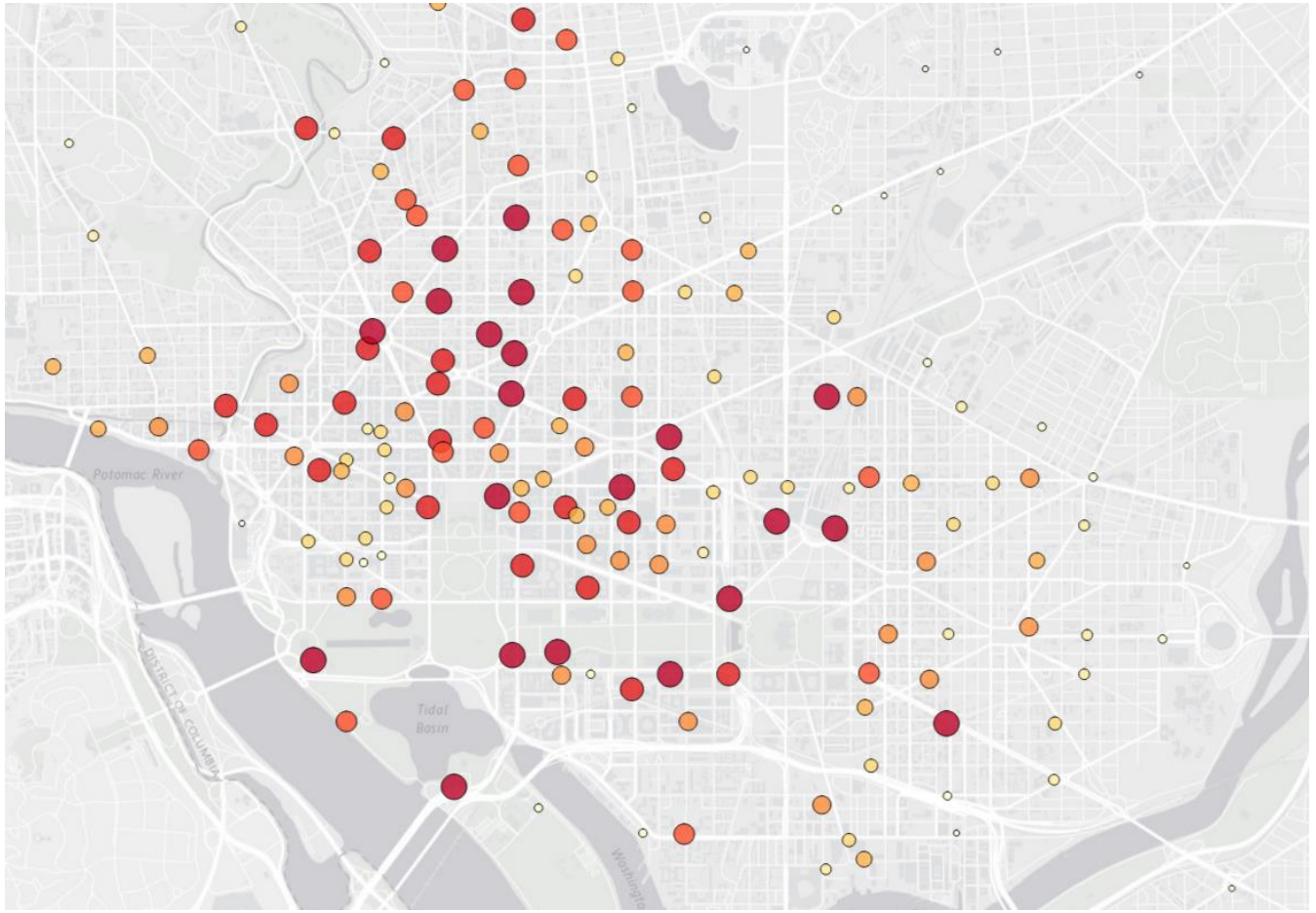
Cabi Visualizations with
Amazon Web Services & Leaflet



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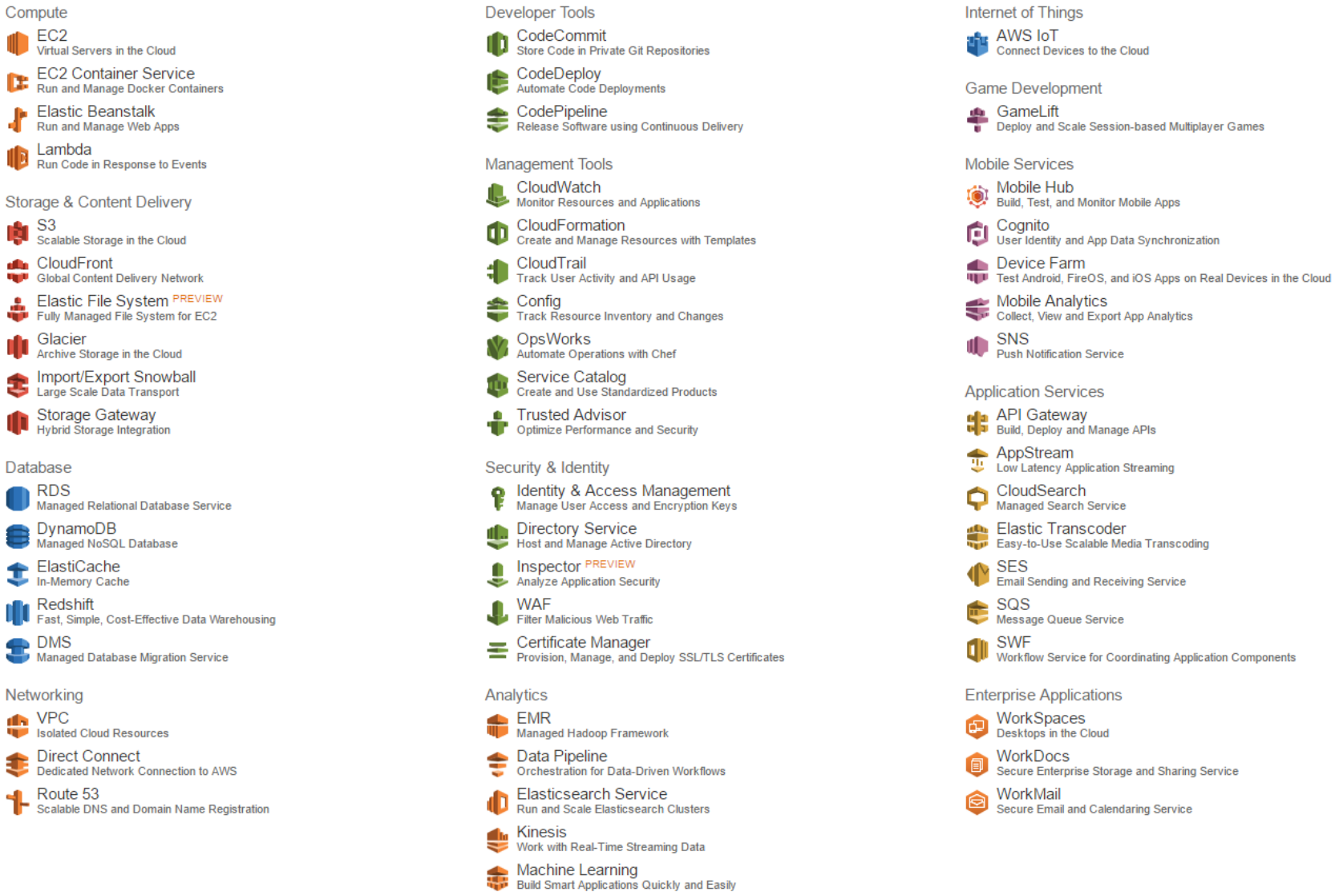
Transportation Techies Meetup 4/28/2016

Background

Amazon web services offers many cloud-based services:



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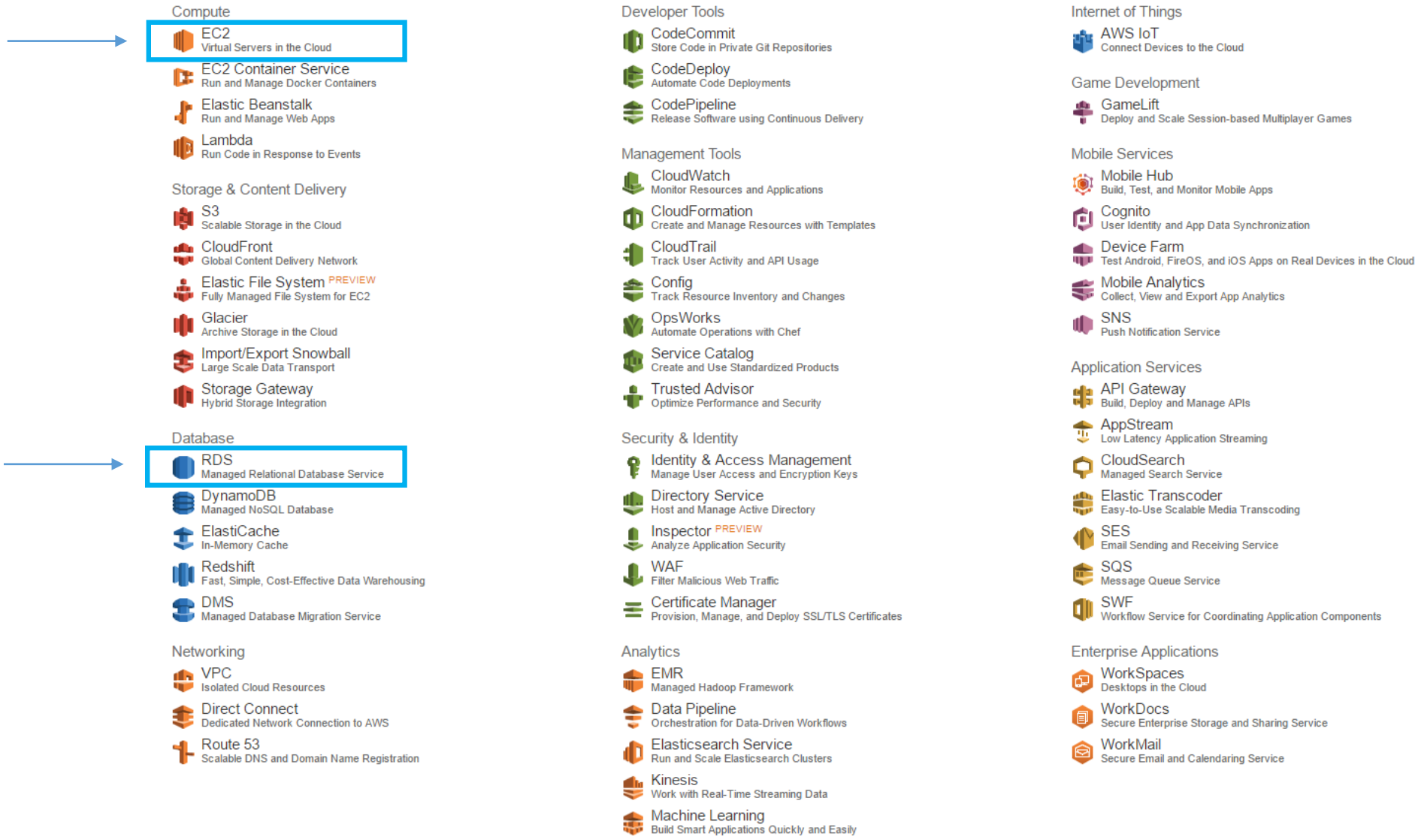
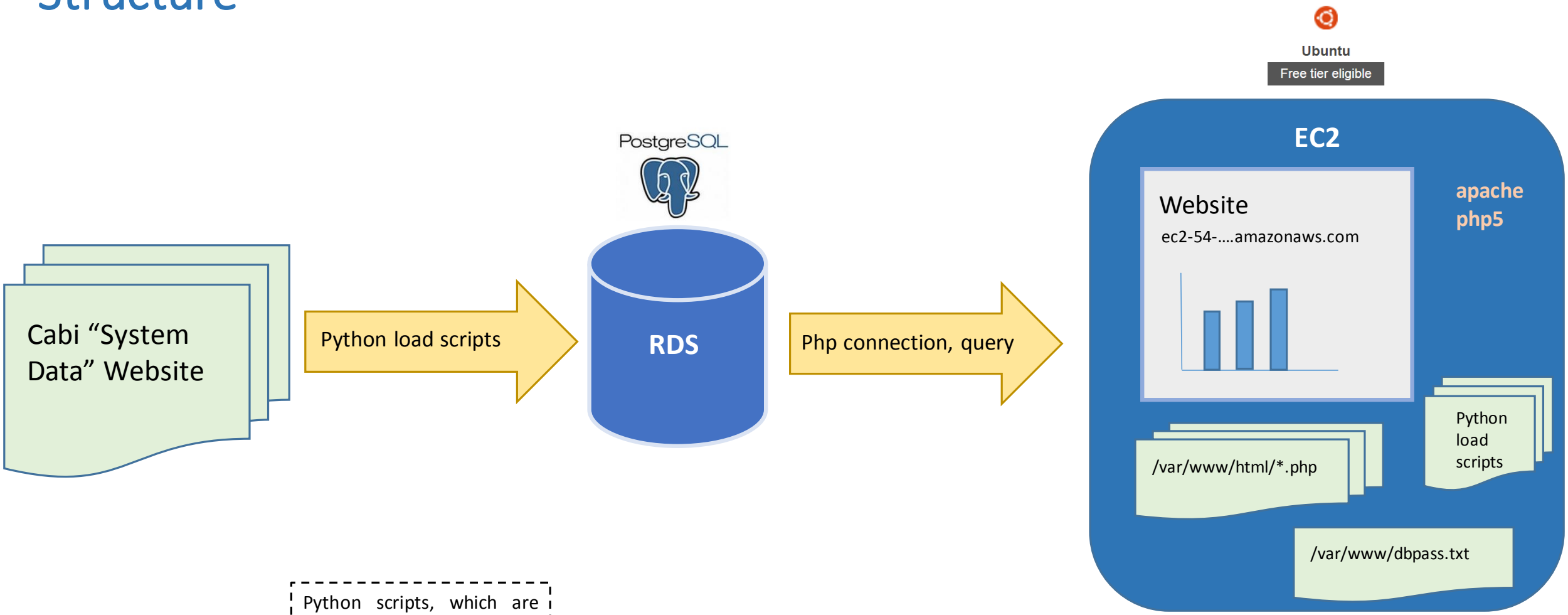


EC2 & RDS

- EC2
  - Creates an Ubuntu server in the cloud
  - Ubuntu Server 14.04 LTS (HVM), SSD Volume Type, 64 bit
  - The free tier (“t2.micro”)
    - 1 vCPU, 1GB RAM, 30 GB storage

- RDS
  - Creates a relational database in the cloud
  - PostgreSQL Database
  - Free tier (“t2.micro”)
    - Dev/Test (production option only available for paid)
    - 1 vCPU, 1 GB RAM, 20 GB storage

Structure



Data is stored on the Capital bikeshare system data website. Each quarter's data is stored in a zip file

Python scripts, which are stored on the EC2 are run to pull the latest ride history files. Use the psycopg2 python library for postgres connectivity.
Also load spatial data: station locations and metro entrance locations.

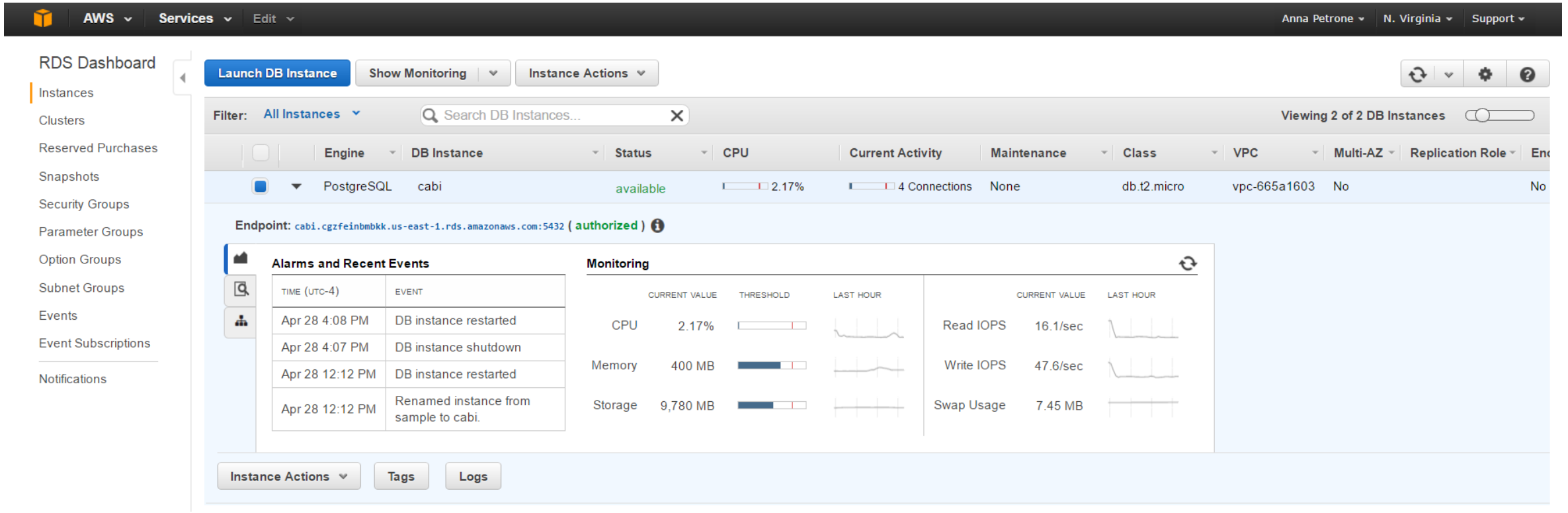
The RDS is a PostgreSQL database with the PostGIS extension installed.

The website makes queries to the RDS. It uses PHP which has a function pg_connect() to connect to a Postgres database.

Website files are stored on the EC2 in /var/www/html/.

AWS Console

- Used to view running instance
- Reboot, modify them if necessary
- Set security permissions (explained on next slide)
- Get database endpoint and EC2 IP address and public DNS



Security

Security is handled through “security groups”

- The EC2 permissions:
  - Accepts SSH requests from
    - Your IP
  - Accepts HTTP requests from
    - Any IP
- The RDS permissions:
  - Accepts PostgreSQL request from
    - Your IP
    - *The private IP of the EC2*

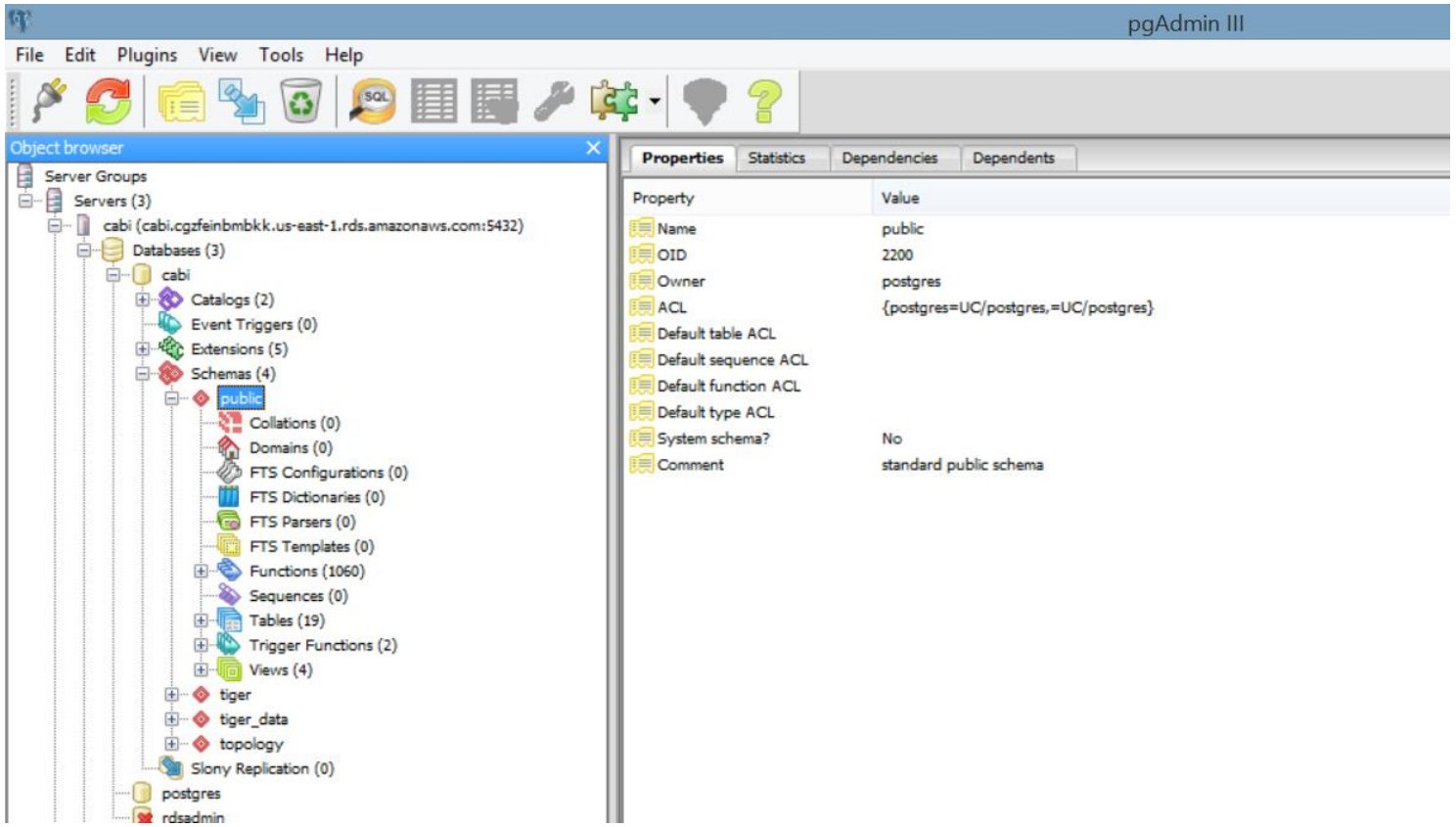
SSH requests in order to execute python load scripts

HTTP requests because it hosts the website.

Accepts Postgres requests to manually run queries, and accept website queries

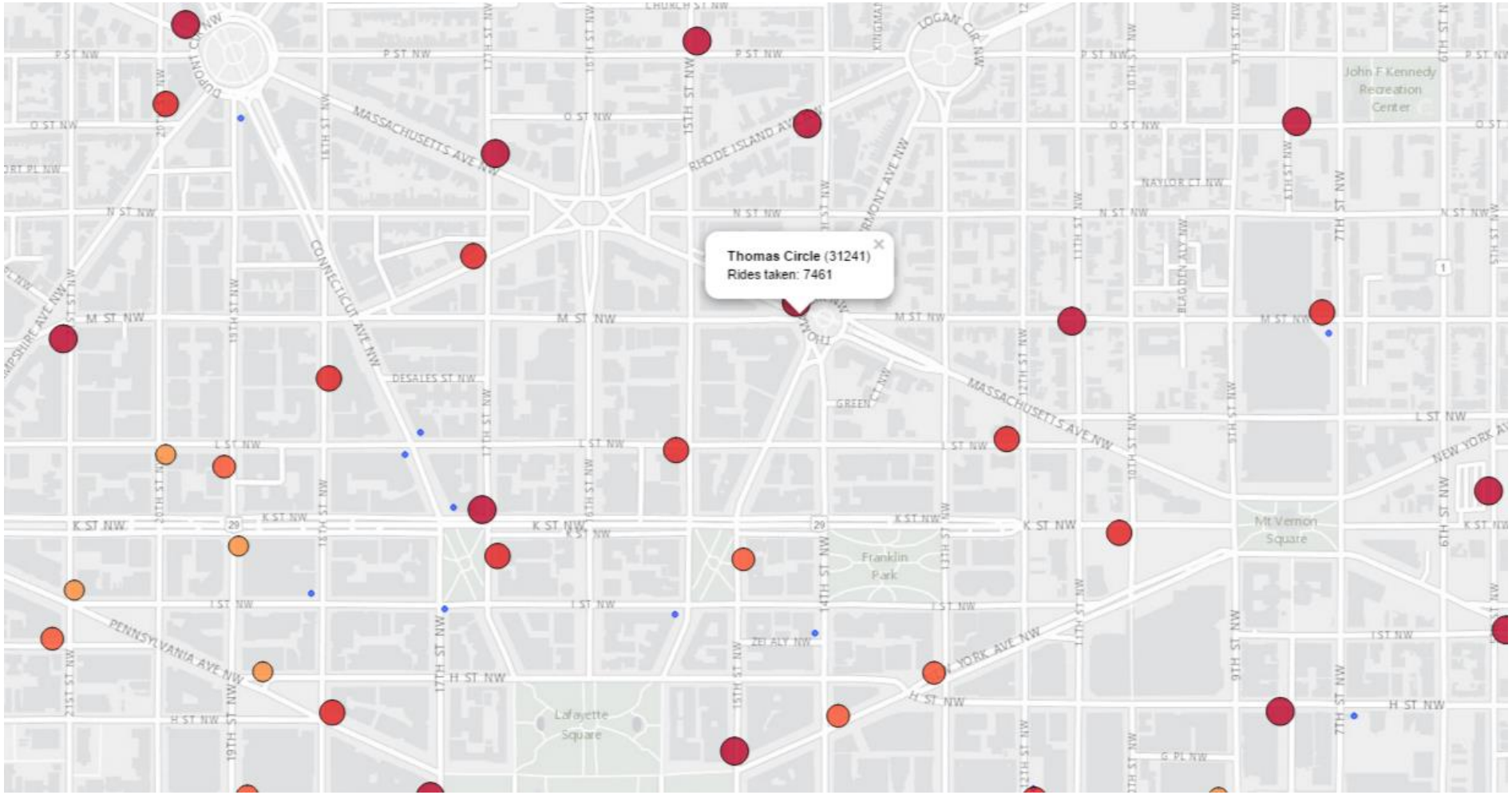
Connecting with pgAdminIII

- http://www.pgadmin.org/
- Connect to your DB and run queries against it
- Database must accept PostgreSQL connections from your IP address
- Good for extracting small data sets. Otherwise write a python script using `copy_from`



Live Demo!

- http://ec2-52-207-212-11.compute-1.amazonaws.com/



Note about data cleaning

- The rides data come from the Cabi Website – one per each quarter since 2010Q4
- The formatting is not the same across all files 😭
- See headers.csv to see the differences
- Most importantly, terminal ID is not present in most files
- Sometimes it's concatenated with the station name, ie station_name = '14th & Harvard St NW (31105)'
  - In this case, the terminal ID is parsed out
- Otherwise, station name is tried to match into stations table (sourcing from the live xml feed file)
  - But there may have been a name change or station relocation in the past. Can't do anything about this
- Overall ~95% rides have matched start and end terminal ID's

Code snippets

Website code: read user form selection

```php
<?php
    $submitted = $_REQUEST['submitted'] ?: 'No filters';

    if($submitted== 'Apply Settings'){
        $output_type = $_REQUEST['output_type'] ?: 'bubble';

    // if user has applied queries, get the values, where now a null means false.
    // the ?: does a coalesce in php5.3 and higher
        $color_by = $_REQUEST['color_by'] ?: 'trip_origins';
        $start_date = $_REQUEST['start_date'] ?: $date_min;
        $end_date = $_REQUEST['end_date'] ?: $date_max;
        $time_period = $_REQUEST['time_period'] ?: 'all';

        $monday = $_REQUEST['monday'] ?: 0;
        $tuesday = $_REQUEST['tuesday'] ?: 0;
        $wednesday = $_REQUEST['wednesday'] ?: 0;
        $thursday = $_REQUEST['thursday'] ?: 0;
        $friday = $_REQUEST['friday'] ?: 0;
        $saturday = $_REQUEST['saturday'] ?: 0;
        $sunday = $_REQUEST['sunday'] ?: 0;

        $registered = $_REQUEST['registered'] ?: 0;
        $casual = $_REQUEST['casual'] ?: 0;
    };
```

Code snippets

Website code: connect to database

```
$dbconn = pg_connect("dbname='cabi' host=$host port=5432 user='postgres' password=$dbpass connect_timeout=5") ;
```

Create query based on inputs

```
$make_temp_table = "
    create table map_temp
    as
    select ride_terminal_id, sum(n_rides) as n_rides
    from ".$from_table."
    where ride_date between '".$start_date."' and '".$end_date."'
    and ".$where_time."
    and ".$where_weekday."
    and ".$where_member."
     group by 1;";

$get_data = "SELECT row_to_json(fc) as json_feature_list
     FROM ( SELECT 'FeatureCollection' As type, array_to_json(array_agg(f)) As features
     FROM (SELECT 'Feature' As type
        , ST_AsGeoJSON(the_geom)::json As geometry
        , row_to_json((SELECT l FROM (SELECT n_rides, terminal_id, station_name) As l
          )) As properties
       FROM stations As lg
       join map_temp as m
       on lg.terminal_id = m.ride_terminal_id::int
       ) As f )  As fc;
    ";
```

Code snippets

- Leaflet: styling function for bubble colors

```
function getColor(d) { // check here for colors http://colorbrewer2.org/
    return (
    d > quantiles[10] ? '#800026v' :
    d > quantiles[9] ? '#bd0026' :
    d > quantiles[8] ? '#e31a1c' :
    d > quantiles[7] ? '#fc4e2a' :
    d > quantiles[6] ? '#fd8d3c':
    d > quantiles[5] ? '#feb24c' :
    d > quantiles[4] ? '#fed976' :
    d > quantiles[3] ? '#ffeda0':
    d > quantiles[2] ? '#ffffcc' :
      '#ffffe6' );
};
```

- Adding pop-ups

```
function onEachFeature_point(feature, layer) {
    // bind whatever popUp info you want
    if (feature.properties ) { //&& feature.properties.neighborhood_name
        layer.bindPopup(
            '<b>'+feature.properties.station_name+'</b><br>'+
            'Rides taken: '+feature.properties.n_rides+'<br>'+
            'Terminal id: '+feature.properties.terminal_id
        );
    }
    };
```

Code snippets

- Adding geometries to map

```
var dat = <?php echo $dat ?>;

var geojson;
geojson = L.geoJson(dat, {
    pointToLayer: function (feature, latlng) {
        return L.circleMarker(latlng, style_point(feature));
        },
    onEachFeature: onEachFeature_point
}).addTo(map);
```

Thank you!

Links

- To visualization tool:
  - http://ec2-52-207-212-11.compute-1.amazonaws.com/
- To Github Repo w/ instructions & code
  - https://github.com/ampetr/aws-leaflet

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