Politics Ain't Beanbag: Using APEX, ML, and GeoCoding In a Modern Election Campaign

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@JimTheWhyGuy
Zero Defect Computing, Inc.

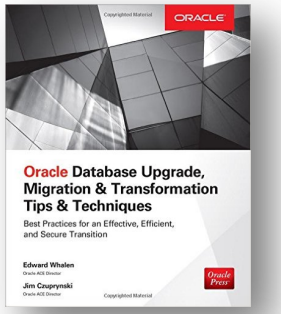
My Credentials

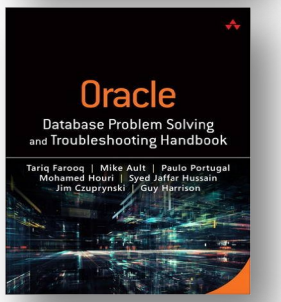
- 40 years of database-centric IT experience
- Oracle DBA since 2001
- Oracle 9i, 10g, 11g, 12c OCP and ADWC
- Oracle ACE Director since 2014
- ODTUG Database Committee Lead
- Editor of ODTUG ***TechCeleration***
- Oracle-centric blog (**Generally, It Depends**)
- Regular speaker at Oracle OpenWorld, COLLABORATE, KSCOPE, and international and regional OUGs

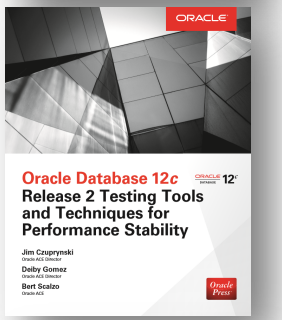
ORACLE ACE Director

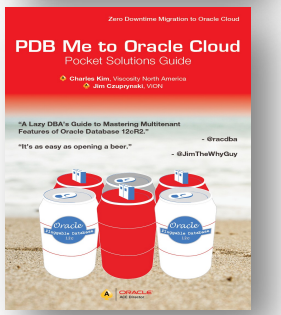
ORACLE Certified Professional

ORACLE Certified Specialist





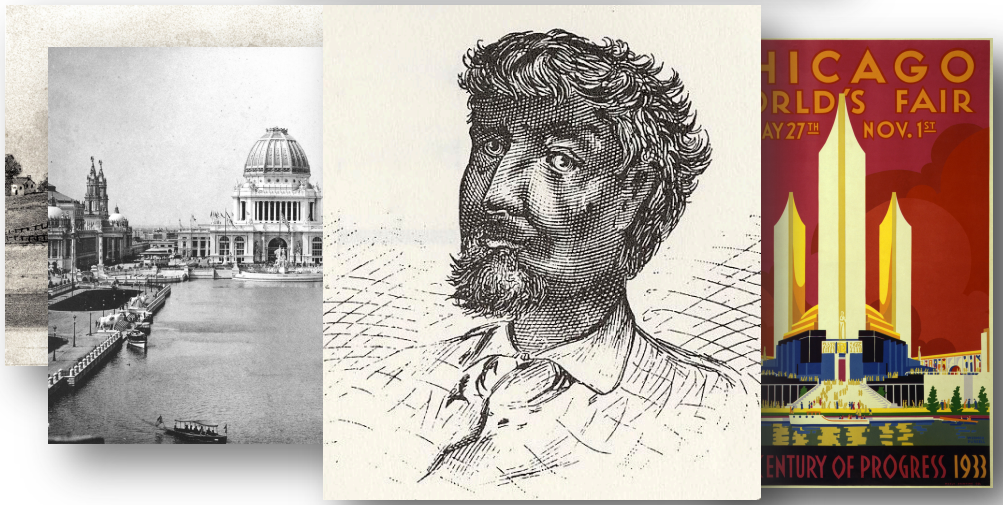


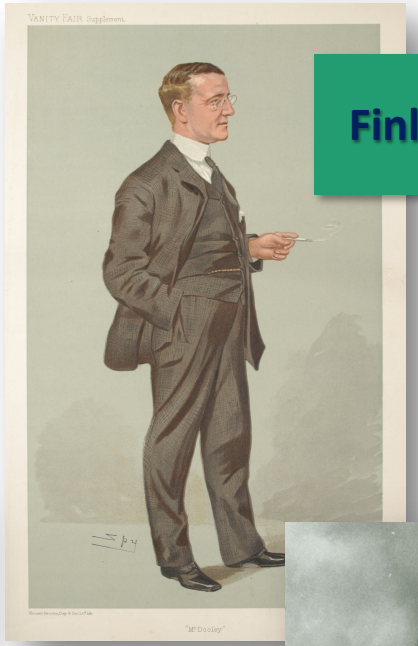


- E-mail me at jczuprynski@zerodefectcomputing.com
- Follow me on Twitter (@**JimTheWhyGuy**)
- Connect with me on LinkedIn (**Jim Czuprynski**)

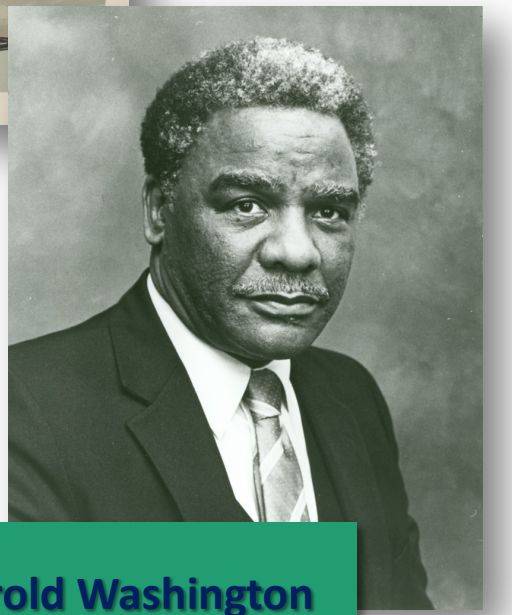
So … What Does the Title Really Mean?

Bean bag
(also known as **cornhole**)





Finley Peter Dunne



Harold Washington

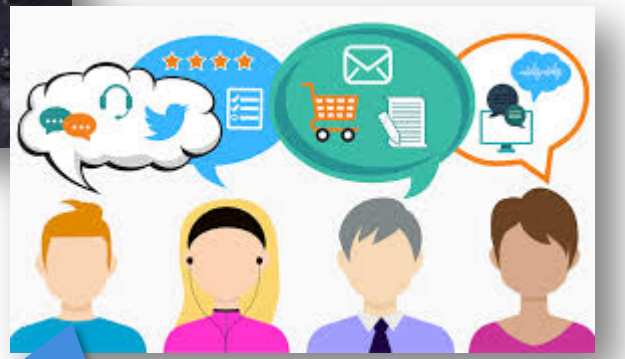
Politics ain't bean-bag.

- Dunne's "Mr. Dooley"

ATP, Machine Learning, and APEX: Benefits and Synergies

APEX, AI, and ML: Where Analytic Magic Happens

Application Express (APEX) makes it trivial to instantly **import data** and **business applications** directly into Oracle … even if it's just resident within a simple **spreadsheet**

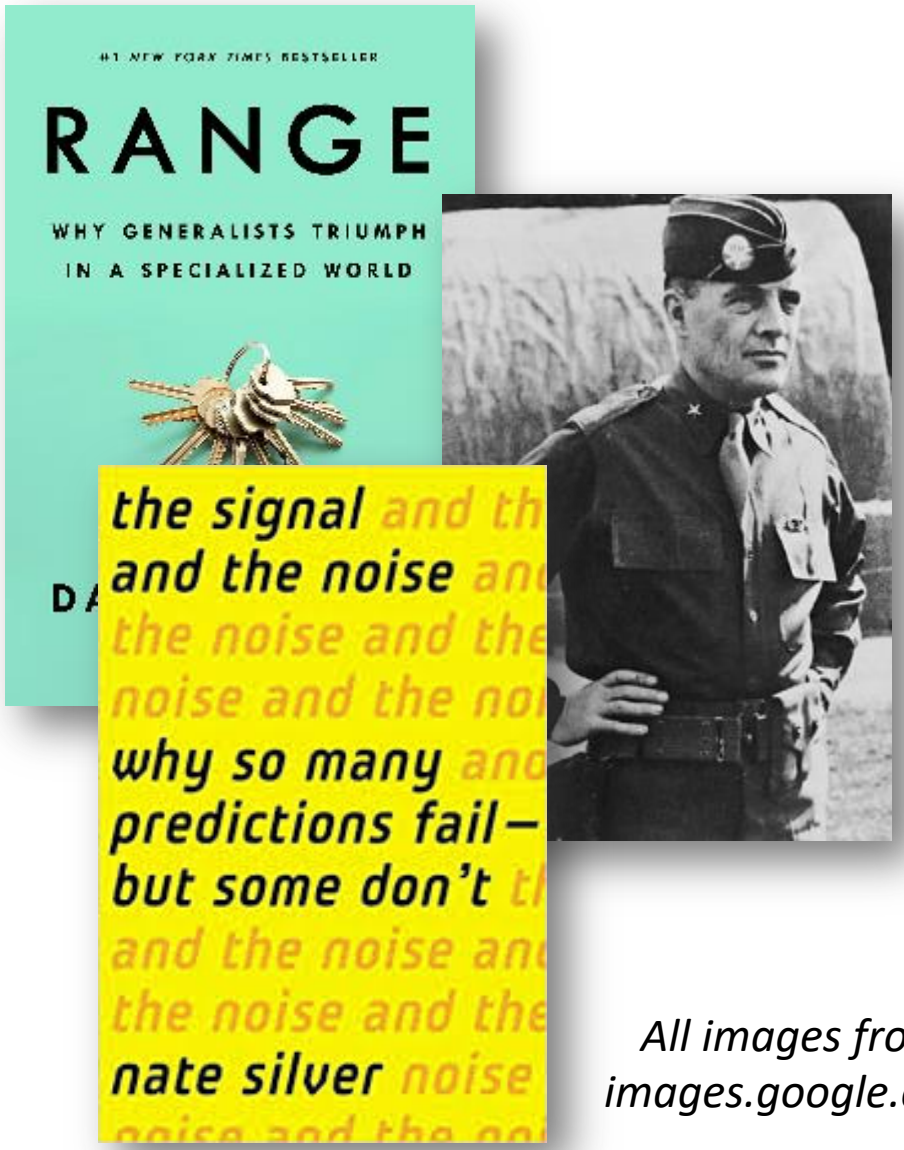


Oracle Application Express

Oracle's **REST API** enables quick development of **complex data entry and reporting applications** within APEX in a **low-code environment**

Once relevant data is captured, Oracle's **built-in data mining tools** make is simple to **build** data models, apply well-known **algorithms**, and obtain **predictions** for **immediate business insights**

Specialization Is Dead. Long Live the Generalist.



All images from images.google.com

Compared to other scientists, Nobel laureates are at least twenty-two times more likely to partake as an amateur actor, dancer, magician, or other type of performer.

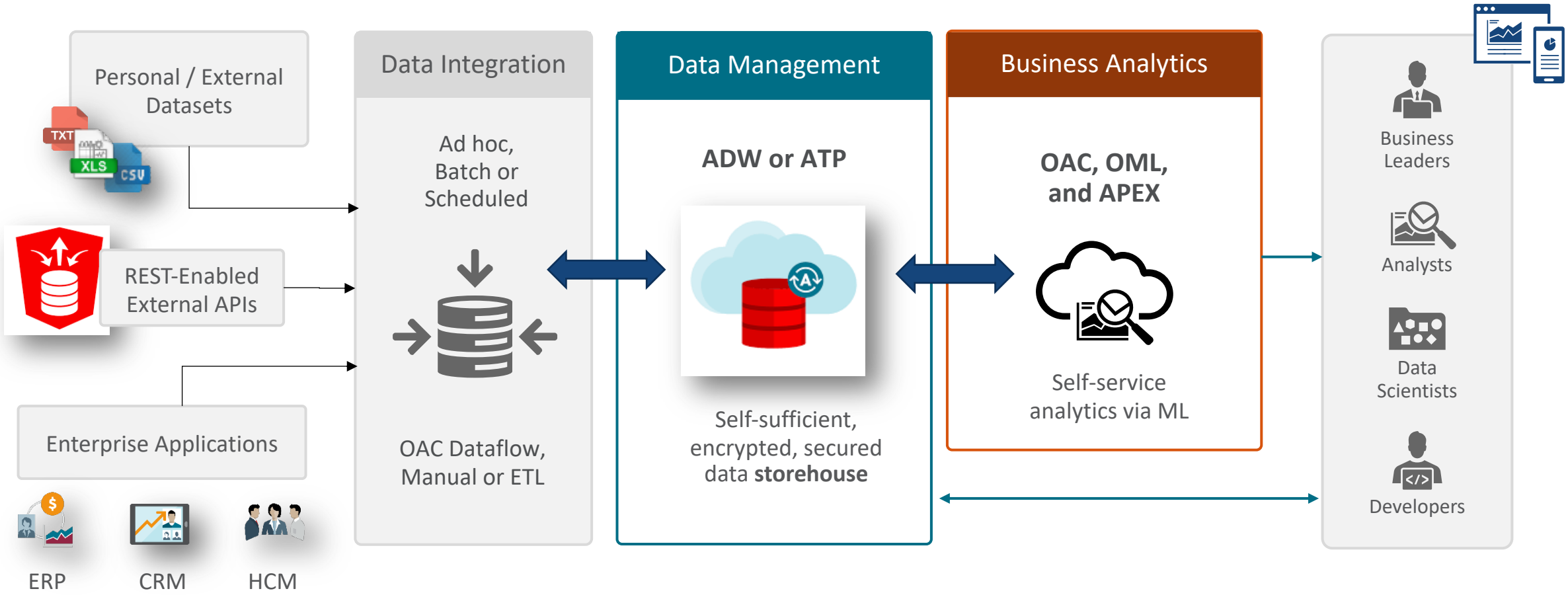
- David J. Epstein. Range (p. 33).

"We now have the [enemy] exactly where we want them. We can now attack in any direction."

- Brigadier General Anthony C. "Nuts" McAuliffe

Data is the new oil, and its miners are data scientists … but DBAs are *uniquely positioned* to support them

The Converged Database: A Vision for the Future, 20*c* and Beyond



VEVO 2.0: (Re)building the APEX Application Framework

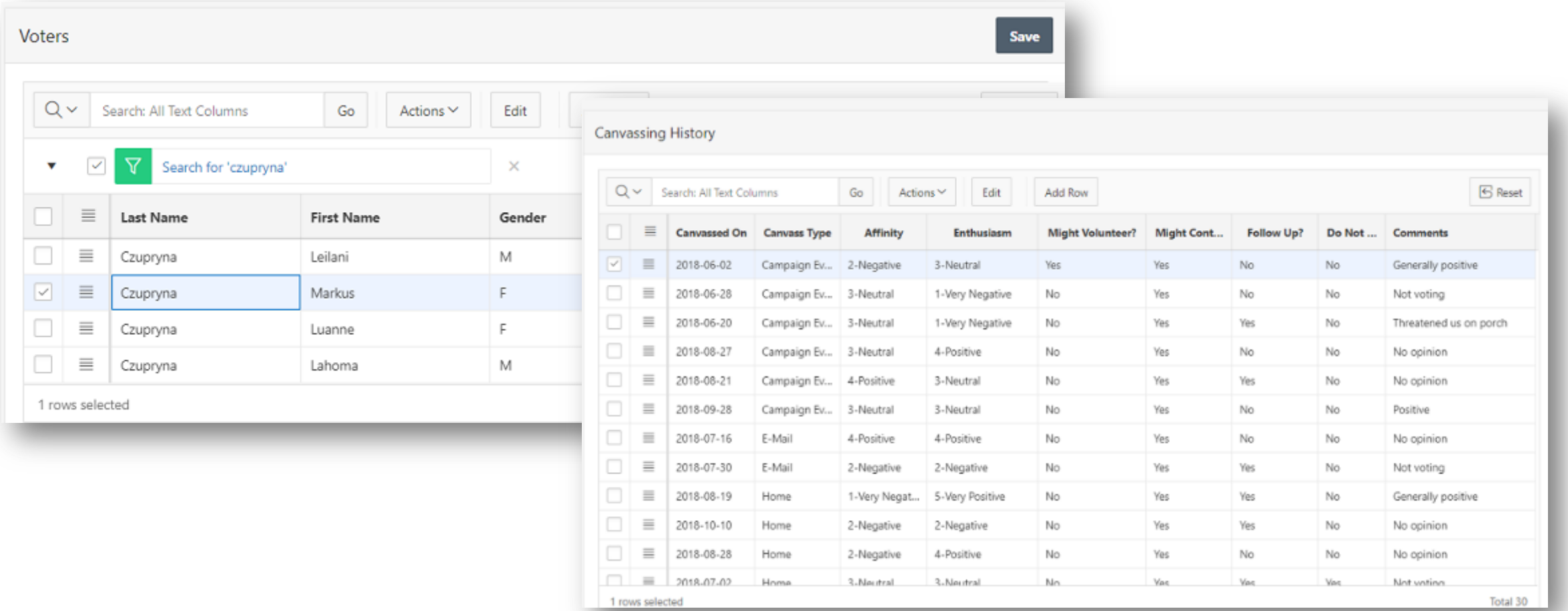
- **VEV0 1.0:** My “Hello World!” APEX Application
- **VEVO 2.0:** A New Campaign. New Requirements.

VEVO 1.0: An (Extremely!) Basic Desktop Application

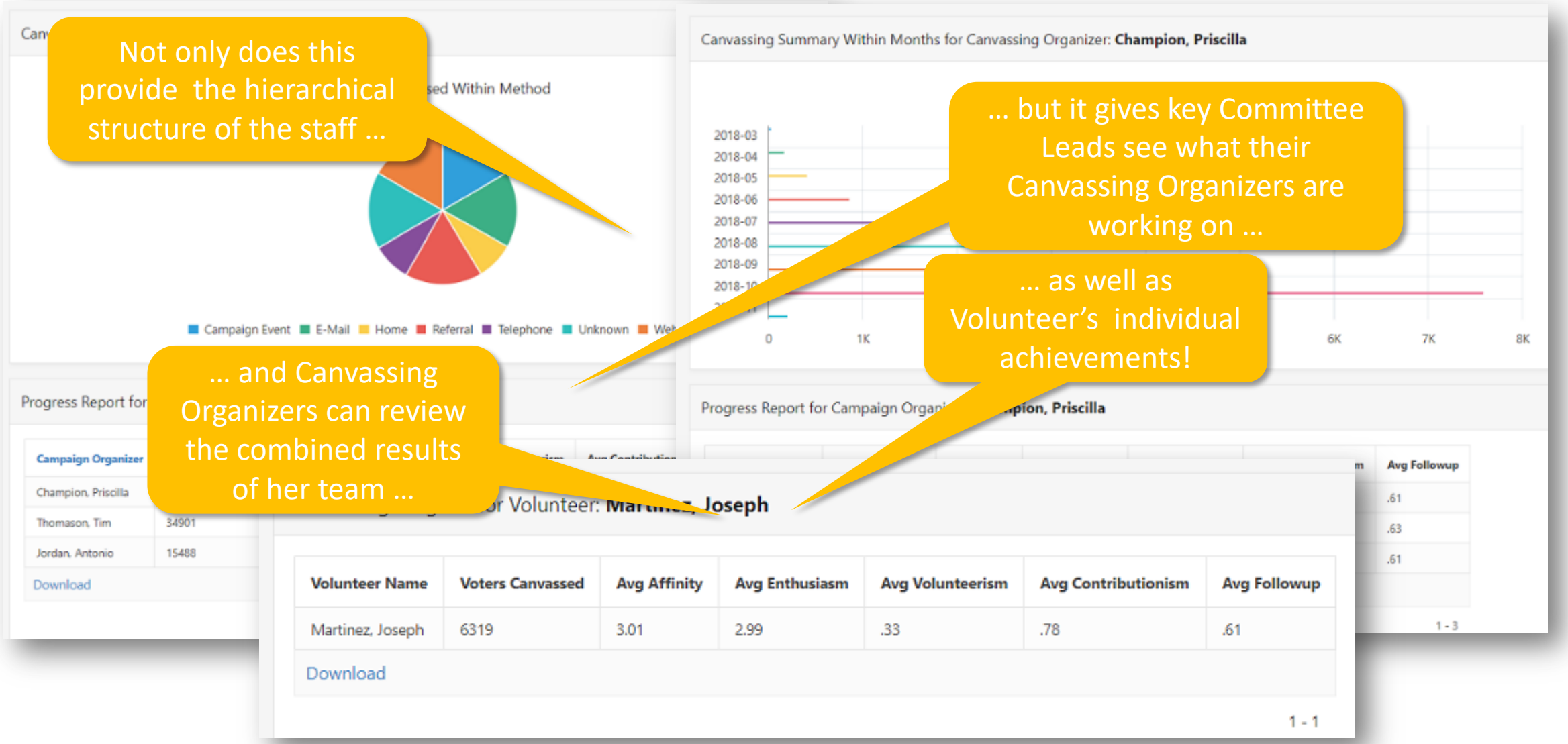
- Campaign organization ***management***
- Canvassing ***progress***
- Campaign organization staff's ***hierarchy***
- Canvassing ***coverage*** within geographic areas

VEVO Desktop: Campaign Overviews, Drill-Downs, and Details

1 Reviewing voter canvassing progress



VEVO Desktop: Campaign Overviews, Drill-Downs, and Details



MobileVEVO: Deploying A Basic Mobile Application

Canvassers in the field needed to:

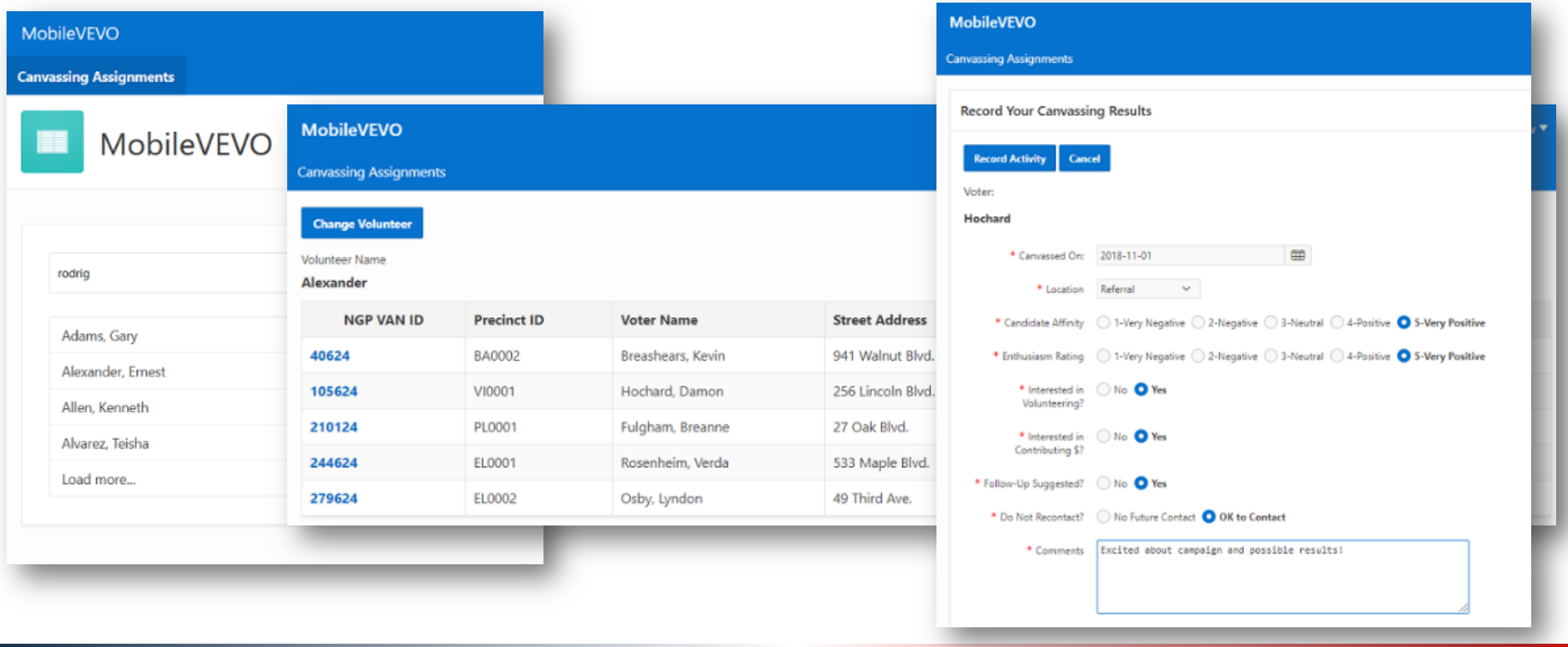
- Find which voters haven't ***yet been canvassed***
- See voters' details while canvassing
- Record ***voter sentiment*** towards candidate
- Mark off voters ***already contacted***

MobileVEVO: Easy to Build. Easy to Use.

1 The canvasser self-assigns …

2 .. and gets assigned a random list of voters to canvass …

3 … and then the canvasser records detailed information about the voter's proclivities towards the candidate and campaign.



VEVO 2.0: A New Election Campaign, With Some New Requirements

Identify potential voters, including "**flippability**" since 2018 election

Deploy **multitudes** of volunteers for maximum efficiency

Analyze results of **voter outreach**

VEVO 2.0: Perfect for Autonomous DB Always-Free.

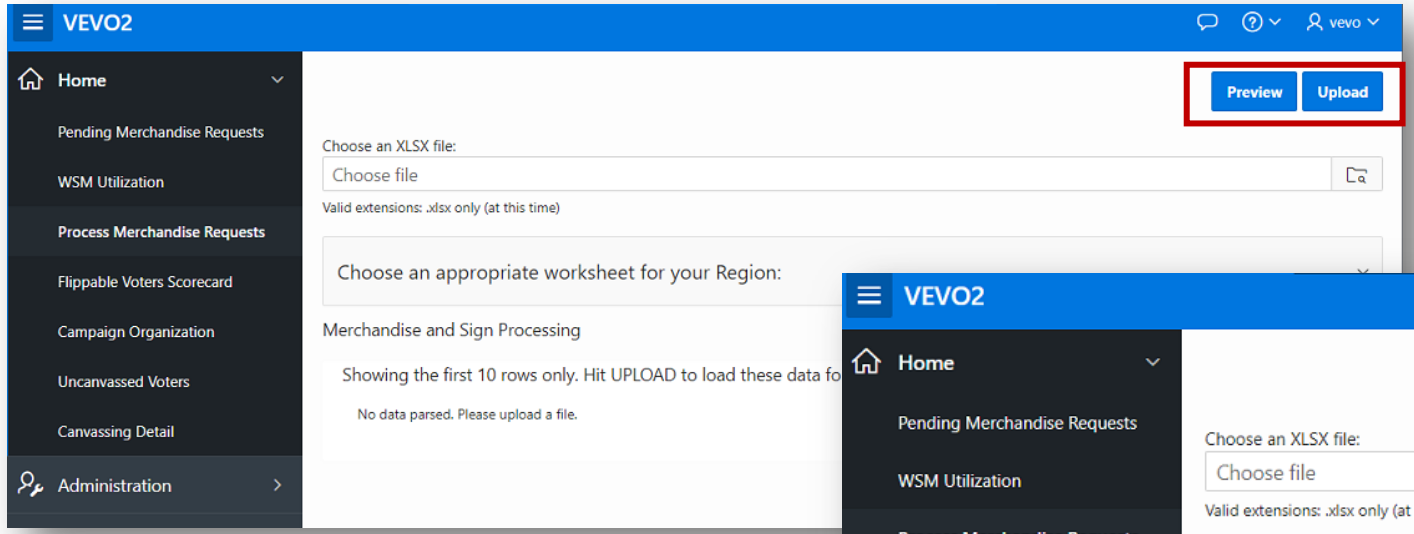
- **Centralized** data management, **consistent** processes
- **Simple** data model, **smallish** data volume
- **Machine Learning, Analytics,** and **GIS** features are **crucial**
- Security is a ***must!***

*Just because you're **paranoid***
*doesn't mean **they're not out to get you.***
- Anonymous

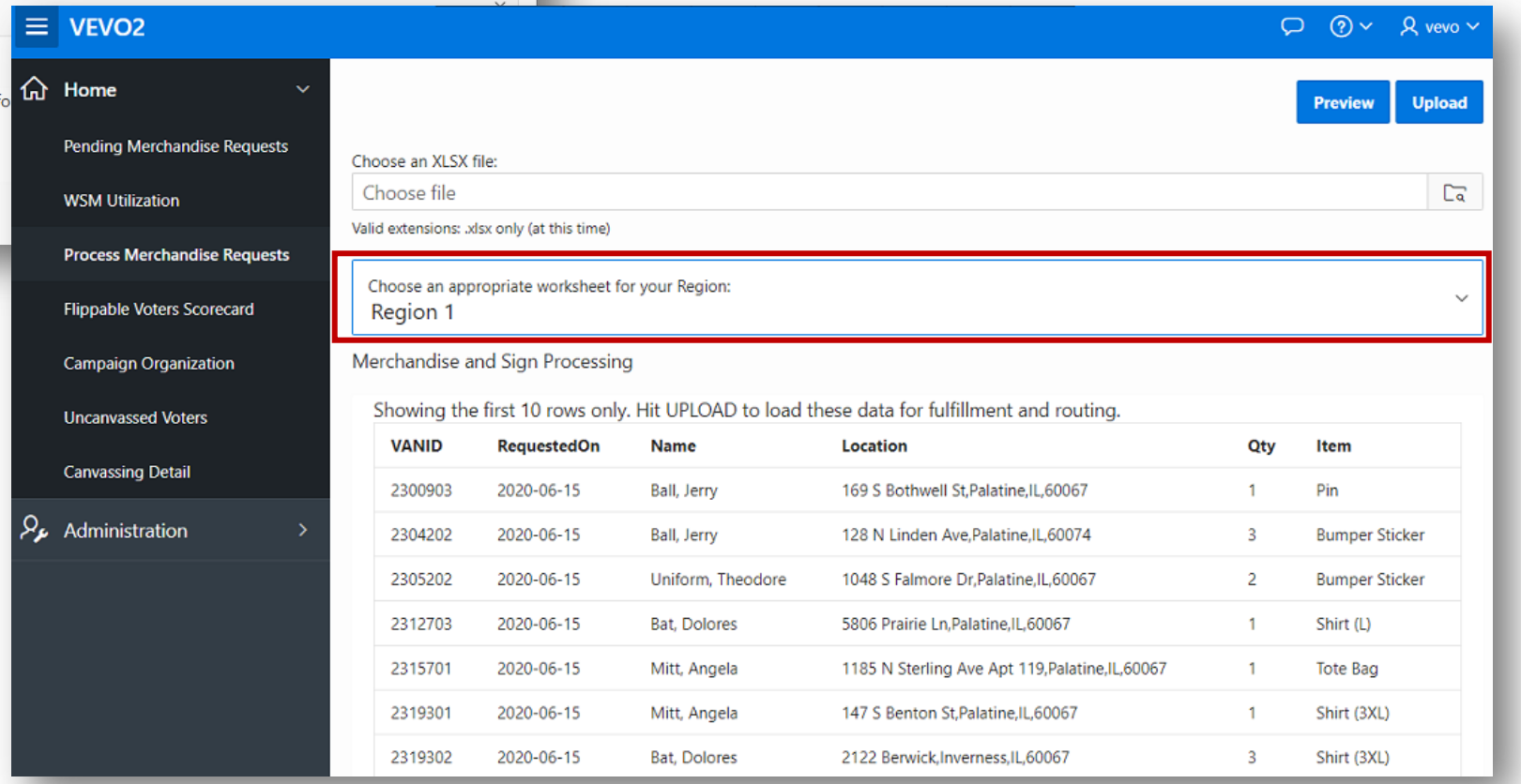
Bringing Code to Data, Not the Other Way Around

- Loading Data from External Sources with APEX_DATA_PARSER
- Leveraging Web Source Modules

Capturing Campaign Merchandising Data From External Sources



1 This page allows **retrieval, review,** and eventual **loading** of data stored within Microsoft Excel spreadsheets



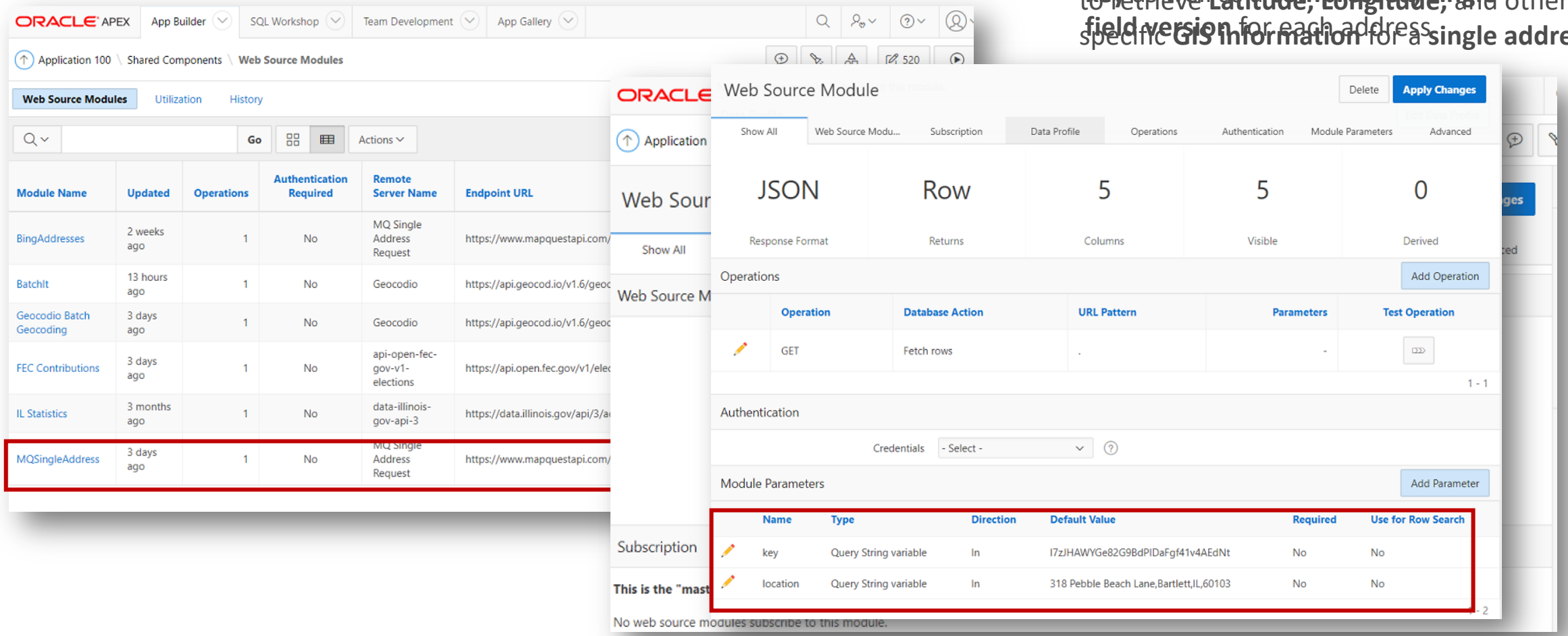
2 If there are more than one sheets in the incoming XLSX workbook, each sheet's contents can be processed **separately**

Web Source Modules: Leave the Data Where It Lives

1 Web Source Modules let you access **vast amounts** of external data via **REST API calls**

3 The REST API call requires an **API key** as well as a **compressed single-field version** for each address

Here we're using the **MapQuest GeoCoding API** to retrieve **Latitude, Longitude,** and other specific **GIS information** for a **single address**



Implementing a Web Source Module

```
DECLARE

   wsm_cor
   wsm_par

   l_locic
   l_gisic
   l_latic
   l_lngic
   l_sosic

   vcGISQu
   nLatitu
   nLongit
   vcLocat
   vcSideO
 . . .
```

```
. . .
BEGIN

   -- Describe
   APEX_EXEC.A
      p_parame
     ,p_name
     ,p_value

   -- Open Web
   wsm_context
     APEX_EXEC
      p_module
     ,p_parame


   -- Retrieve
   l_locidx :=
   l_latidx :=
   l_lngidx :=
   l_gisidx :=
   l_sosidx :=
 . . .
```

```
. . .
        -- Loop thru returned values in the WSM result set
   WHILE APEX_EXEC.NEXT_ROW (wsm_context)
      LOOP
        IF APEX_EXEC.GET_VARCHAR2 (wsm_context, l_locidx) IS NULL THEN
           :P135_LATITUDE    := NULL;
           :P135_LONGITUDE   := NULL;
           :P135_QUALITYCODE := 'N/F!!';
           :P135_SIDEOFSTREET  := NULL;
        ELSE
           :P135_LATITUDE    := APEX_EXEC.GET_NUMBER(wsm_context, l_latidx);
           :P135_LONGITUDE   := APEX_EXEC.GET_NUMBER(wsm_context, l_lngidx);
           :P135_QUALITYCODE := APEX_EXEC.GET_VARCHAR2(wsm_context, l_gisidx);
           :P135_SIDEOFSTREET  := APEX_EXEC.GET_VARCHAR2(wsm_context, l_sosidx);
        END IF;
      END LOOP;
   -- Close Web Source
   APEX_EXEC.CLOSE (wsm_context);

EXCEPTION
   WHEN OTHERS THEN
      -- Close Web Source
      APEX_EXEC.CLOSE (wsm_context);

END;
```

Loop thru all returned values, setting them **as page variables**

Complex Web Source Module Requests? APEX Packages to the Rescue!

```
. . .
BEGIN
  -----
  -- Create a CLOB containing the necessary address elements
  -----
  APEX_JSON.INITIALIZE_CLOB_OUTPUT;
  APEX_JSON.OPEN_OBJECT;
```

… and calling WSMs with **APEX_WEB_SERVICE** when complex processing and formatting of **JSON or XML** is required

… but consider leveraging **APEX_JSON** to **create, submit, receive,** and **interpret** large volume batch requests instead …

```
  APEX_JSON.CLOSE_O

  sent_clob := APEX
  APEX_JSON.FREE_OU
. . .
```

```
. . .
  APEX_WEB_SERVICE.G_REQUEST_HEADERS.DELETE();
  APEX_WEB_SERVICE.G_REQUEST_HEADERS(1).name := 'Content-Type';
  APEX_WEB_SERVICE.G_REQUEST_HEADERS(1).value := 'application/json';

  recv_clob :=
    APEX_WEB_SERVICE.MAKE_REST_REQUEST(
      p_url => 'https://api.geocod.io/v1.6/geocode?api_key=ofe…^$#@%^&$#@...ee5'
     ,p_http_method =>  'POST'
     ,p_body =>         sent_clob
     );
. . .
```

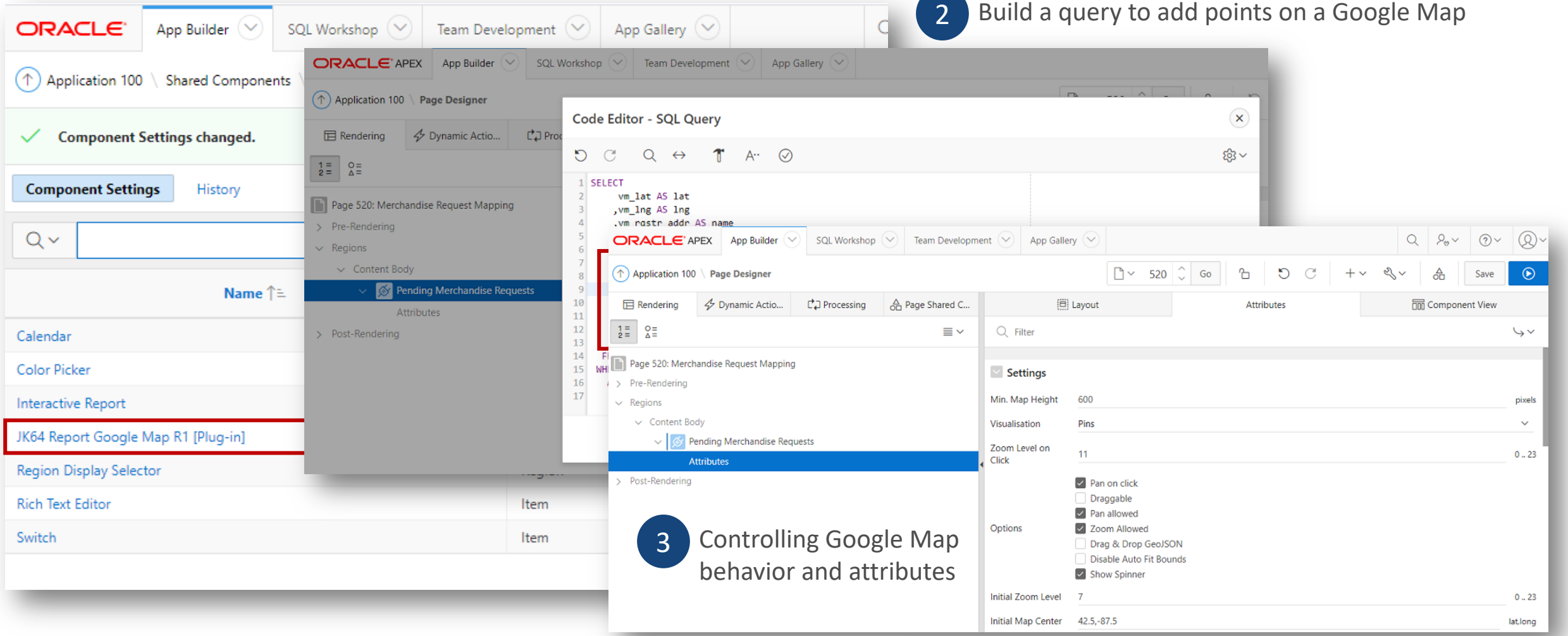
Mapping Our Progress … Literally

- APEX Google Map Plug-Ins
- APEX Oracle Spatial and Graph Map Plug-Ins

Leveraging Google Map Plug-In Features

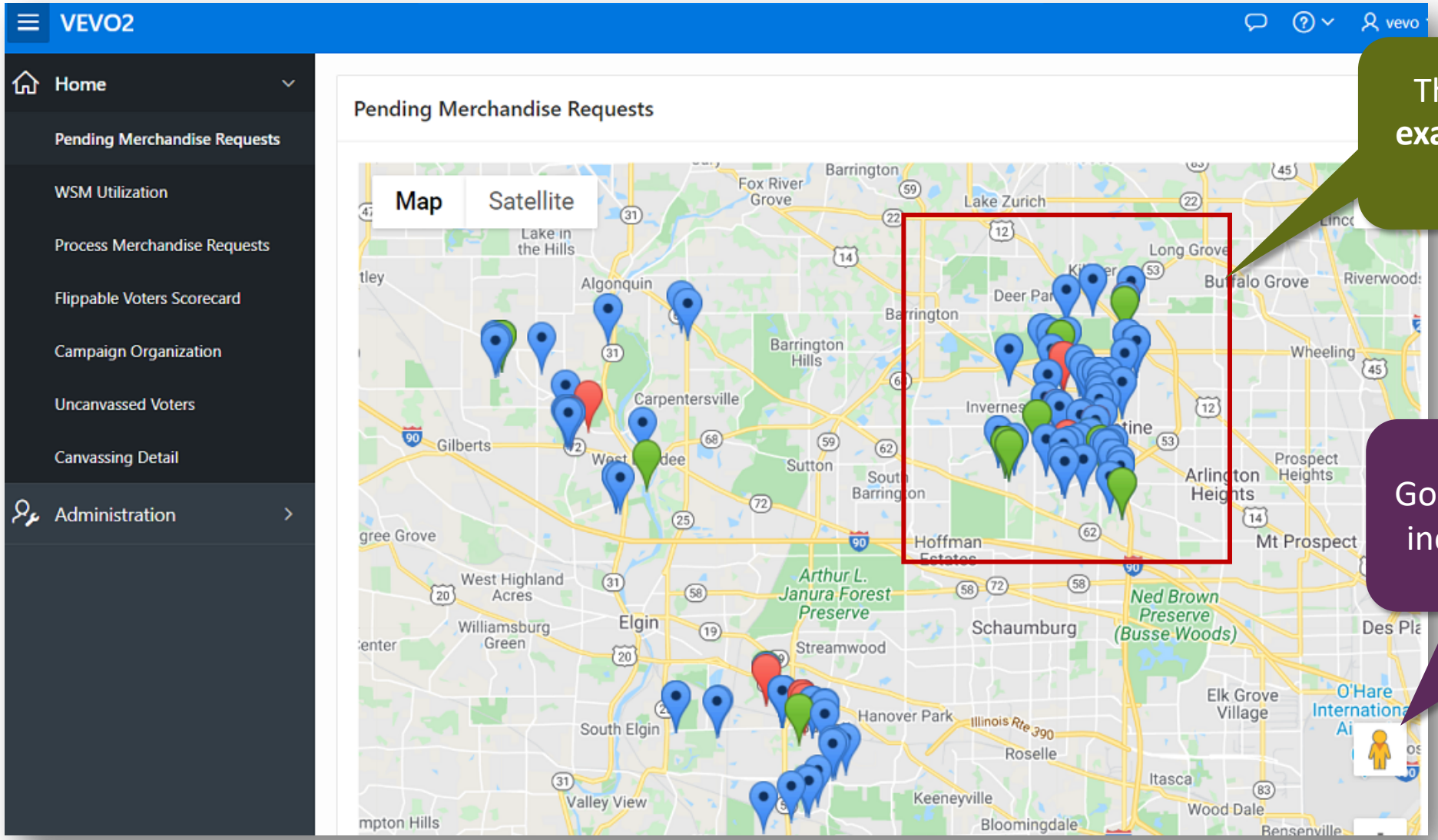
1 Post-installation of Jeffery Kemp's Google Maps API Plug-in

2 Build a query to add points on a Google Map



3 Controlling Google Map behavior and attributes

Voila! Google Maps for Merchandise and Sign Distribution



This is an **extremely simple example** of the power behind this plug-in!

Just about **any** feature of Google Maps can be exploited, including **distancing, routing,** and **directions**

Get **Jeffrey Kemp's** excellent Google Map Plug-ins**:** https://jeffkemponoracle.com/2016/02/google-map-apex-plugins/

A Last-Minute Request: Where Can I Drop Off My Vote-By-Mail Ballot?

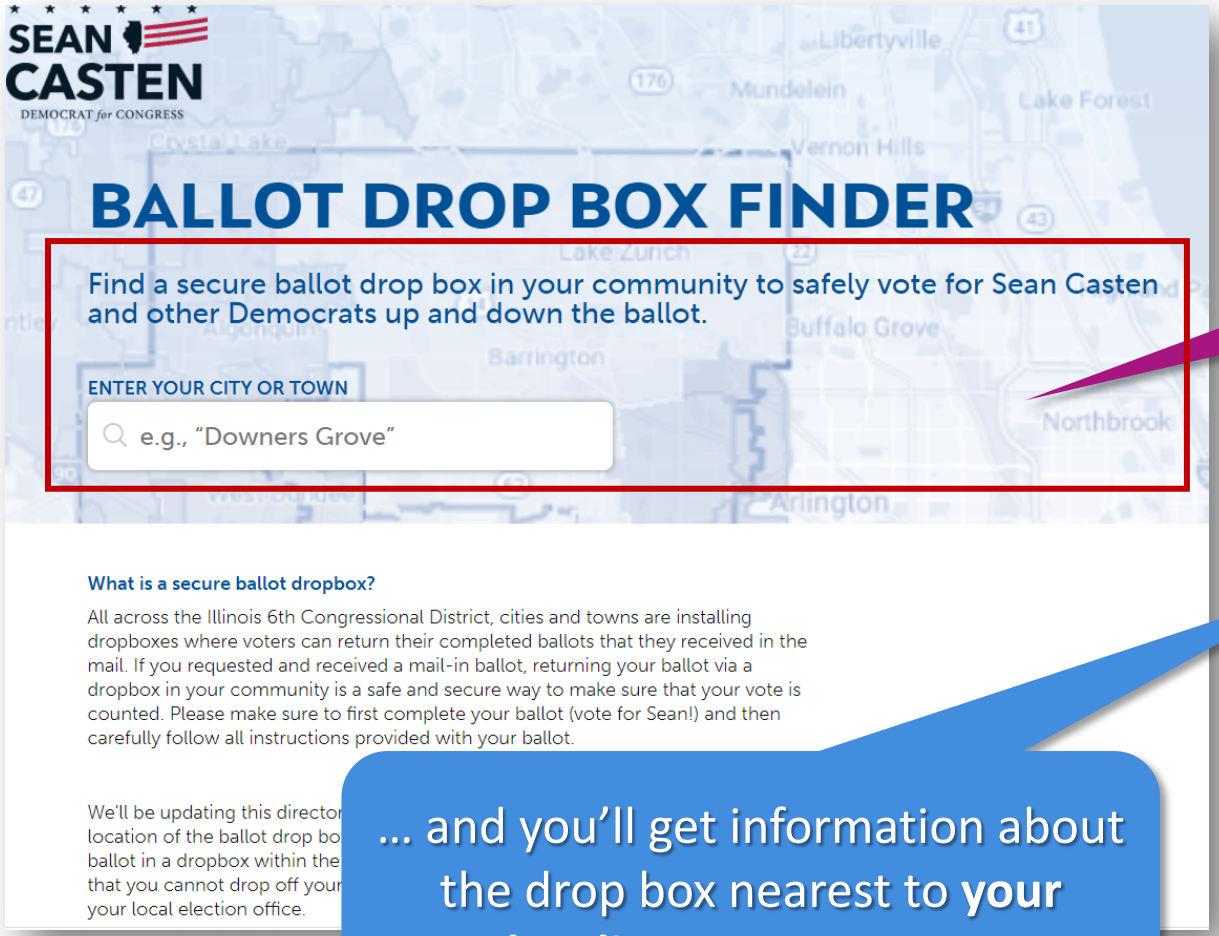
A **heavily-gerrymandered** district, the Illinois Sixth Congressional District (IL-06) spans **five** **different counties: Cook, DuPage, Kane, Lake,** and **McHenry**

Vote-By-Mail (VBM) ballots **must** be dropped off within the **same** county in which you reside … and some localities spanned **3** counties

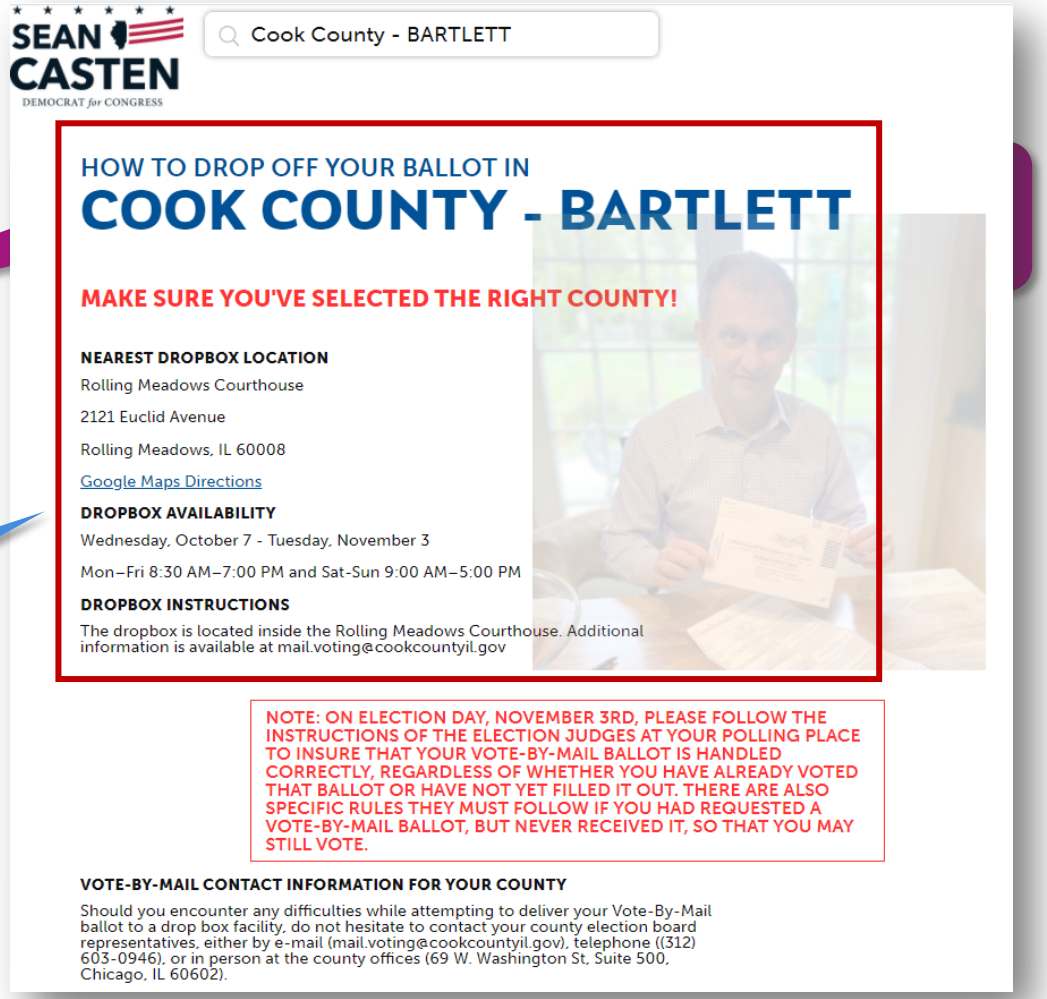
Even **more** confusing, these VBM drop boxes:

- Are in different **locations** (some inside, some outdoors)
- Have different **availability schedules** (dates and times)
- And not all will be **open** on Election Day!

A Quick (But Imperfect) Solution, Via NodeJS, React, and GitLab



… and you'll get information about the drop box nearest to **your locality** in **your county**



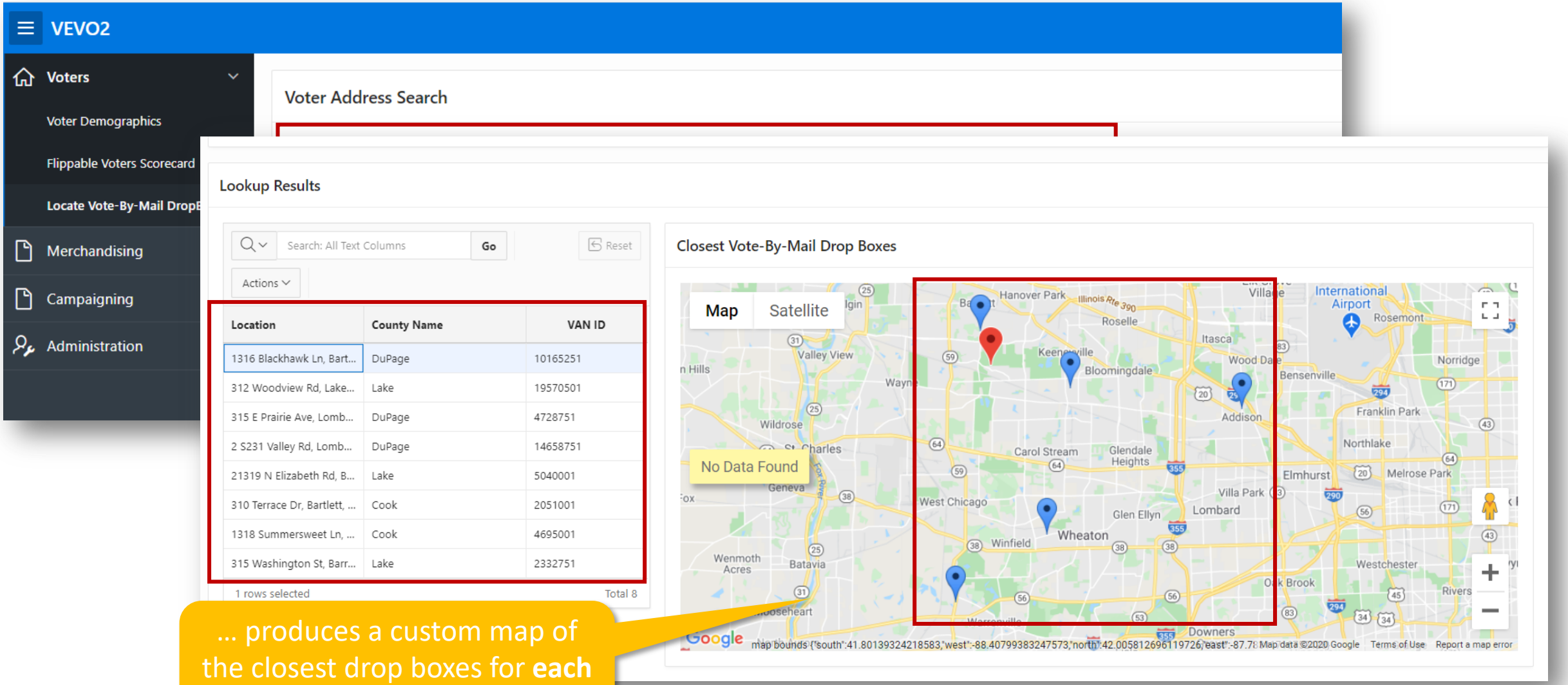
Offering Voters a Choice: Finding the Closest VBM Drop Boxes

```
SELECT
  vbm_dbl_lat AS lat
 ,vbm_dbl_lng AS lng
 ,vbm_dbl_name AS name
 ,vbm_dbl_id AS id
 ,vbm_dbl_street_addr || ', ' || vbm_dbl_city || ', IL ' || vbm_dbl_zip_code AS info
 ,'Dates: ' || TO_CHAR(vbm_dbl_opens_on, 'MON-DD') || ' - '
            || TO_CHAR(vbm_dbl_closes_on, 'MON-DD') || ' Hours: '
            || vbm_dbl_hours AS HoursOpen
 ,'https://mt.googleapis.com/vt/icon/name=icons/spotlight/spotlight-waypoint-blue.png' AS icon
  FROM vevo.vote_by_mail_dropbox_locations
 WHERE vbm_dbl_county = (SELECT v_county_name
                           FROM vevo.voters_microcosm
                          WHERE v_id = &v_id)
   AND vbm_dbl_opens_on <= TRUNC(SYSDATE)
   AND vbm_dbl_closes_on >= TRUNC(SYSDATE)
   AND SDO_NN(
       vbm_dbl_geopoint
      ,(SELECT v_geolocation FROM vevo.voters_microcosm WHERE v_id = &v_id)
      ,'sdo_batch_size=5 distance=&dist unit=mile') = 'TRUE';
```

Capturing attributes for **mapping display**

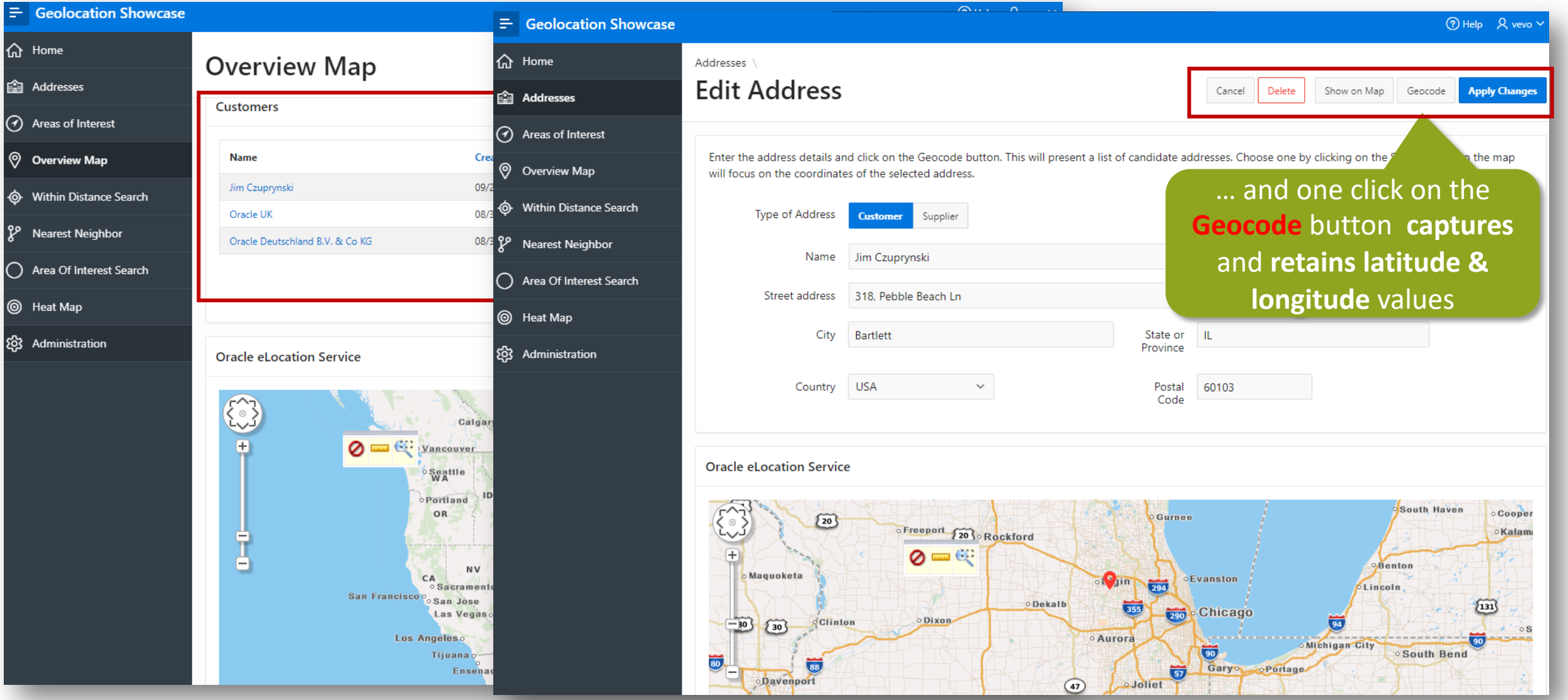
Using **SDO_GEOMETRY** features to find the closest 5 drop boxes within a specific radius, in miles

Offering Voters a Choice: Mapping the Closest VBM Drop Boxes



… produces a custom map of the closest drop boxes for **each voter** within the chosen **radius**

Don’t Like Google Maps? Then Use Oracle’s HTML5 APEX Mapping Features



Full details here: https://cloudmarketplace.oracle.com/marketplace/en_US/listing/75461594

Charting Campaign Progress

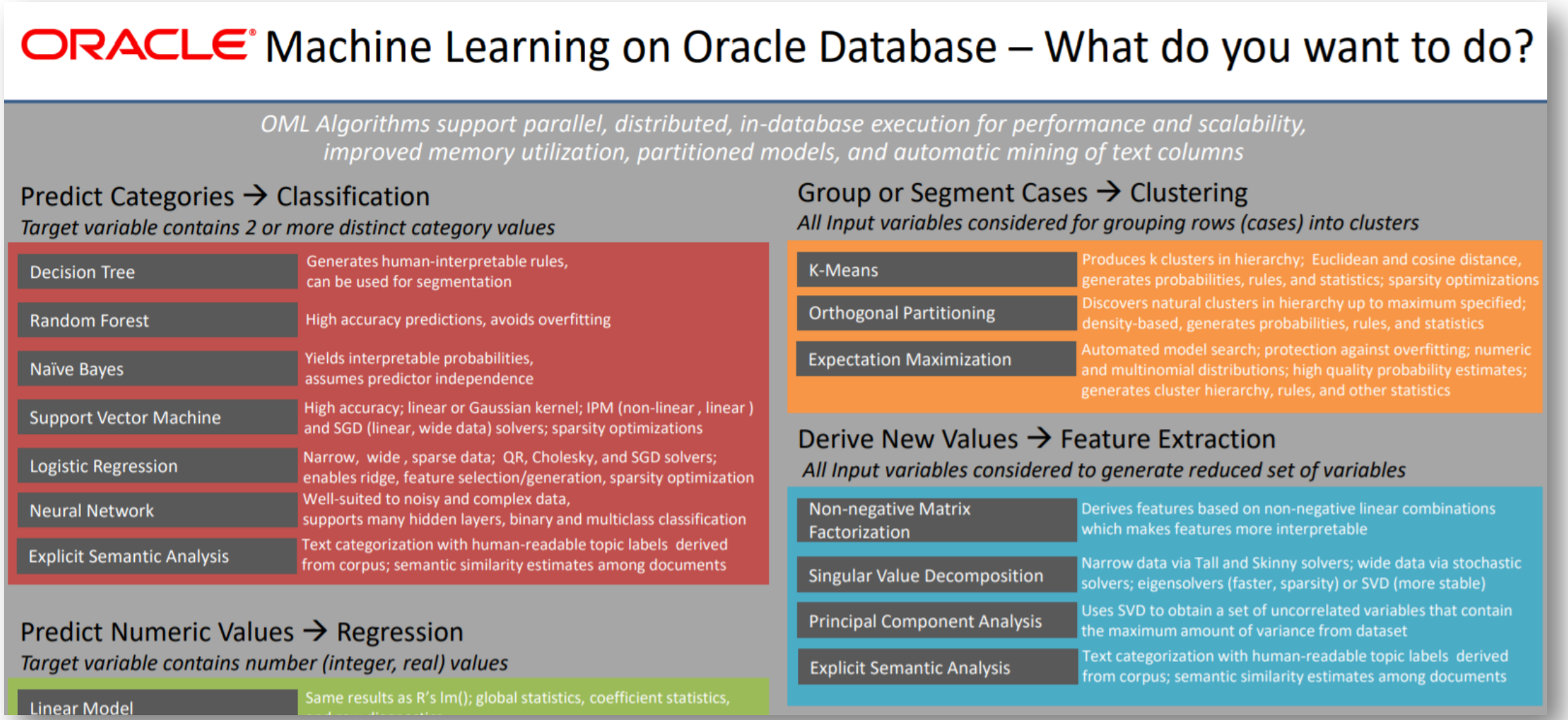
- Oracle Machine Learning Algorithms
- Visualizing Data In APEX With JET Charts

Application Express (APEX) and ML / Analytics: A Most Excellent Pairing!

APEX's extensive and flexible **application development capabilities** pair nicely with **ML algorithms and analytic reporting** techniques

- Accesses **same schema objects** that *Oracle Machine Learning* (OML) and *Oracle Analytic Cloud* (OAC) ***already use***
- Powerful **reporting and graphic toolsets**
- **Seamless integration** with Autonomous DB (**ATP** & **ADW**)

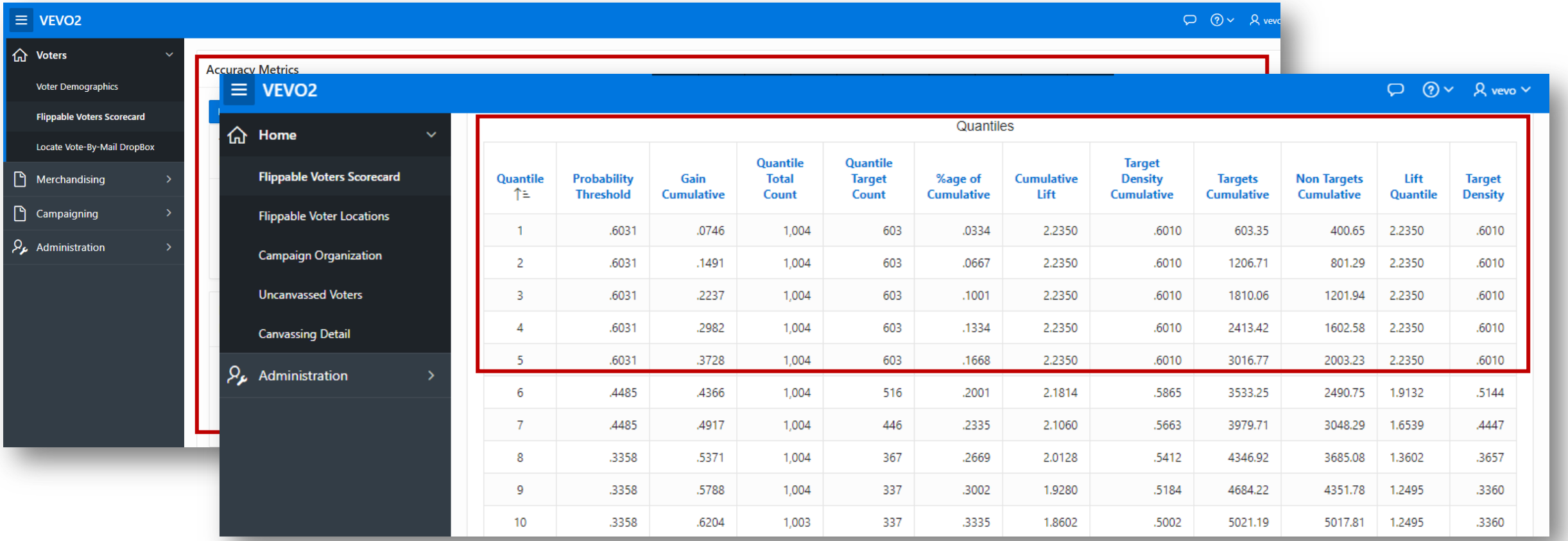
Machine Learning and Analytics: Finding Order Amidst Chaos



See the full "cheat sheet" **here:** https://www.oracle.com/a/tech/docs/oml4sql-algorithm-cheat-sheet.pdf

Leveraging APEX for Machine Learning and Analytics

1 APEX makes it simple to **visualize analytics results in graphic format** …

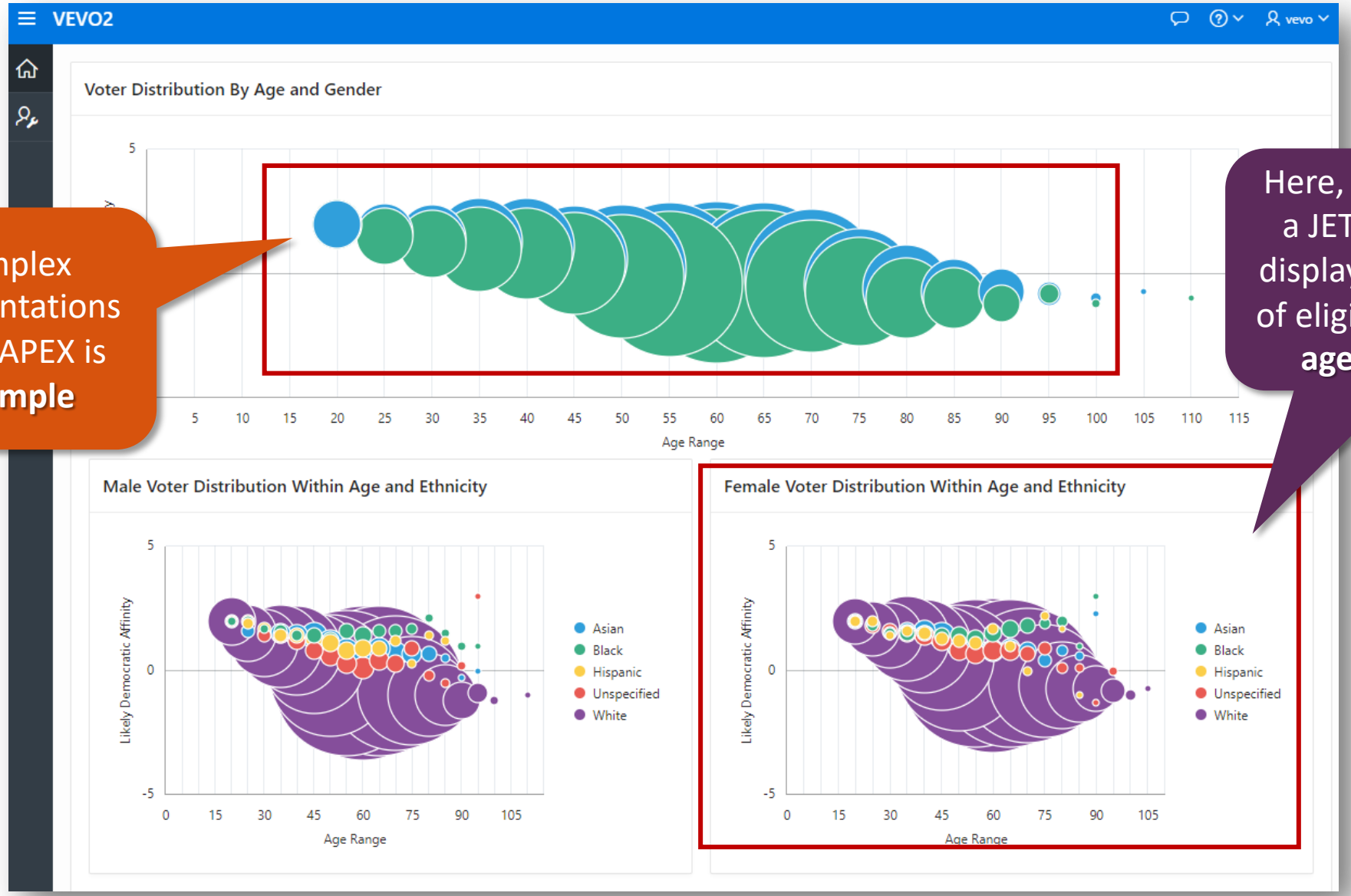


Quantile	Probability Threshold	Gain Cumulative	Quantile Total Count	Quantile Target Count	%age of Cumulative	Cumulative Lift	Target Density Cumulative	Targets Cumulative	Non Targets Cumulative	Lift Quantile	Target Density
1	.6031	.0746	1,004	603	.0334	2.2350	.6010	603.35	400.65	2.2350	.6010
2	.6031	.1491	1,004	603	.0667	2.2350	.6010	1206.71	801.29	2.2350	.6010
3	.6031	.2237	1,004	603	.1001	2.2350	.6010	1810.06	1201.94	2.2350	.6010
4	.6031	.2982	1,004	603	.1334	2.2350	.6010	2413.42	1602.58	2.2350	.6010
5	.6031	.3728	1,004	603	.1668	2.2350	.6010	3016.77	2003.23	2.2350	.6010
6	.4485	.4366	1,004	516	.2001	2.1814	.5865	3533.25	2490.75	1.9132	.5144
7	.4485	.4917	1,004	446	.2335	2.1060	.5663	3979.71	3048.29	1.6539	.4447
8	.3358	.5371	1,004	367	.2669	2.0128	.5412	4346.92	3685.08	1.3602	.3657
9	.3358	.5788	1,004	337	.3002	1.9280	.5184	4684.22	4351.78	1.2495	.3360
10	.3358	.6204	1,003	337	.3335	1.8602	.5002	5021.19	5017.81	1.2495	.3360

2 … as well as provide detailed formatted information on the **accuracy of the data model itself**

Applying APEX Data Visualization Via JET Charts

Building complex graphic representations of data within APEX is **extremely simple**



Here, we're leveraging a JET **bubble plot** to display the distribution of eligible voters within **age** and **ethnicity**

Useful Resources and Documentation

Articles on Leveraging APEX For ML, Mapping and Geolocation:
https://www.odtug.com/p/bl/et/blogaid=966
https://www.odtug.com/p/bl/et/blogaid=981

APEX_DATA_PARSER and APEX_JSON Implementation Examples:
https://blogs.oracle.com/apex/super-easy-csv-xlsx-json-or-xml-parsing-about-the-apex_data_parser-package
https://jsao.io/2015/07/relational-to-json-with-apex_json/

Two-Minute Tech Tips on Using GeoLocation, Spatial, and Graph Features:
Part 1: https://www.youtube.com/watch?v=0MRnKsRL3-Q
Part 2: https://www.youtube.com/watch?v=7WAs1-bbWLM
Part 3: https://www.youtube.com/watch?v=bPL-AHrhI8s

Jeffrey Kemp's Google Maps APEX Plug-ins:
https://jeffkemponoracle.com/2016/02/google-map-apex-plugins/
https://jeffkemponoracle.com/tag/apex-plugins/
https://github.com/jeffreykemp/jk64-plugin-reportmap/wiki/SQL-Query-Examples

OML "Cheat Sheet":
https://www.oracle.com/a/tech/docs/oml4sql-algorithm-cheat-sheet-19c-v2.pdf