Scalable, Server-side Mapping in Drupal with the Geocluster-Leaflet Stack

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Phase2

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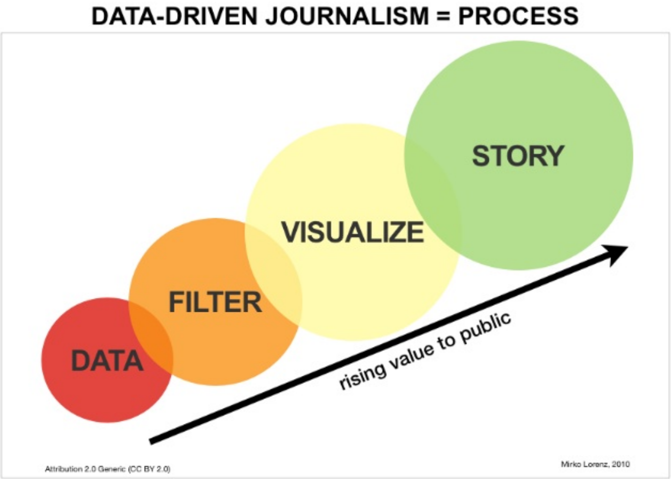
Mapping: What Is Going On Here?


DATA-DRIVEN JOURNALISM = PROCESS
DATA
FILTER
VISUALIZE
STORY
rising value to public
Attribution 2.0 Generic (CC BY 2.0)
Mirko Lorenz, 2010

The Process

Data Driven Presentation as a Process

- Data must be found
- Data must be interrogated
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- Data can then tell the story

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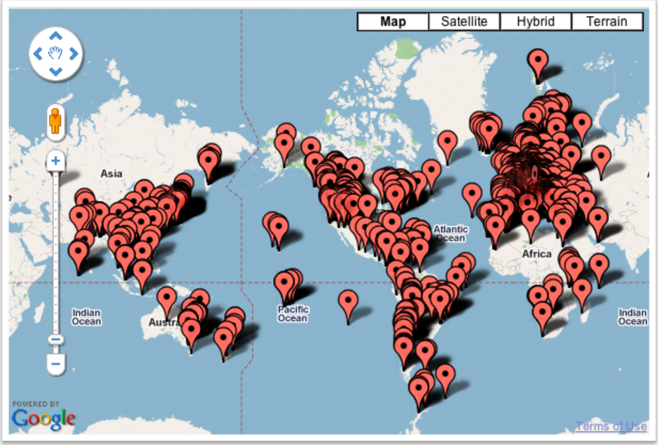
This allows content authors to present data in context in ways that would be difficult with words alone.

Mapping: Why is This Important?

The human aspect. Usability matters.

The Problem: Dense-Point Data

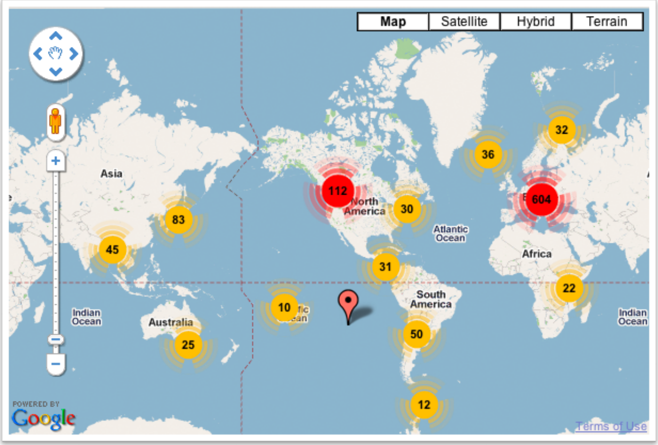
First pass: we have point crowding.



Really not usable.

One Solution: Client-Side Clustering

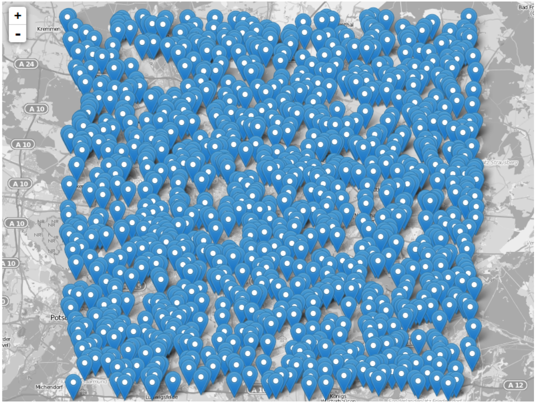
First step: lets cluster on the client side.



More usable, we gain context and can zoom in on areas of interest.

Solution Breakdown: Clustering Thousands of Points

What if we have thousands of points?



Client-side clustering breaks down upwards of a few hundred points.

Roadblock: Client-Side Clustering at Large Scale

Why Does it Break?

1. Views (PHP) renders each data point as a row of output, one at a time (thousands).
2. Views (PHP) renders the popup info (hidden) at page-load time.
3. The mapping library (JS) must parse the data.
4. The mapping library (JS) clusters the points.
5. The mapping library (JS) renders the map.

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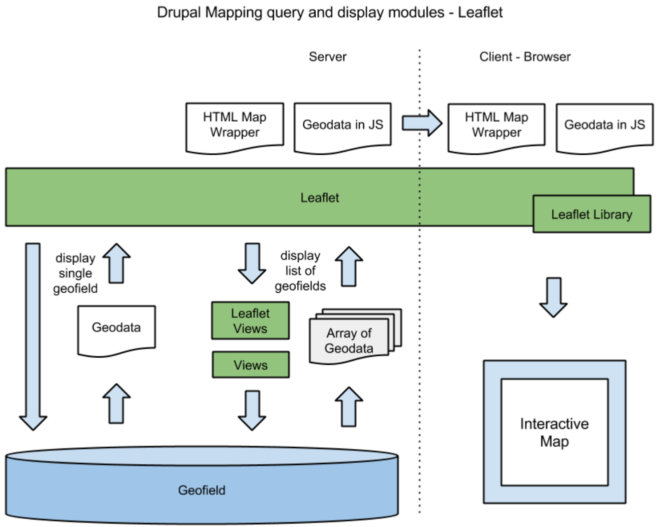
Both PHP and JS are asked to do too much at once.

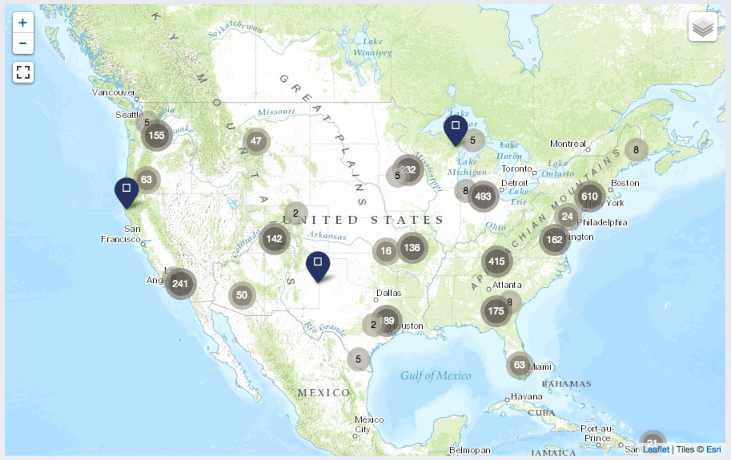
- The breaking point is about 300 data points (empirical).

Client-Side Clustering Visualized



Demo

http://vistacampus.gov/map



Demo: Things of Note

- Bounded mapping
- Load time under 1sec
- Clusters are single things, not collections of things
- On-demand, ajax-delivered infobubbles
- About 5K points
-

Starter Build

If you really want to build this...

1. Clone the starter build
2. Modify to suit

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Starter Build:
http://cgit.drupalcode.org/geocluster/tree/modules/geocluster_demo

- Instructions: https://www.drupal.org/node/1962198

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Why?

- The configuration is tedious and complex.
- Way too easy to break to start from scratch.

The Recipe

Basic Recipe

- Address Field (location storage)
- Geocoder (geocoding addresses, requires GeoPHP)
- Geofield (geocode storage)
- **Geocluster** (server-side clustering)
- Views
- Views GeoJSON (GeoJSON feeds)
- Leaflet GeoJSON (2.x for Panels support, 1.x for Bean)
- Leaflet Integration (requires Leaflet core library)

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But... we need lots of patches.

A Working Model

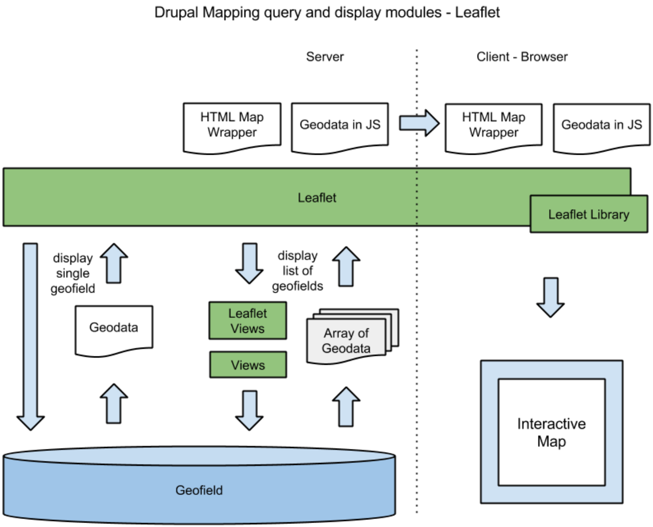
The client build has been released as GPL2.0

- https://github.com/mpgeek/VistaMap

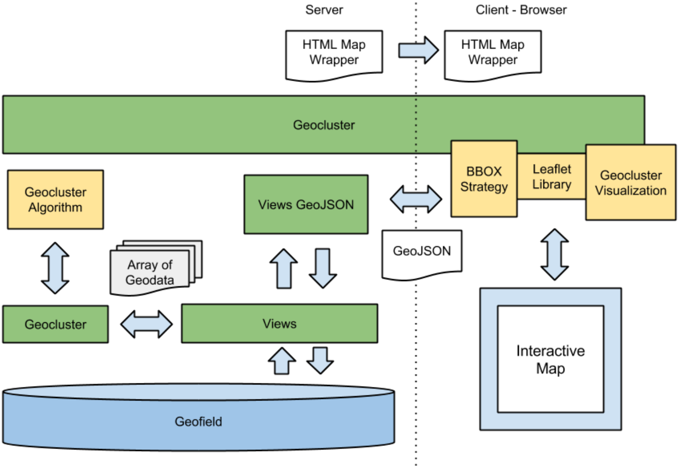
Patch mania! How about a makefile?

- https://github.com/mpgeek/VistaMap/blob/master/vista_map.make

Client-Side Clustering Visualized (Redux)



Server-Side Clustering with Geocluster Visualized



Key Architectural Feature

Geocluster Keys

- Clustering is performed at the query level by Geocluster
- PHP and JS only see the clusters as single (Views) rows.
- This feature alone is almost entirely responsible for the performance gain.

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But How?

- By geohashing!

Geocluster & Geohash

In a nutshell:

- Geocluster adds a hierarchical, spatial index to geofields based on the Geohash algorithm.
- Each geofield has columns for varying levels of precision (geohash index) created/updated on `entity_save`.
- A query for points/clusters specifies a geohash index and asks for clusters based on that index.

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Notice:

- The clustering information is created when the content is created.
- A request for points and clusters doesn't actually cluster. Rather it's a simple query of a spatial index.

Near-point Clusters vs. Exact-point Clusters

Monolithic Clusters

- Leaflet doesn't discern between points that are near to one another versus multiple points at the same location.
- We needed to create two cluster types, on for each condition.

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- `vista_map.module`, lines 115-155

On-Demand Popups

AJAX!

- We don't load the popup info into the DOM at map-load time (performance tactic).
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- `vista_map.js`, lines 324-404

Current-user Zoom

Focus the Map on the Current-user's Location

- One of the purposes of the map was to emphasize making local connections.
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Limit Geocoder Granularity

Geocode to Center of ZIP-code Only

- One of two data layers needed to geocode only to ZIP-code precision.
- Removing more-specific information and passing abbreviated info only to geocoder.

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- `vista_map.module`, lines 12-72

Multiple Data Layers

Implement Data Layering and Panels Support

- OG membership drove layer membership, and source geofield.
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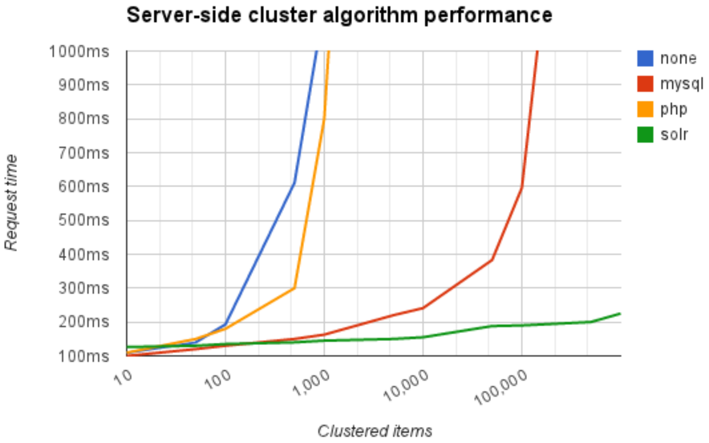
Implement Data Layering and Panels Support

- OG membership drove layer membership, and source geofield.
- Views necessitated that different source geofields be separate data layers.
- Contiributed the 2.x branch of Leaflet GeoJSON for panels support with multiple data layers (https://www.drupal.org/node/2225815)

Scalability



References & Resources

Things we saw and more resources:

- Feature-ized map application: https://github.com/mpgeek/Vista-Map
- Geohash Algorithm: http://en.wikipedia.org/wiki/Geohash
- Geocluster Master's Thesis (by @dasjo): http://dasjo.at/thesis