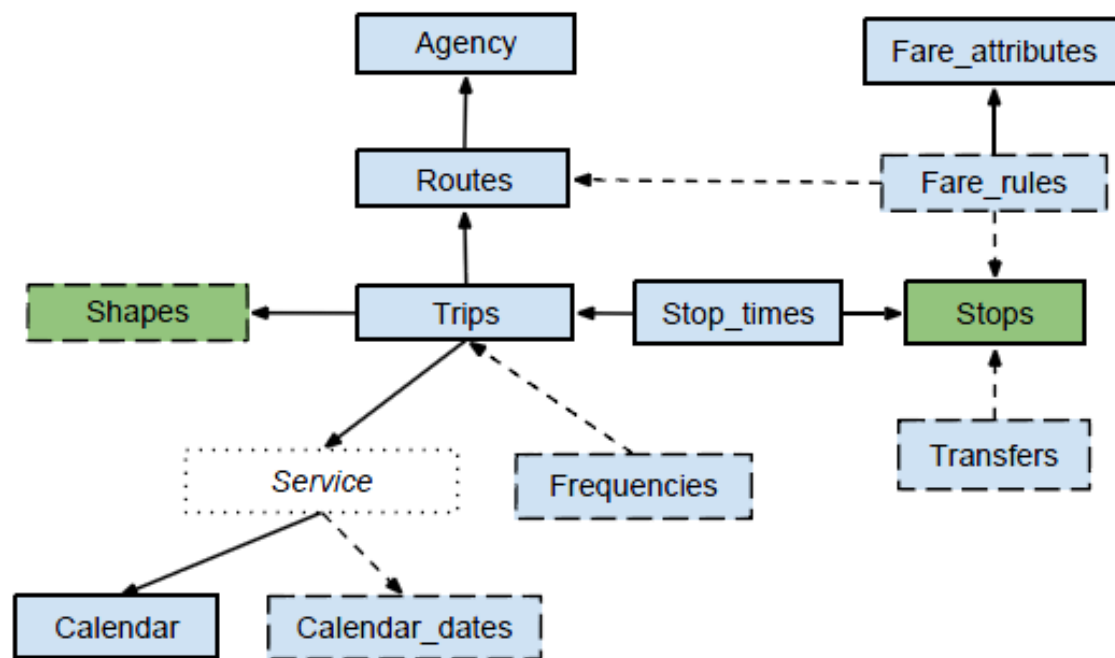
stop_id	stop_code	stop_name	stop_desc	stop_lat	stop_lon	zone_id	stop_url	location_type
2523		Center Street		37.8702946	-122.26851			0
2524		Sproul Hall: Bancroft Way @ Barrow Lane		37.868811	-122.25899			0
2525		Banway Building: Bancroft Way @ Shattuck Avenue		37.867679	-122.2675			0
2526		Buchanon Street @ 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:

ALL

[See commuting patterns](#)

No. of Trips

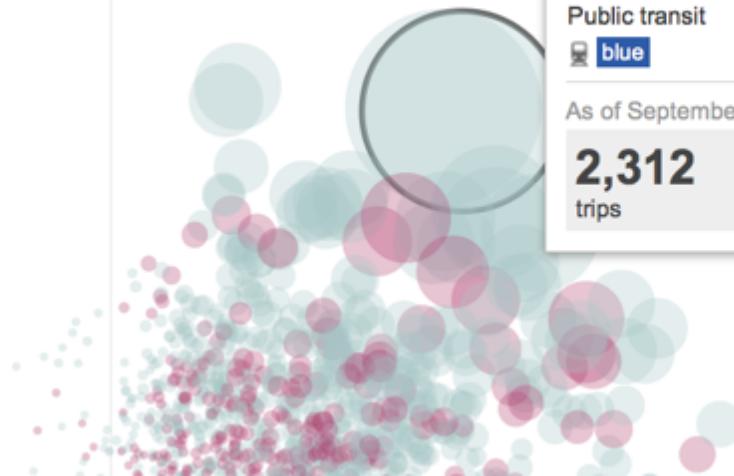
3,200 -

1,600 -

800 -

400 -

200 -



From:

South Station - 700 Atlantic Ave.

To:

Lewis Wharf - Atlantic Ave.

0.84 mi

Travel time savings **12 mins**

Bike 7 mins

or

Public transit 19 mins



As of September 2012

2,312
trips

425 hrs
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

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

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

Venerable API directory programmableweb.com

TRANSIT
SCREEN

OUR TEAM



OUR MISSION

- **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

