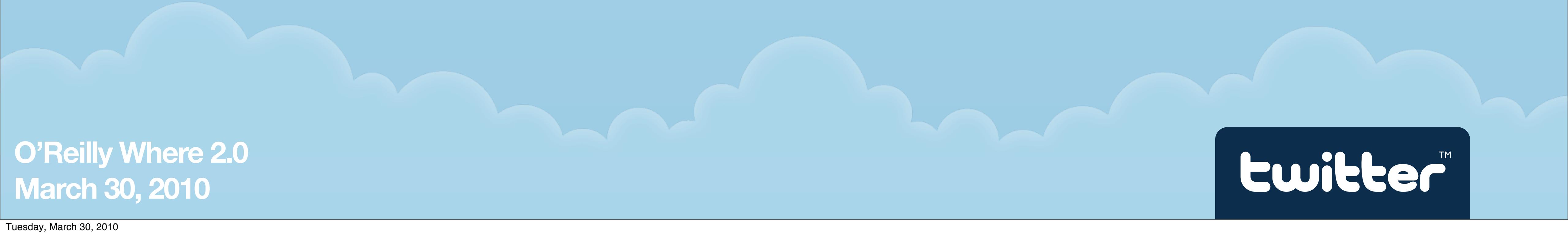


Handling Real-time Geostreams

#rtgeo #where20



O'Reilly Where 2.0
March 30, 2010



Twitter / raffi: Check out that X

http://twitter.com/raffi/status/

twitter

Login Join Twitter!

Hi, I'm @raffi
<http://twitter.com/raffi>

1 minute ago from api

 raffi

© 2009 Twitter [About Us](#) [Contact](#) [Blog](#) [Status](#) [Goodies](#) [API](#) [Business](#) [Help](#) [Jobs](#) [Terms](#) [Privacy](#)

Background

Wherehoo (2000)

- “The Stuff Around You”
- “Wherehoo Server: An interactive location service for software agents and intelligent systems” - J.Youll, R.Krikorian
- In your `/etc/services` file

BusRadio (2004)

- Designed mobile computers to play media while also transmitting telemetry
- Looked and sounded like a radio - but really a Linux computer

OneHop (2007)

- Bluetooth proximity-based social networking

Table of Contents

Background

- ▶ Why are we interested in this?

Twitter's Geo APIs

- ▶ How do we allow people to talk about place?

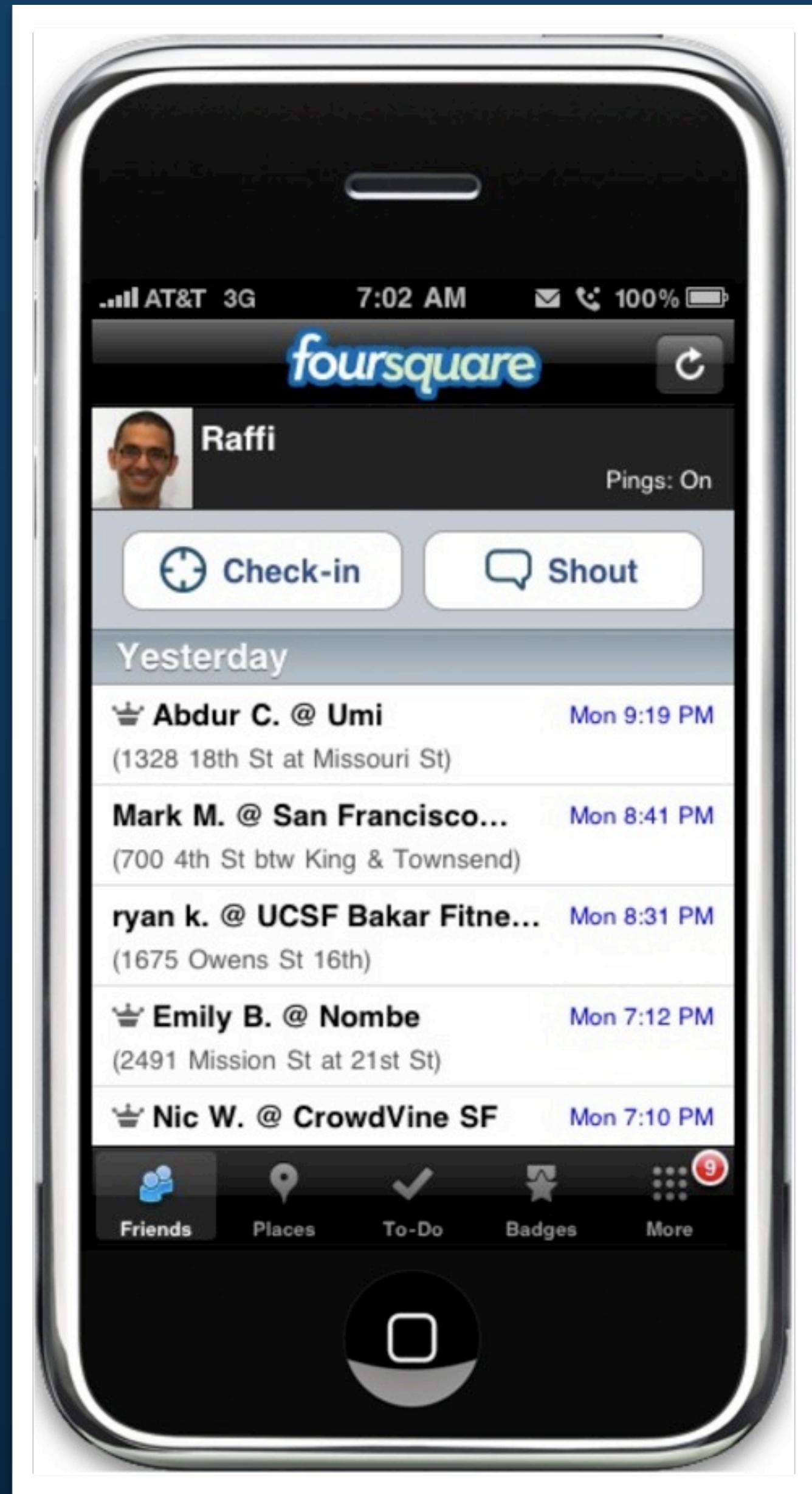
Problem statement

- ▶ What are we trying to have our system do?

Infrastructure

- ▶ How is Twitter solving this problem?

People want to talk
about places



My setup at the new office is

http://www.flickr.com/photos/raffik/4109176147/

Signed in as raffik

Home You Organize & Create Contacts Groups Explore Search

My setup at the new office is complete.

Share This

Upgraded on November 16, 2009 by raffik

raffik's photostream

948 uploads

2 people call this photo a favorite

People in this photo

Add a person

Tags

Add a tag

Additional Information

Some rights reserved (edit)

Anyone can see this photo (edit)

Add to your map

Taken on November 16, 2009 (edit)

Comments



My setup at the new office is

http://www.flickr.com/photos/raffik/4109176147/

Signed in as raffik

Home You Organize & Create Contacts Groups Explore Search

My setup at the new office is complete.

Share This

Add to your map

Map Hybrid Satellite

Here's 795 Folsom St, San Francisco. Move the map to place your photo.

Or, search again.

795 folsom st GO (Some formats are OK.)

SAVE TO MAP Or, cancel.

125m 1528ft

Data © 2009 NAVTEQ

Go to the Organizr | Go to the map

37°46'56"N, 122°24'04"W
(37.7821, -122.401)

Comments

Taken on November 16, 2009 (edit)

Flickr: Explore your photos

http://www.flickr.com/photos/raffik/map/?photo=4109176147&zl=2

Signed in as raffik

Home You Organize & Create Contacts Groups Explore Find a place Search Link to this map

Map Hybrid Satellite

Bayside

My setup at the new office is complete. by raffik

Your stuff (1). Sort by: Interesting • Recent

Search the map

125m 1528ft

Data ©2009 NAVTEQ

The map displays a detailed street layout of San Francisco, specifically the area around Market Street and Howard Street. Key landmarks labeled include the Bart-Powell Street Station, Westfield San Francisco Centre, Metreon, Moscone Center West, Moscone Center, and various city blocks. A yellow line traces a path along Market Street, while a red line highlights a more direct route through the grid. A pink star marks a specific location in the center of the map. In the bottom left corner, there is a thumbnail image of a blue cloth or bag with the words "HOME TWEET HOME" printed on it in white. Below the thumbnail, a caption reads "My setup at the new office is complete. by raffik". At the bottom of the map, there is a search bar with the placeholder "Search the map" and a scale bar indicating 125m (1528ft) distance.

What's happening here?

Twitter's Geo APIs

Original attempts

Adding it to the tweet

- Use myloc.me, et. al. to add text to the tweet
- Localizes mobile phone and puts location “in band”
- Takes from 140 characters

Setting profile level locations

- Set the user/location of a Twitter user
- There is an API for that!
- Not on a per-tweet basis and not designed for high frequency updates

Tuesday, March 30, 2010

Twitter / Evan Williams: I thin

http://twitter.com/ev/statuses/6587709893

twitter Login Join Twitter!

I think there needs to be more beer
drinking at Tea Time
<http://myloc.me/22e00>

6:43 PM Dec 11th from UberTwitter

ev
Evan Williams

© 2009 Twitter About Us Contact Blog Status Goodies API Business Help Jobs Terms Privacy

UberTwitter - ev - I think the

http://myloc.me/show.php?id=22e00

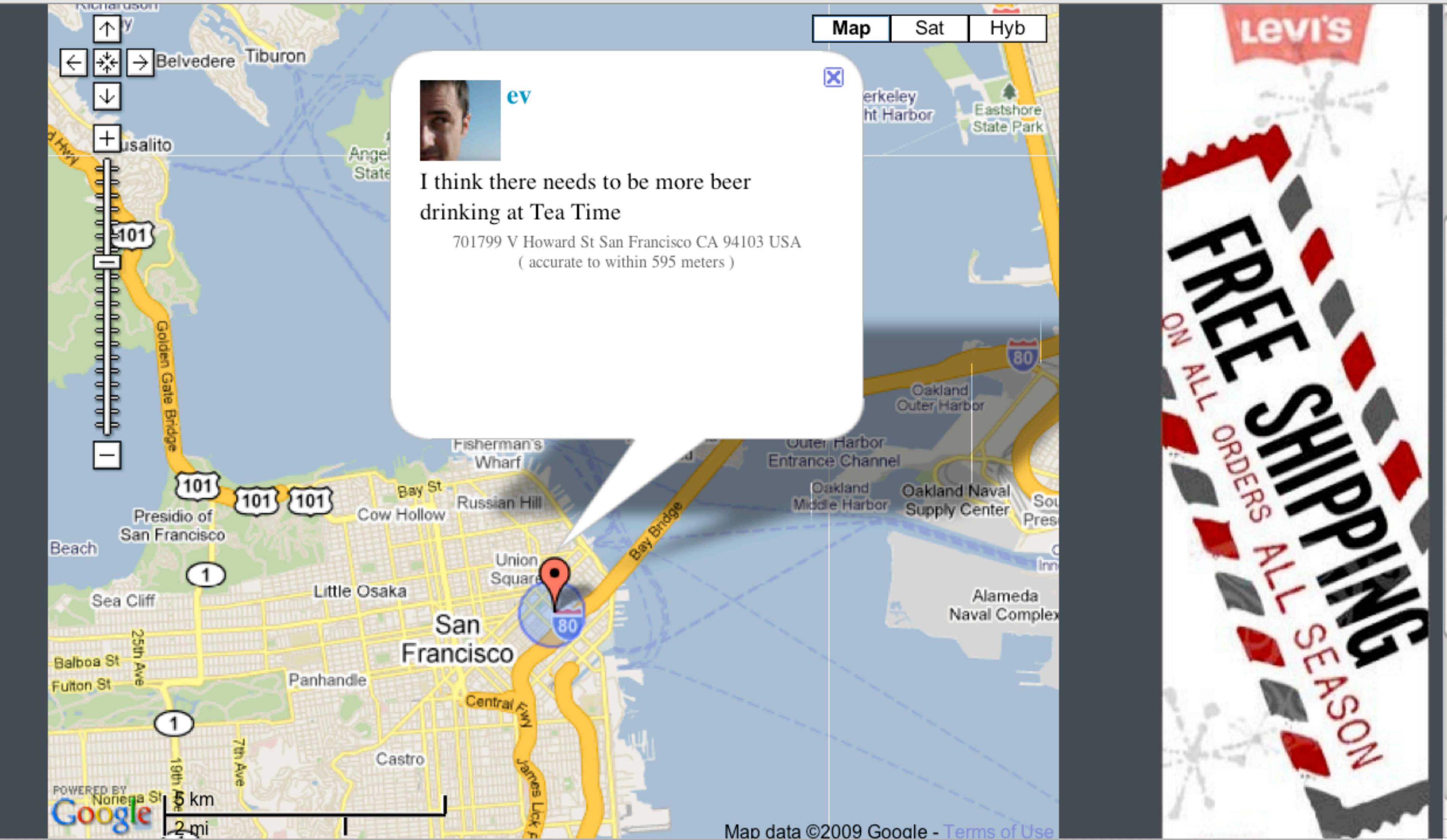
Map Sat Hyb

 ev

I think there needs to be more beer drinking at Tea Time

701799 V Howard St San Francisco CA 94103 USA
(accurate to within 595 meters)

Map data ©2009 Google - [Terms of Use](#)



```
curl -u USERNAME:PASSWORD \  
-d location="San Francisco, California" \  
http://twitter.com/account/update\_location.xml
```

```
<user>  
  <id>8285392</id>  
  <name>raffi</name>  
  <screen_name>raffi</screen_name>  
  <location>San Francisco, California</location>  
  ...  
</user>
```

Geotagging API



Geotagging API

Adding it to the tweet

- Per-tweet basis
- Out of band / pure meta-data
- Does not take from the 140 characters

Native Twitter support

- Simple way to update status with location data
- Ability to remove geotags from your tweets en masse
- Using GeoRSS and GeoJSON as the encoding format
- Across all Twitter APIs (REST, Search, and Streaming)

Sending an update

status/update

```
curl -u USERNAME:PASSWORD -d "status=hey-ho&lat=37.3&long=-121.9" \  
http://api.twitter.com/1/status/update.xml
```

```
<status>  
  <text>hey-ho</text>  
  ...  
  <geo xmlns:georss="http://www.georss.org/georss">  
    <georss:point>37.3 -121.9</georss:point>  
  </geo>  
  ...  
</user>
```

near:"San Francisco" from:rsarver

http://search.twitter.com/search?q=near:"San+Francisco"+from:rsarver

twitter

near:"San Francisco" from:rsarver

Search Advanced Search

Realtime results for **near:"San Francisco"** from:rsarver 0.89 seconds

 [rsarver](#): Watching the South Park episode about WOW. Forgot how funny it was.
One of their best
[37.775400, -122.397400](#)
about 9 hours ago from *Tweetie* · [Reply](#) · [View Tweet](#)

 [rsarver](#): For those of you in SOMA, [@groupon](#)'s deal today is for eating at Zuppa.
\$15 for \$35 <http://bit.ly/4Epldu> ([expand](#))
[San Francisco, CA](#)
about 11 hours ago from *Tweetie* · [Reply](#) · [View Tweet](#)

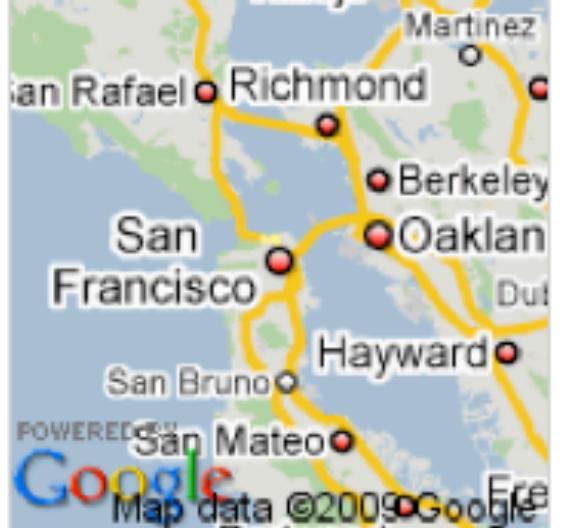
 [rsarver](#): [@georgemedia](#) check out the Search API and the "geocode" parameter
<http://apiwiki.twitter.com/Twitter-Search-API-Method:-search>
[San Francisco, CA](#)
about 14 hours ago from *Tweetie* · [Reply](#) · [View Tweet](#) · [Show Conversation](#)

 [rsarver](#): RT [@dreetje](#): Wrote a simple tool to see your geo-tagged tweets on a map
:) <http://bit.ly/6yy2e9> ([expand](#)) <http://yfrog.com/3ldskp>
[San Francisco, CA](#)
about 15 hours ago from *Topsy* · [Reply](#) · [View Tweet](#)

 [rsarver](#): RT [@OliRyan](#): Retweet me (that's you team twitter!) Twitter is hiring, a LOT, check out www.twitter.com/jobs and tell your friends!

[!\[\]\(510607c8d65afc24820ec3baaf53ec88_img.jpg\) Feed for this query](#)
[!\[\]\(90ed8a7295b2f9dc88991b7e4bf8543a_img.jpg\) Tweet these results](#)

Show tweets **near:**


POWERED BY Google Map data ©2009 Google

Within: kms

Show tweets **written in:**

Trending topics:

- [#nowplaying](#)
- [#freakythoughts](#)
- [#somethingaintright](#)
- [Christmas](#)
- [#xiahjunsu](#)
- [Xmas](#)
- [#omgfaacts](#)

Search

search (with geocode)

```
curl "http://search.twitter.com/search.atom?  
geocode=40.757929%2C-73.985506%2C25km&source=foursquare"
```

geocode parameter takes “latitude,longitude,radius” where radius has units of mi or km

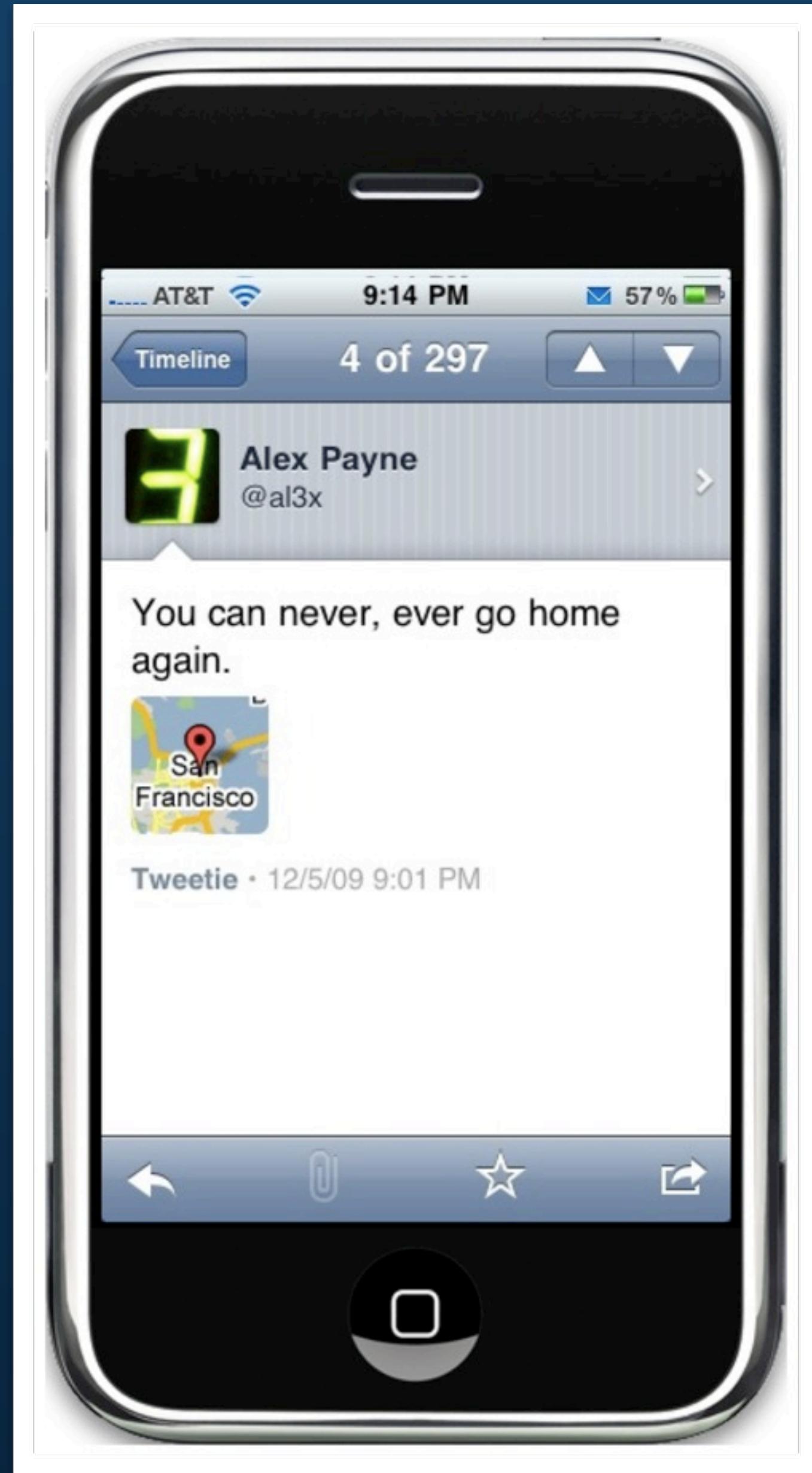
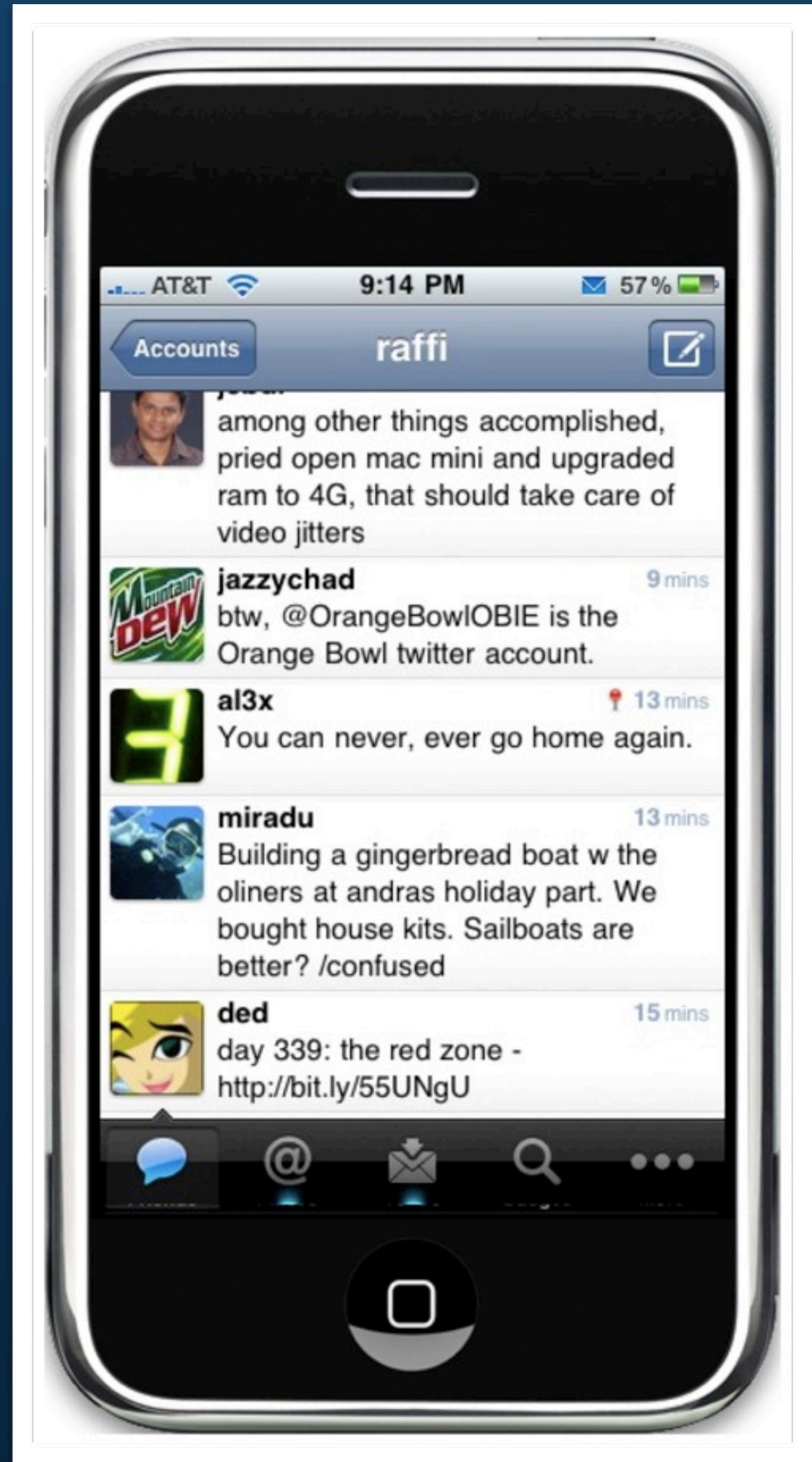
...

```
<title>On the way to ace now, so whenever you can make it I'll be there. (@  
Port Imperial Ferry in Weehawken) http://4sq.com/2rq0v0</title>
```

...

```
<twitter:geo>  
  <georss:point>40.7759 -74.0129</georss:point>  
</twitter:geo>
```

...



Seesmic

You are using Seesmic in preview mode. To save your session, [Sign up](#) | [Help](#) | [Feedback](#) | Language English ▾ | Theme White ▾ | Logout

Home Messages Click here to enter your status update search

Timeline Mentions Sent Favorite Direct messages Lists Searches Trending Topics

Timeline

tiger My mouse feels under-dressed for this palatial pad. Thanks, @dino! <http://twitpic.com/tmr8t>
14m ago via Tweetie

swissmiss My studiomate @Shiflett just announced their little web design and development co-operative called Analog (@analogcoop): <http://analog.coop>
18m ago via TweetDeck

rsarv order
jess I
ajturn set of
zzgav
Pista
Pistachio dear lazyweb - wondering if ANY hallmark store in the Boston area has ANY recordable storybooks left. not just the Christmas one.
tigoe Why are all hospitals such labyrinthine nightmares to get around in?
iTunes Trailers Exclusive HD trailer debut- Russell Crowe & Cate Blanchett in Ridley Scott's Robin Hood http://tinyurl.com/rh_film

@ Mentions

tiger @raffi and how!
11m ago via web in reply to raffi

KnoWhen2SayWhen That's pretty cool, Raffi. :-) RT @raffi Check out that byline <http://flic.kr/p/7nStw4>
13h ago via web

Manjeera @raffi I am looking at the contributor API post (<http://bit.ly>) and wanted to know when the new parameter will be added to the calls.
13h ago via web

abrahamvegh @raffi Can't wait to play with this one in the API. :)
16h ago via web in reply to raffi

gotwalt @raffi CoTags are dead! Long live the CoTags!
16h ago via CoTweet in reply to raffi

vl @raffi that byline looks slick.
17h ago via web in reply to raffi

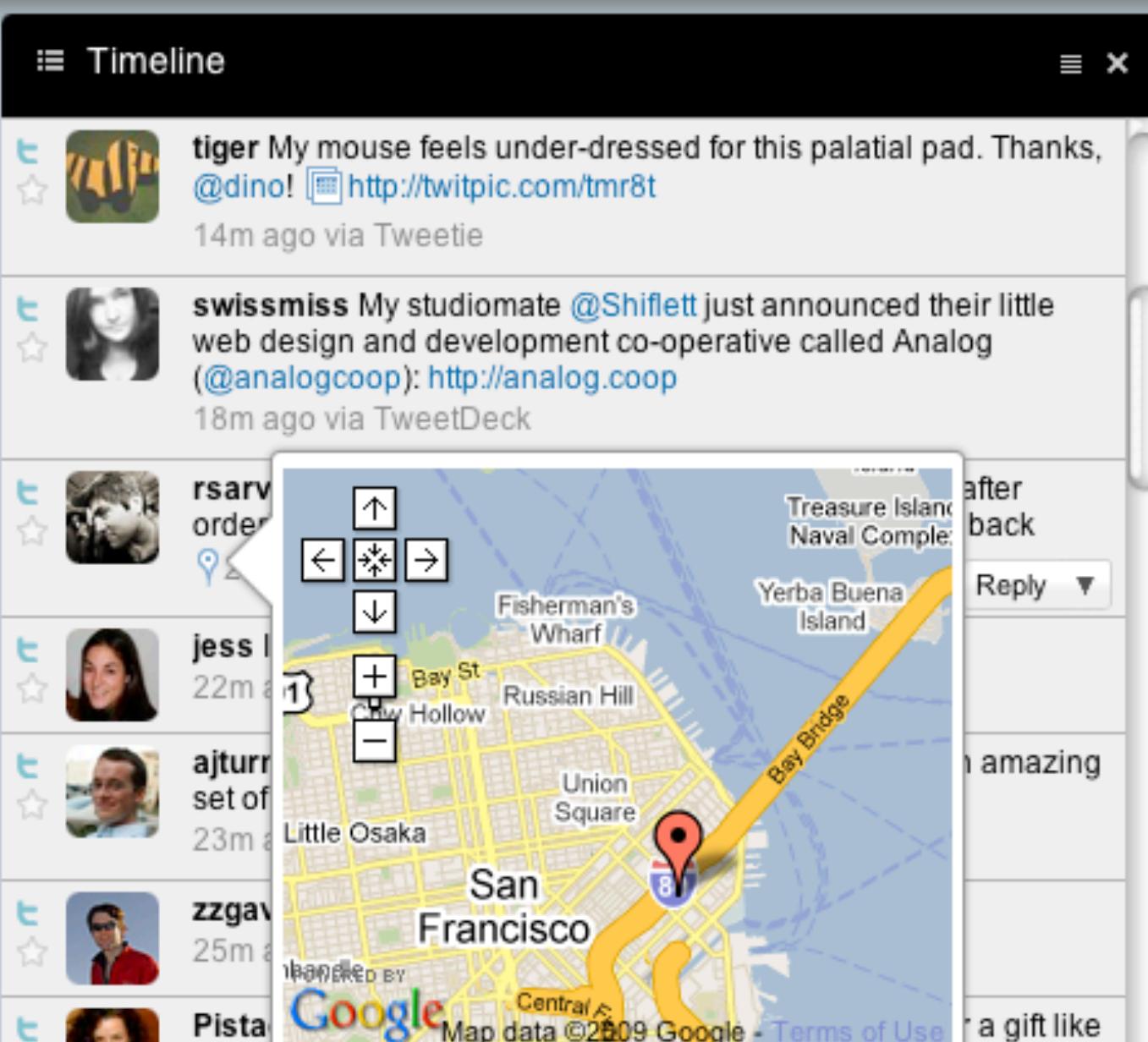
happn_in_trendr @raffi You just set the trend for 'cell phones' on @happn_in_sfbay | <http://happn.in/sfbay/14dec09-08am/>
1d ago via API

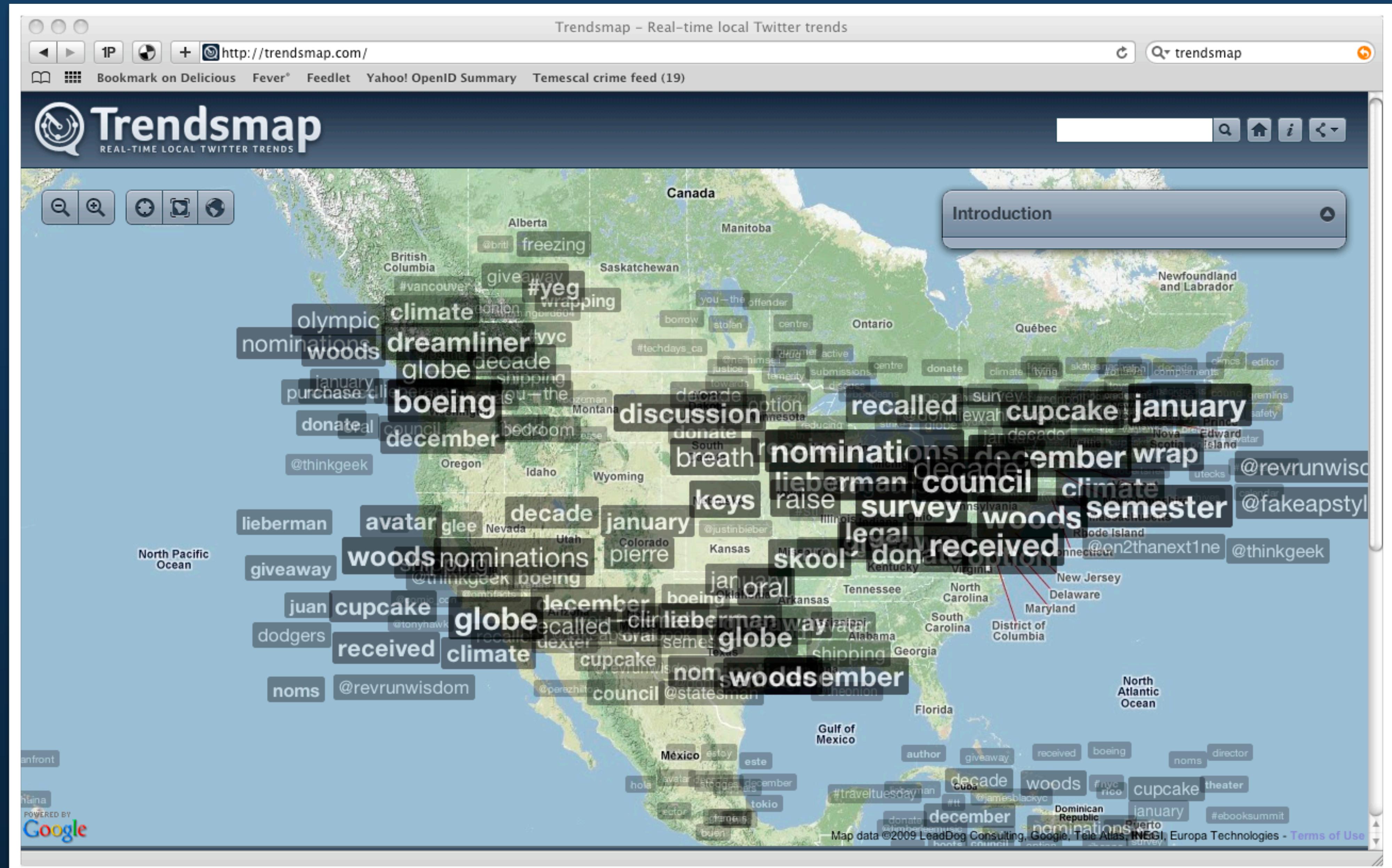
miradu @raffi and @flyingzumwalt are two of the most amazing people in my life. I feel so privliged to get to dine with them in sf!
2d ago via Tweed

miradu @raffi they already make a really good wind turbine lego set. It comes with a truck for you to drive to the plains and set up!
2d ago via Tweed in reply to raffi

annmarie_thomas maybe replace "study" with "learns"? @raffi OH: "A geek is somebody who studies, studies, and studies- all the time". Practical definition.
2d ago via web

mohdabdurrasafu @raffi ohi I'm sorry. It's on 15th. I Never mind





Twitter / @twitterapi's team | X

← → C Home Star http://maps.google.com/maps?q=http://api.twitter.com/1/twitterapi/lists/team/statuses.atom

Web Images Videos Maps News Shopping Gmail more ▾ raffi.krikorian@gmail.com | My Profile | Web History | My Account | Help | Sign out

Google maps

http://api.twitter.com/1/twitterapi/lists/team/statuses.atom | Search Maps | Show search options

Find businesses, addresses and places of interest.

Get Directions | My Maps | Save to My Maps

Print | Send | Link

Twitter / @twitterapi's team list

Twitter list /twitterapi/team

- mccv: Apparently swing doesn't have to suck. I remain dubious. UI coding in general chills me bones.
- mccv: Apparently swing doesn't have to suck. I
- mccv: Interesting note in this presentation: is java becoming an idl for interop between it's more modern associates (groovy, scala, clojure)?
- mccv: Interesting note in this presentation: is java
- mccv: One of these days I need to look harder at why air gained so much territory that should have been easy pickings for swing
- mccv: One of these days I need to look harder at
- noradio: Fifty pages in & I'm sad to say I'm dissapointed with The Timeless Way of Building despite having high hopes. Vague, repetitive, New Agey.
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- noradio: OH: "It was published in the 70s but you can find a copy of the book if you mouse around on your website."
- noradio: OH: "It was published in the 70s but you
- rsarver: Finally home after a great, but long week in Paris for #leweb. Looking forward to getting back to work. Lots to do :)
- rsarver: Finally home after a great, but long week
- rsarver: Nice. FitBits have arrived! Only like 18 months after ordering them. Looking forward to trying it out. I'll report back
- rsarver: Nice. FitBits have arrived! Only like 18
- rsarver: Watching the South Park episode about WOW. Forgot how funny it was. One of their best
- rsarver: Watching the South Park episode about

Displaying content from api.twitter.com

The content overlaid onto this map is provided by a third party.

Save to My Maps

Traffic More... Creek Map Satellite Terrain

Print Send Link

Twitter / @twitterapi's team list

Twitter list /twitterapi/team

mccv: Apparently swing doesn't have to suck. I remain dubious. UI coding in general chills me bones.

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rsarver: Watching the South Park episode about WOW. Forgot how funny it was. One of their best

rsarver: Watching the South Park episode about

Displaying content from api.twitter.com

The content overlaid onto this map is provided by a third party.

Geo-hose

Geo-hose

location filtering

```
curl "http://stream.twitter.com/1/statuses/filter.xml?  
locations=-74.5129,40.2759,-73.5019,41.2759"
```

locations is a bounding box specified by “long₁,lat₁,long₂,lat₂” and can track up to 10 locations that are most 1 degree square (~60 miles square and enough to cover most metropolitan areas)

Trends API

Twitter x +/-

http://twitter.com/

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POPULAR TOPICS BY THE MINUTE, DAY, AND WEEK [?](#)

🕒 #SomethingAintRight #didyoujustsay #nowplaying Christmas Mami Shorty Oral...
📅 Christmas Xmas X-Mas Tiger Woods Santa RATM Chris Brown Copenhagen Oral Roberts GLEE
📅 Christmas Tiger Woods Glee Olly Follow Friday Santa SNL X-mas Mark Ingram Xmas Jersey Shore Google Ch...

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Trends API

Global trends

- Currently on front page of Twitter.com and on search.twitter.com
- Analysis of “hot conversations”
- Does not take from the 140 characters

Location specific trends

- Tweets being localized through a variety of means into trends
- Locations exposed over the API as WOEIDs
- Can ask for available trends sorted by distance from your location
- Querying for a parent of a location will return all locations under it

Available locations

trends/available

```
curl "http://api.twitter.com/1/trends/available.xml"
```

Can optionally take a lat and long parameter to have trends locations returned, sorted, as distance from you.

```
<locations type="array">
  <location>
    <woeid>2487956</woeid>
    <name>San Francisco</name>
    <placeTypeName code="7">Town</placeTypeName>
    <country type="Country" code="US">United States</country>
    <url>http://where.yahooapis.com/v1/place/2487956</url>
  </location>
  ...
</locations>
```

Available locations

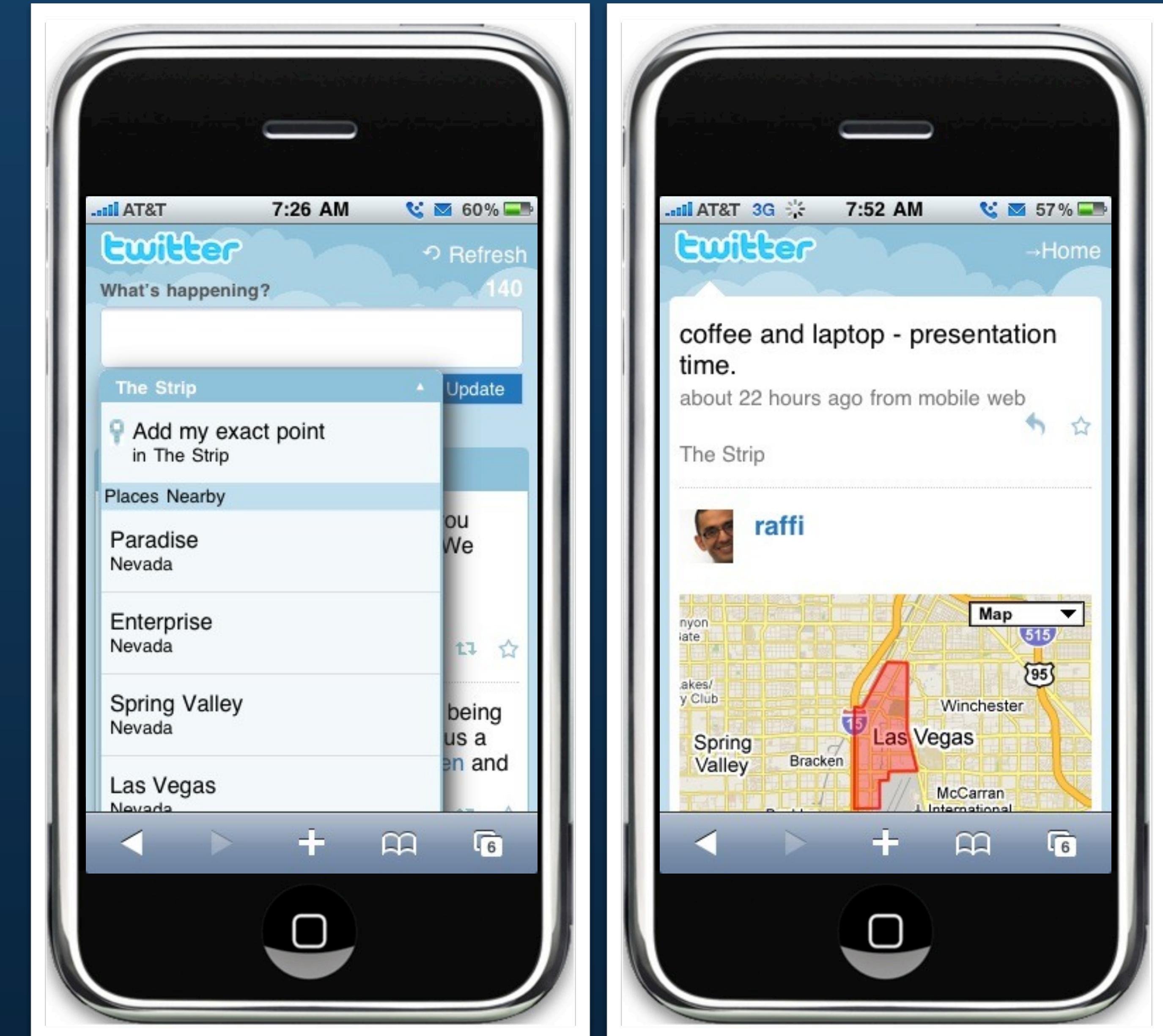
trends/*woeid*.xml (trends/*twid*.xml coming soon)

```
curl "http://api.twitter.com/1/trends/2487956.xml"
```

Look up the trends at the given WOEID

```
<matching_trends type="array">
  <trends as_of="2009-12-15T20:19:09Z">
    ...
    <trend url="http://search.twitter.com/search?q=Golden+Globe+nominations" query="Golden
+Globe+nominations">Golden Globe nominations</trend>
    <trend url="http://search.twitter.com/search?q=%23somethingaintright" query="%23somethingaintright">#somethingaintright</trend>
    ...
  </trends>
</matching_trends>
```

Geo-place API



Geo-place API

Support for “names”

- Not just coordinates
- More contextually relevant
- Positive privacy benefits

Increased complexity

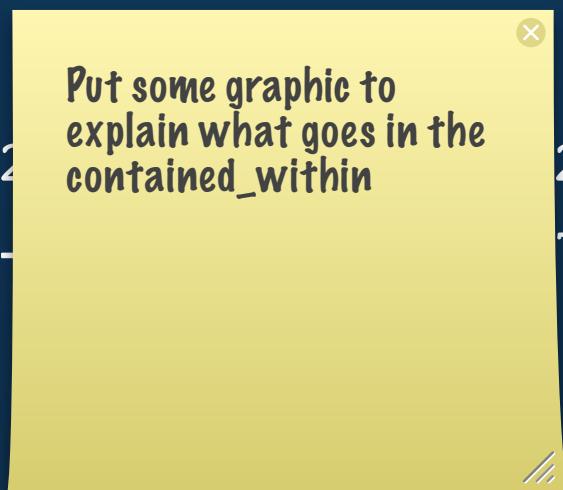
- Need to be able to look up a list of places
- Requires a “reverse geocoder”
- Human driven tagging and not possible to be fully automatic

Finding a place

geo/reverse_geocode

```
curl http://api.twitter.com/1/geo/reverse\_geocode.json&lat=37.3&long=-121.9
```

```
{  
  "result": {  
    "places": [  
      {  
        "place_type": "neighborhood",  
        "country_code": "US",  
        "contained_within": [...]  
        "full_name": "Willow Glen",  
        "bounding_box": {  
          "type": "Polygon",  
          "coordinates": [[  
            [-121.92481908, 37.275903], [-121.88083608, 37.31548203], [-121.88083608, 37.275903], [-121.92481908, 37.275903]]  
        },  
        "name": "Willow Glen",  
        "id": "46bc64ecd1da2a46",  
        "url": "http://api.twitter.com/1/geo/id/46bc64ecd1da2a46.json",  
        "country": ""  
      },  
      ...  
    ]  
  }  
}
```



Sending an update

status/update

```
curl -u USERNAME:PASSWORD -d "status=hey-ho&place_id=46bc64ecd1da2a46" \
http://api.twitter.com/1/status/update.xml
```

```
<status>
  <text>hey-ho</text>
  ...
  <place xmlns:georss="http://www.georss.org/georss">
    <id>46bc64ecd1da2a46</id>
    <name>Willow Glen</name>
    <full_name>Willow Glen</full_name>
    <place_type>neighborhood</place_type>
    <url>http://api.twitter.com/1/geo/id/46bc64ecd1da2a46.json</url>
    <country code="US">United States</country>
  </place>
  ...
</user>
```

Twitter / Home

raffi | Switch account ▾

Send us your feedback

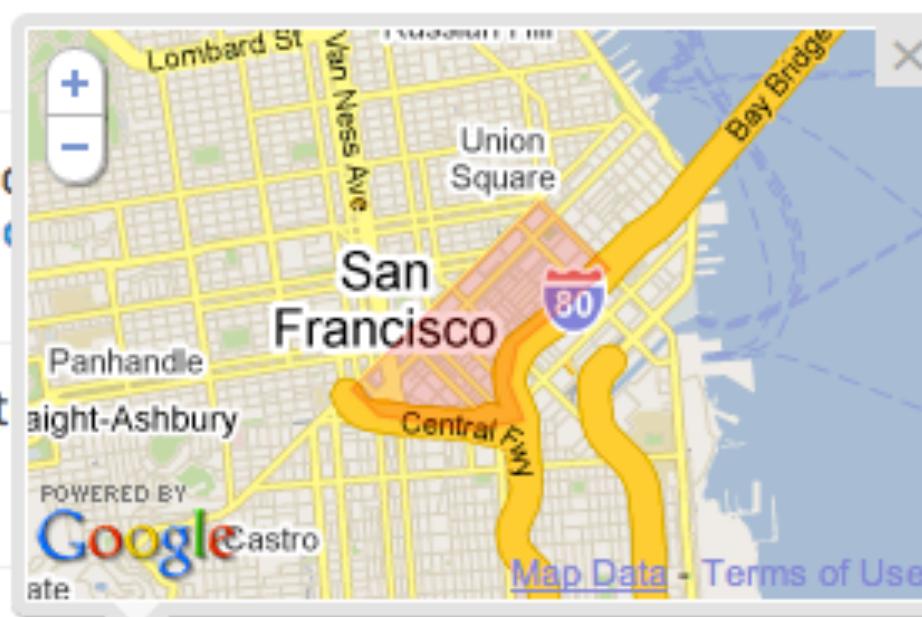
 **raffi** [worldchanging](#) [Watershed Technologies and the Smart City](#) <http://bit.ly/cSv1tB>
about 1 hours ago via twitterfeed
Retweeted by [AlexSteffen](#) and 3 others

 **mutgoff** Happy Birthday @Mattgar! I feel so lucky to give you as my good friend!
about 1 hours ago via txt

 **episod** My Top 3 Weekly #lastfm artists: Department of Eagles (24), Fleet Foxes (20) and The Clientele (20)
<http://bit.ly/auhydV>
about 1 hours ago via Tweekly.fm

 **funkatron** Oh my, this is go <http://www.dollardreadful.com>
[http://www.dollardreadful.com](#)
about 1 hours ago via Spaz

 **kellan** Sitting, listening to t
about 1 hours ago via Birdfeed

 A Google map of San Francisco showing major streets like Lombard St, Van Ness Ave, and Union Square. The map highlights areas such as the Panhandle,aight-Ashbury, Central Fm, and Castro. It includes a legend for 'Map Data' and 'Terms of Use'. The map is powered by Google.

 **ChloeS** Congrats @CNN for hitting over 1MM followers today!
about 1 hours ago via web from SoMa, San Francisco

 **mrtall** OH: "I'm not working on your tool Trammell, John's working on your tool. Also we've made your tool last 30 seconds instead of 30 minutes."
about 1 hours ago via web

 **bs** Going through notes on fantastic people I met at SxSW. So many people crafting interesting and beautiful things.
about 1 hours ago via web

 **joestump** Sometimes, if I listen hard enough, I can hear the faint cackle of @ieure over IM.
about 1 hours ago via Tweetie

Problem statement

What do we need to build?

What do we need to build?

- ▶ Database of places
 - ▶ Given a real-world location, find programmatic places that that place maps to
 - ▶ Spatial search
 - ▶ Method to store places with content
 - ▶ Per user basis
 - ▶ Per tweet basis

Spatial lookup and index

As background... MySQL + GIS

- ▶ Ability to index points and do a spatial query
 - ▶ For example, get points within a bounding rectangle
 - ▶

```
SELECT
MBRContains(GeomFromText(
'POLYGON((0 0, 3, 3 3, 3 0, 0 0))'), coord)
FROM geometry
```
- ▶ Hard to cache the spatial query
- ▶ Possibly requires a DB hit on every query

Options

Grid / Quad-tree

- ▶ Create a grid (possibly nested) of the entire Earth

Geohash

- ▶ Arbitrarily precise and hierarchical spatial data reference

Space filling curves

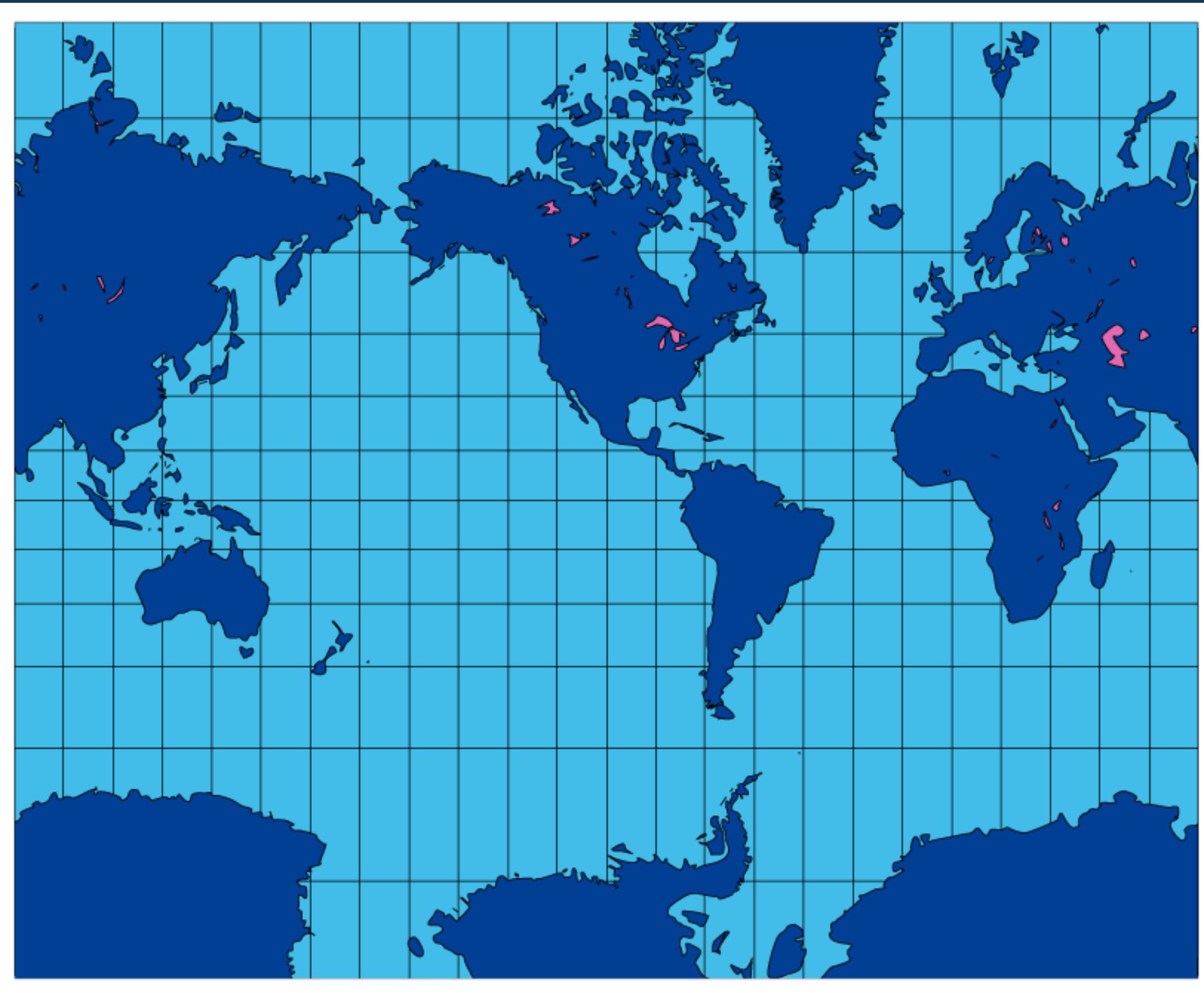
- ▶ Mapping 2D space into 1D while preserving locality

R-Tree

- ▶ Spatial access data structure

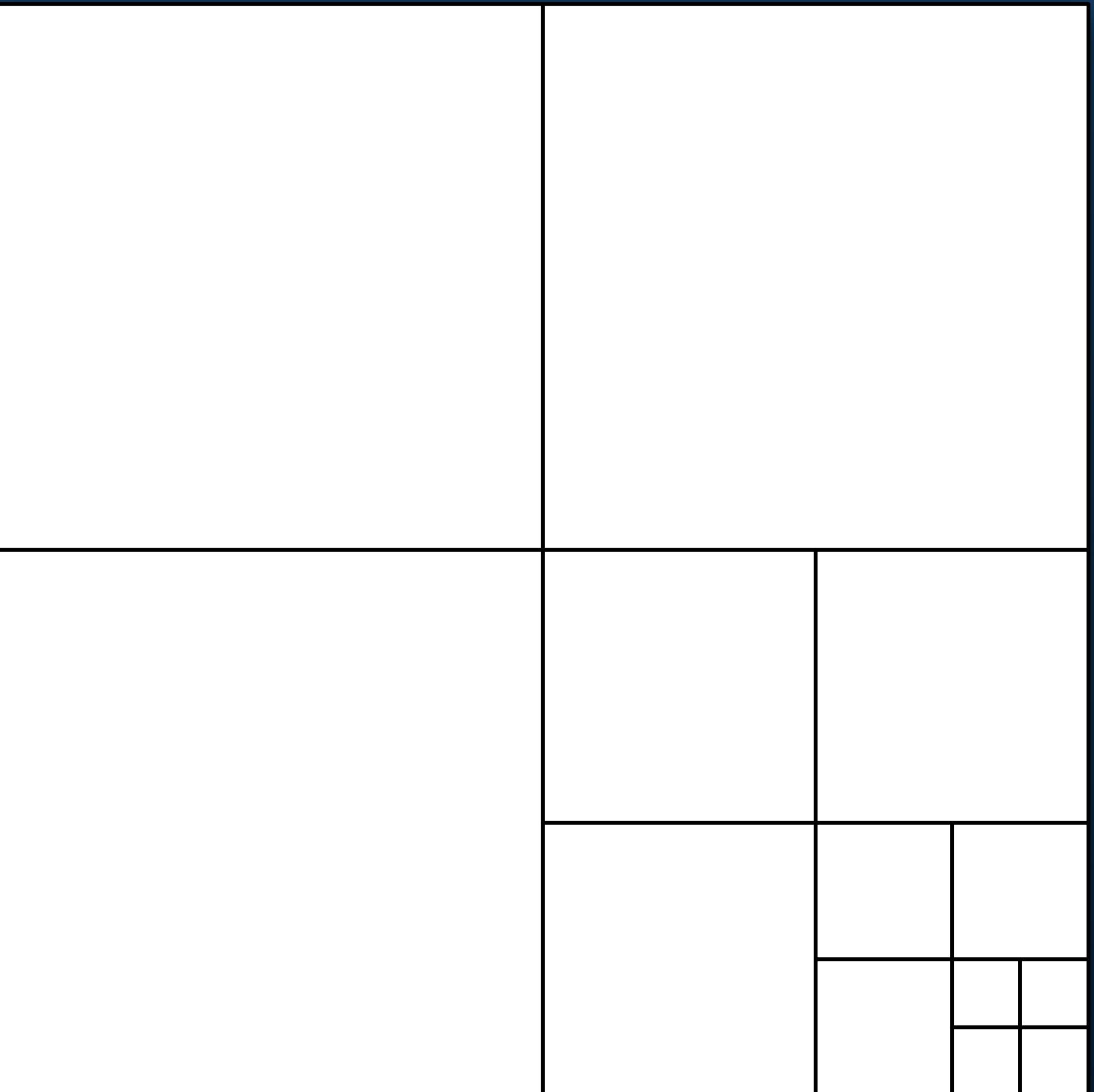
Grid / Quad-Tree

Grid / Quad-Tree



Grid / Quad-Tree

- ▶ Recursively subdivide regions
- ▶ Trie structure to store “prefixes”
- ▶ Spatially oriented data structure



Geohash

Geohash

- ▶ $37^{\circ}18'N\ 121^{\circ}54'W = 9q9k4$
- ▶ Hierarchical spatial data structure
- ▶ Precision encoded
- ▶ Distance captured
 - ▶ Nearby places (usually) share the same prefix
 - ▶ The longer the string match, the closer the places are

Geohash

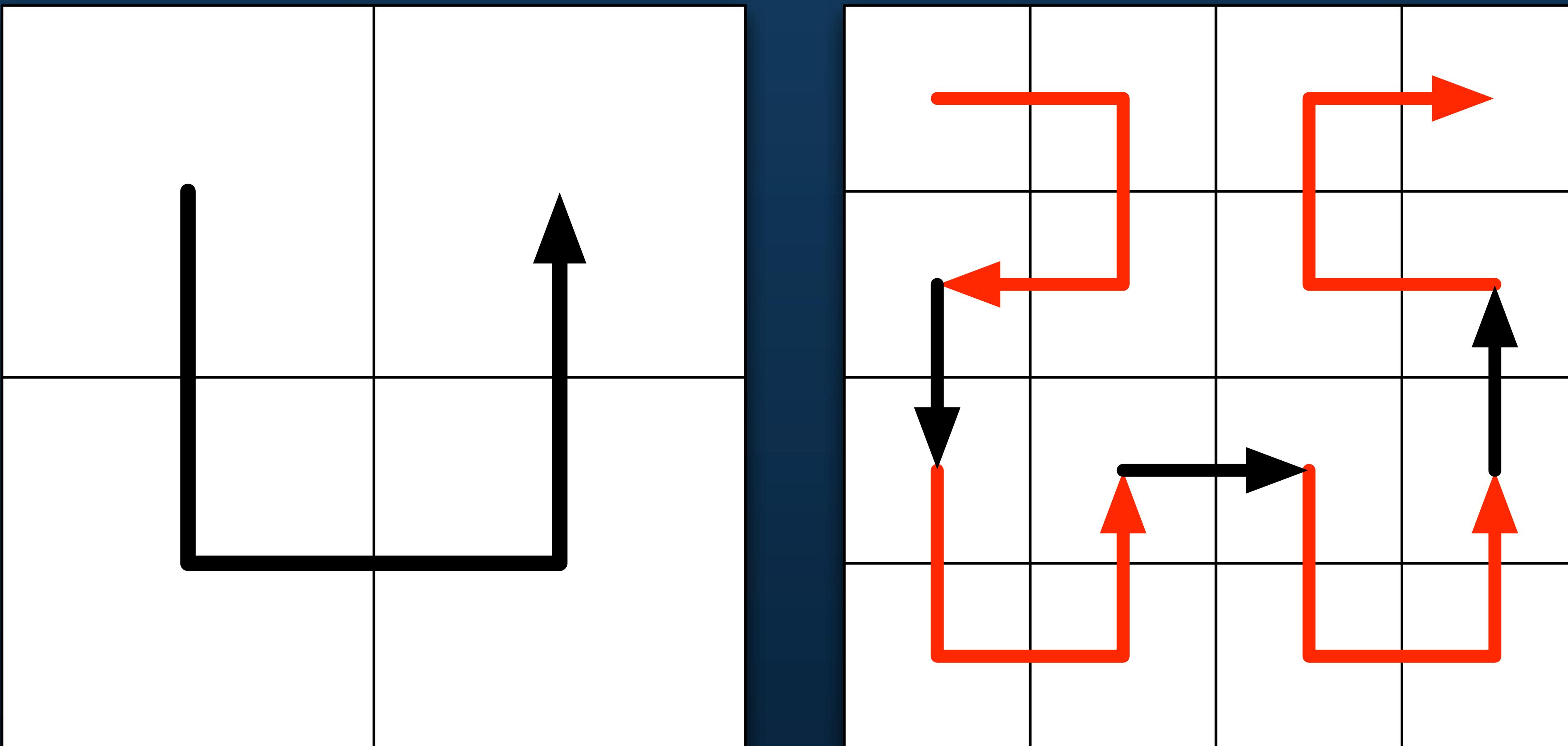
- ▶ 9q9k4 = 01001 / 10110 / 01001 / 10010 / 00100
- ▶ Longitude bits = 0010100101010
 - ▶ -90.0 (0), -135.0 (0), -112.5 (1), -123.75 (0), -118.125 (1), -120.9375 (0),
-122.34375 (0), -121.640625 (1), -121.9921875 (0), -121.81640625 (1),
-121.904296875 (0), -121.8603515625(1), -121.88232421875 (0) = $121^{\circ}53'W$
- ▶ Latitude bits = 1011010100000
 - ▶ 45.0 (1), 22.5 (0), 33.75 (1), 39.375 (1), 36.5625 (0), 37.96875 (1), 37.265625 (0),
37.617185 (1), 37.4414025 (0), 37.35351125 (0), 37.309565625 (0),
37.287692813 (0) = $37^{\circ}17'N$

Geohash

- ▶ Possible to do range query in database
 - ▶ Matching based on prefix will return all the points that fit in that “grid”
 - ▶ Able to store 2D data in a 1D space

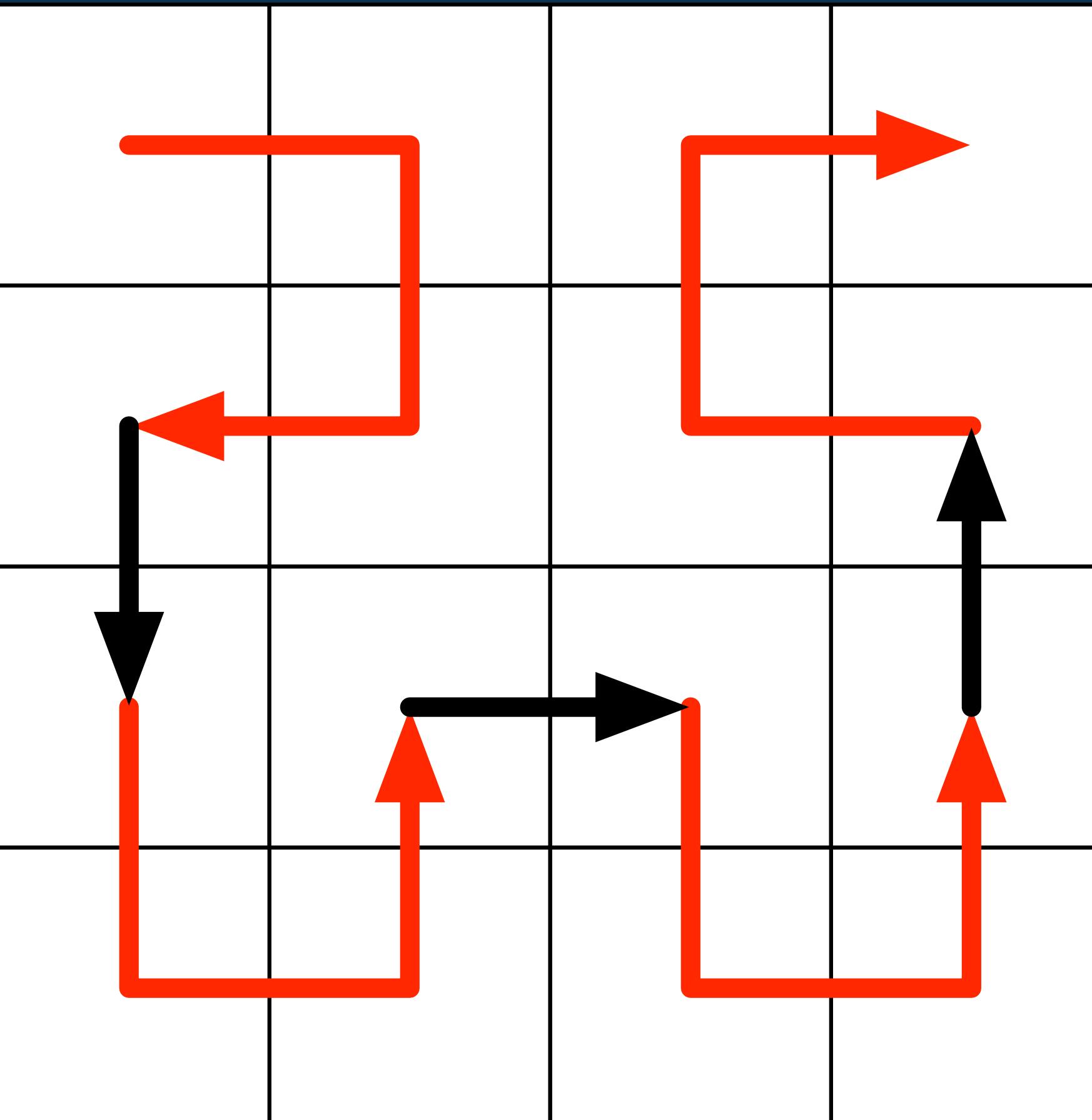
Space filling curve

Space filling curve



Space filling curve

- ▶ Generalization of geohash
- ▶ 2D to 1D mapping
- ▶ Nearness is captured
- ▶ Recursively can fill up space depending on resolution desired
- ▶ Fractal-like pattern can be used to take up as much room as possible



R-Tree

R-Tree

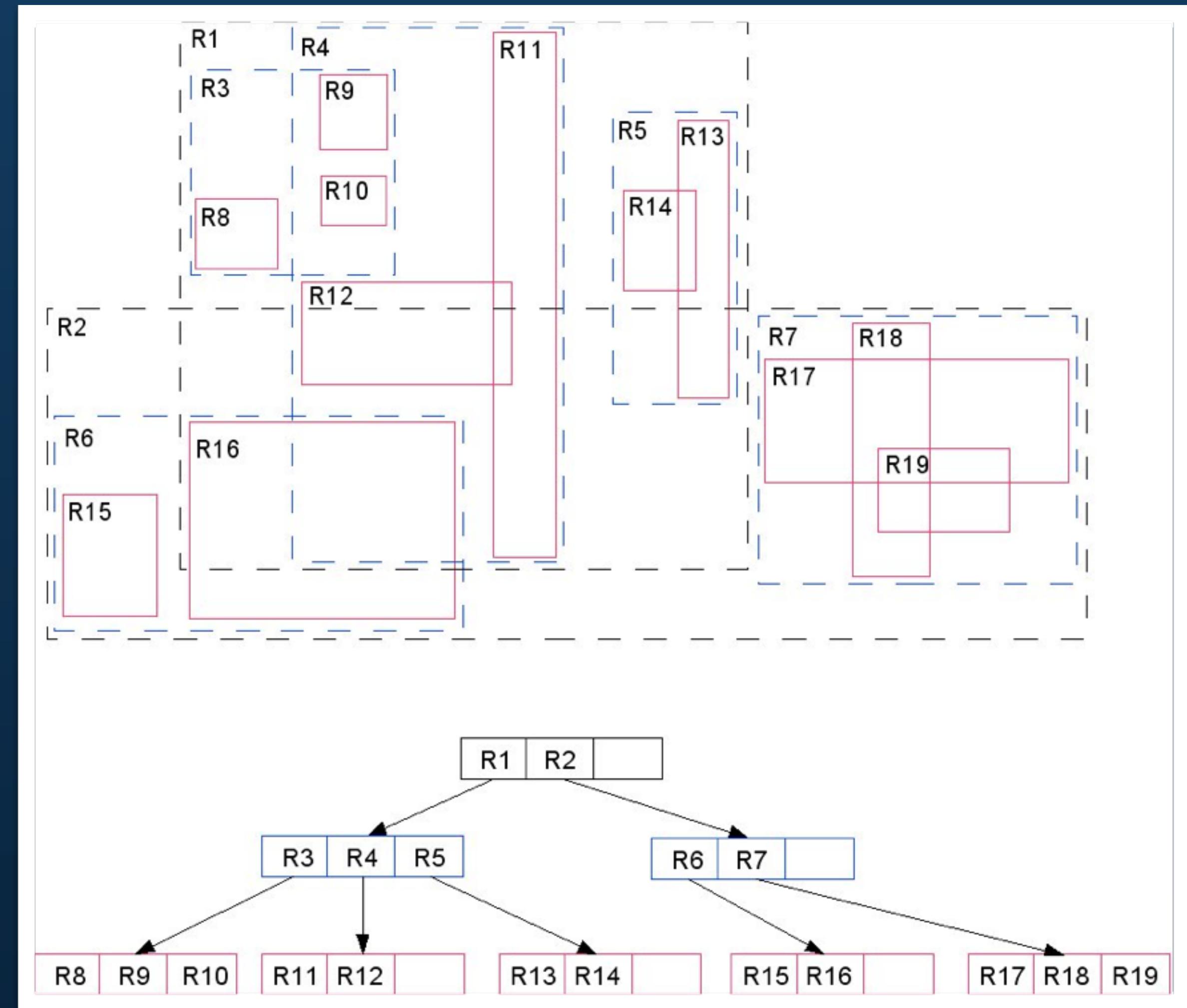
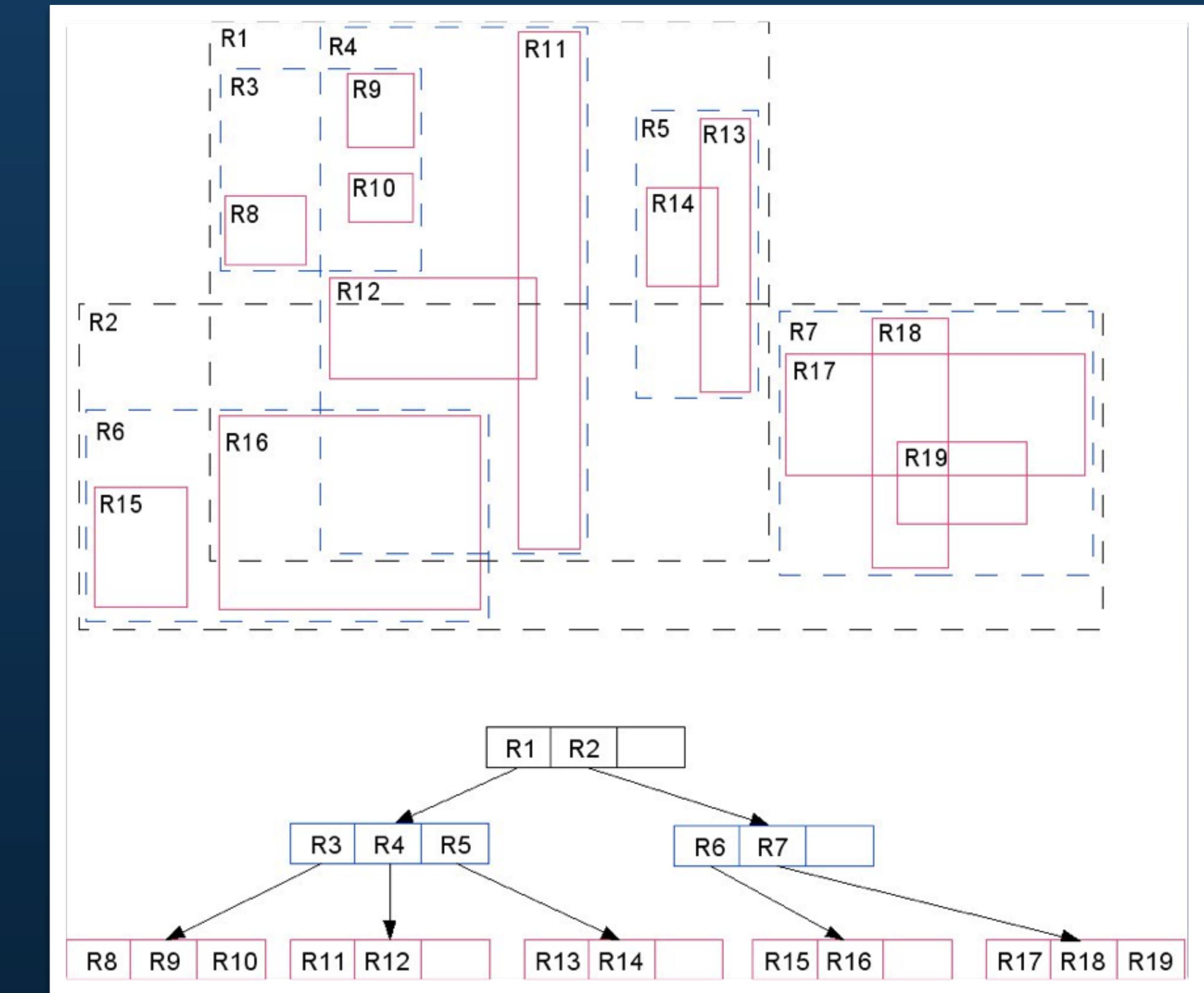


Image from Wikipedia

R-Tree

- ▶ Height-balanced tree data structure for spatial data
- ▶ Uses hierarchically nested bounding boxes
- ▶ Nearby elements are placed in the same node



Representations

GeoRSS / GeoJSON

- ▶ <http://www.georss.org/> and <http://geojson.org/>
- ▶ <georss:point>37.3 -121.9</georss:point>
- ▶ {
 “type”: “Point”,
 “coordinates”:[-121.9, 37.3]
}

How do you store precision?

- ▶ “Precision” is a hard thing to encode
- ▶ Accuracy can be encoded with an error radius
- ▶ Twitter opts for tracking the number of decimals passed
 - ▶ `140.0 != 140.00`
 - ▶ `DecimalTrackingFloat`

decimal_tracking_float.rb #

raw

```
1 class DecimalTrackingFloat < DelegateClass(Float)
2   attr_reader :num_decimals
3
4   # create a new DecimalTrackingFloat -- this expects a string and will compute
5   # the number of decimals and store it
6   def initialize(f, number_decimals = nil)
7     @num_decimals = if number_decimals.nil?
8       self.class.compute_decimals(f)
9     else
10      [0, number_decimals].max
11    end
12    super Float(f)
13  end
14
15  # properly format this number with the correct number of decimals
16  def to_s; ('%.%df' % num_decimals) % self; end
17  alias_method :to_json, :to_s
18
19  class << self
20    # a helper function that given a float as a string, will return the number
21    # of decimals
22    def compute_decimals(num)
23      num_str = num.to_s
24      return 0 unless num_str.include?('.')
25      num_str.length - num_str.index('.') - 1
26    end
27  end
28end
```

Twitter



Twitter Infrastructure

- ▶ Ruby on Rails-ish frontend
- ▶ Scala-based services backend
- ▶ MySQL and soon to be Cassandra as the store
- ▶ RPC to back-end or put items into queues

Rock Dove (redux)

Can be used as a homing pigeon



Simplified architecture

- ▶ R-Tree for spatial lookup
 - ▶ Data provider for front-end lookups
 - ▶ Store place object with envelope of place in R-Tree
- ▶ Mapping from ID to place object

Java Topology Suite (JTS)

- ▶ <http://www.vividsolutions.com/jts/jtshome.htm>
- ▶ Open source
- ▶ Good for representing and manipulating “geometries”
- ▶ Has support for fundamental geometric operations
 - ▶ contains
 - ▶ envelope
- ▶ Has a R-Tree implementation

```
simplecontains.scala #  
raw  
  
1 import com.vividsolutions.jts.geom.{Coordinate,GeometryFactory}  
2  
3 object SimpleContains {  
4     def main(args:Array[String]) {  
5         val gf = new GeometryFactory // a geometry factory  
6  
7         // two points  
8         val pointInside = gf.createPoint(new Coordinate(1,1))  
9         val pointOutside = gf.createPoint(new Coordinate(-1,-1))  
10  
11        // a square centered at (1,1)  
12        val vertices =  
13            Array(  
14                new Coordinate(0,0), new Coordinate(2,0), new Coordinate(2,2), new Coordinate(0,2),  
15                new Coordinate(0,0))  
16        val polygon = gf.createPolygon(gf.createLinearRing(vertices), null)  
17  
18        // simple containment  
19        Console.println("pointInside in polygon? " + polygon.contains(pointInside))  
20        Console.println("pointOutside in polygon? " + polygon.contains(pointOutside))  
21    }  
22}
```

pointInside in polygon? true
pointOutside in polygon? false

rtree.scala

[raw](#)

```
1 import com.vividsolutions.jts.geom.{Coordinate, Envelope}
2 import com.vividsolutions.jts.index.strtree.SRTree
3 import scala.collection.jcl.Conversions._
4 import java.util.{List=>JList}
5
6 object RTree {
7   val rtree = new SRTree
8
9   def query(point:Coordinate) {
10     val results = rtree.query(new Envelope(point)).asInstanceOf[JList[String]]
11     Console.println("at (" + point.x + ", " + point.y + ")")
12     if (results.isEmpty)
13       Console.println(" -- empty")
14     else {
15       results.foreach { n:String => Console.println(" -- " + n) }
16     }
17   }
18
19 def main(args:Array[String]) {
20   // insert the first object
21   val regionOne = new Envelope(new Coordinate(0,0), new Coordinate(2,2))
22   rtree.insert(regionOne, "region 1")
23
24   // insert the second object
25   val regionTwo = new Envelope(new Coordinate(1,1), new Coordinate(3,3))
26   rtree.insert(regionTwo, "region 2")
27
28   (0 until 5).foreach { i:Int => query(new Coordinate(i,i)) }
29 }
30 }
```

```
at (0.0, 0.0)
-- region 1
at (1.0, 1.0)
-- region 1
-- region 1
at (2.0, 2.0)
-- region 2
-- region 1
-- region 1
at (3.0, 3.0)
-- region 2
-- region 2
at (4.0, 4.0)
-- empty
```

Java Topology Suite (JTS)

- ▶ Serializers and deserializers
 - ▶ Well-known text (WKT)
 - ▶ Well-known binary (WKB)
 - ▶ No GeoRSS or GeoJSON support

Interface / RPC

- ▶ RockDove is a backend service
 - ▶ Data provider for front-end lookups
 - ▶ Uses some form of RPC (Thrift, Avro, etc.) to communicate with
 - ▶ Data could be cached on frontend to prevent lookups
- ▶ Simple RPC interface
 - ▶ `get(id)`
 - ▶ `containedWithin(lat, long)`

SimpleRockDove.scala

[raw](#)

```
1 import com.vividsolutions.jts.geom.{Coordinate, Envelope}
2 import com.vividsolutions.jts.index.strtree.STRtree
3 import java.util.{List=>JList}
4 import scala.collection.jcl.Conversions._
5 import scala.collection.mutable.HashMap
6
7 trait Place {
8     def id:Int
9     def envelope:Envelope
10 }
11
12 object RTree {
13     val rtree = new STRtree
14     val map = new HashMap[Int,Place]
15
16     def insert(place:Place) {
17         rtree.insert(place.envelope, place)
18         map += place.id -> place
19     }
20
21     def get(id:Int):Place = map(id)
22     def containedWithin(point:Coordinate):Seq[Place] =
23         rtree.query(new Envelope(point)).asInstanceOf[JList[Place]]
24 }
```

Interface / RPC

- ▶ Watch those RPC queues!
- ▶ Fail fast and potentially throw “over capacity” messages
 - ▶ `get(id)` throws `OverCapacity`
 - ▶ `containedWithin(lat, long)` throws `OverCapacity`
- ▶ Distinguish between write path and read path

GeoRuby

- ▶ <http://georuby.rubyforge.org/>
- ▶ Open source
- ▶ OpenGIS Simple Features Interface Standard
- ▶ Only good for *representing* geometric entities
- ▶ `GeoRuby::SimpleFeatures::Geometry::from_ewkb`
- ▶ No GeoJSON serializers

place.rb

[raw](#)

```
1 class GeoRuby::SimpleFeatures::Polygon
2   def to_hash
3     {
4       :type => "Polygon",
5       :coordinates => [outer_ring_to_point_array]
6     }
7   end
8
9   def to_json
10    to_hash.to_json
11  end
12
13  def outer_ring_to_point_array
14    first.map { |point| [point.x, point.y] }
15  end
16 end
17
18 class GeoRuby::SimpleFeatures::MultiPolygon
19   def to_hash
20     {
21       :type => "MultiPolygon",
22       :coordinates => map { |polygon| [polygon.outer_ring_to_point_array] }
23     }
24   end
25 end
```

Front-end

Bringing geo data to and from the web

Location in Browser

- ▶ Geolocation API Specification for JavaScript
`navigator.geolocation.getCurrentPosition`
- ▶ Does a callback with a position object
- ▶ `position.coords` has
 - ▶ latitude and longitude
 - ▶ accuracy
 - ▶ other stuff
- ▶ Support in Firefox 3.5, Chromium, Opera, and others with Google Gears

Twitter / Home

RSS Google

raffibot | Switch account

Send us your feedback

twitter

What's happening? 140

in Temescal, Oakland • x Latest: heyho 12 days ago

Tweet

Home

 **raffi** its a two bagel day
about 21 hours ago via web from South Beach

 **raffi** speaking at #where20 tomorrow – "handling real-time geostreams" <http://oreil.ly/4W3TMv>
about 21 hours ago via web from SoMa, San Francisco

 **raffi** there's been a @DanaDanger sighting! new peep on @twitterapi!
about 21 hours ago via web from SoMa, San Francisco

 **raffi** I love the coaches at the gym, but they need to learn some elementary calculus & kinematics. On a related note: in serious (but good) pain.
about 23 hours ago via Tweetie from Southwst Berkeley ↗

 **Twitter_Tips** Twitter Isn't Down As Much As You Think – 99.74% Uptime Since March 2009 <http://j.mp/d6LFFv>
8:29 PM Mar 28th via API
Retweeted by raffi and 21 others

 **raffi** HOT! it finally worked! made a (verb) using the new (feature) through the stack.
7:10 PM Mar 28th via web from Temescal, Oakland

raffibot 98 tweets
1 15 1 following followers listed

Tweet·Brac·ket
n. March Madness meets Twitter.

Home

@raffibot

Direct Messages 0

Favorites

Retweets

Search

Lists

other-bots

New list | View all

Trending: Worldwide Change

#nowplaying

#youmightwannastop

Ricky Martin

#idoit2

#30stmday

Factor

Go to "<http://twitter.com/>"

Twitter / Home

raffi | Switch account ▾

Send us your feedback

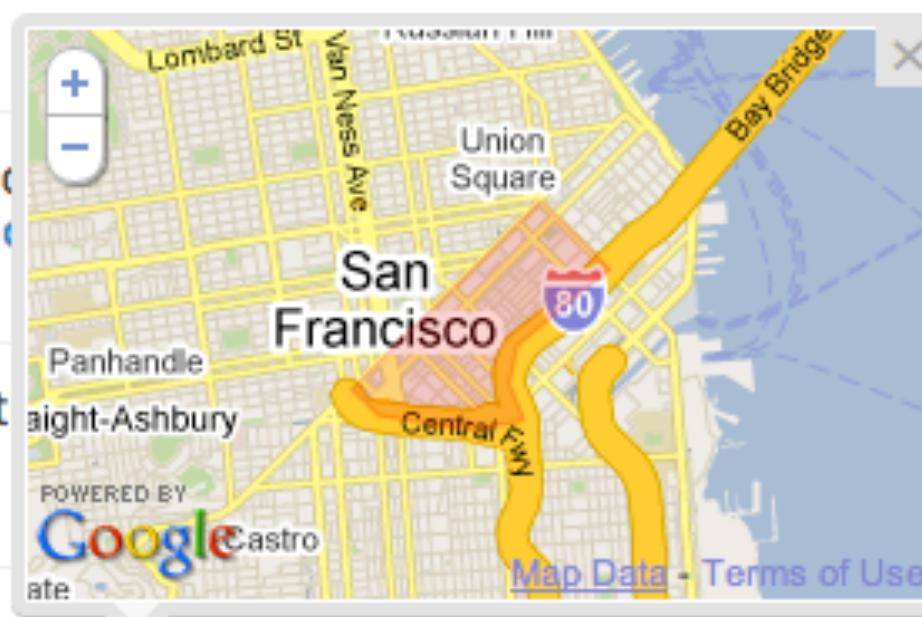
 **raffi** [worldchanging](#) [Watershed Technologies and the Smart City](#) <http://bit.ly/cSv1tB>
about 1 hours ago via twitterfeed
Retweeted by [AlexSteffen](#) and 3 others

 **mutgoff** Happy Birthday @Mattgar! I feel so lucky to give you as my good friend!
about 1 hours ago via txt

 **episod** My Top 3 Weekly #lastfm artists: Department of Eagles (24), Fleet Foxes (20) and The Clientele (20)
<http://bit.ly/auhydV>
about 1 hours ago via Tweekly.fm

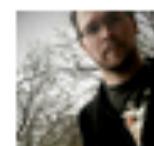
 **funkatron** Oh my, this is go <http://www.dollardreadful.com>
[http://www.dollardreadful.com](#)
about 1 hours ago via Spaz

 **kellan** Sitting, listening to t
about 1 hours ago via Birdfeed

 A Google map of San Francisco showing major streets like Lombard St, Van Ness Ave, and Union Square. The map highlights areas such as the Panhandle,aight-Ashbury, Central Fm, and Castro. It includes a legend for 'Map Data' and 'Terms of Use'. The map is powered by Google.

 **ChloeS** Congrats @CNN for hitting over 1MM followers today!
about 1 hours ago via web from SoMa, San Francisco

 **mrtall** OH: "I'm not working on your tool Trammell, John's working on your tool. Also we've made your tool last 30 seconds instead of 30 minutes."
about 1 hours ago via web

 **bs** Going through notes on fantastic people I met at SxSW. So many people crafting interesting and beautiful things.
about 1 hours ago via web

 **joestump** Sometimes, if I listen hard enough, I can hear the faint cackle of @ieure over IM.
about 1 hours ago via Tweetie

Hose

Streaming out real-time geo data

Geo-hose

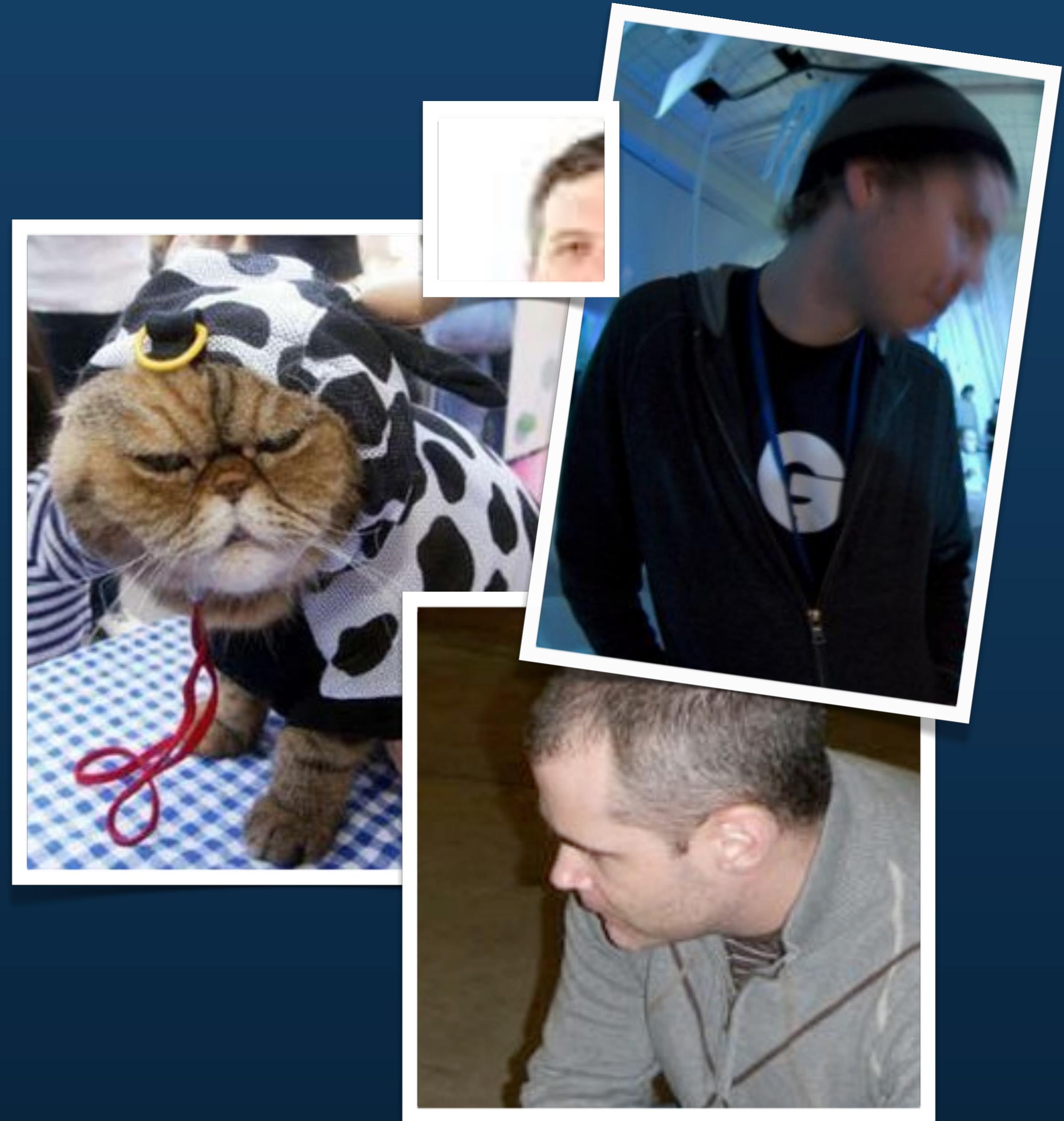
location filtering

```
curl "http://stream.twitter.com/1/statuses/filter.xml?  
locations=-74.5129,40.2759,-73.5019,41.2759"
```

- Status objects are enqueued
- Hose server parses location (parsing place data COMING SOON)
- Quickly determines if there are any subscribers for location
- Streams out serialized object

Thanks also to

- ▶ Marius Eriksen (@marius)
- ▶ David Helder (@dhelder)
- ▶ Marc McBride (@mccv)
- ▶ John Kalucki (@jkalucki)



Questions?

Follow me at
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