

Federal GIS Conference 2014

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Geocoding Techniques and Options for US and International Locations

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Doug Geverdt, Census

Chuck Whittington, Census

Types of Geocoding

- GeoSearch



Sydney Opera House



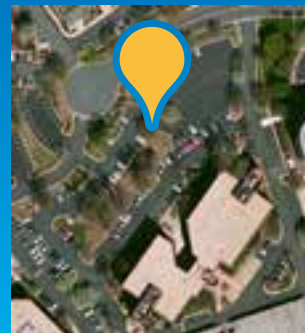
- Batch Geocoding



| Address | Latitude | Longitude |
|---|-----------|------------|
| 1000 Broadway, New York, NY 10018 | 40.758896 | -87.629778 |
| 1000 Pennsylvania Ave, Washington, DC 20004 | 38.907229 | -77.036881 |
| 1000 Vermont Ave, Washington, DC 20005 | 38.907229 | -77.036881 |
| 1000 Wisconsin Ave, Washington, DC 20007 | 38.907229 | -77.036881 |
| 1000 W. 10th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 15th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 21st St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 24th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 30th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 32nd St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 36th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 40th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 44th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 48th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 52nd St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 56th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 60th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 64th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 68th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 72nd St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 76th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 80th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 84th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 88th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 92nd St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 96th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |
| 1000 W. 100th St, Oklahoma City, OK 73106 | 35.467537 | -97.516432 |



- Reverse Geocoding



Address: 8615 Westwood Center Dr
City: Tysons Corner
Region: Virginia
Postal: 22182
Country: USA

Loc_name: USA.PointAddress

On premises vs Online

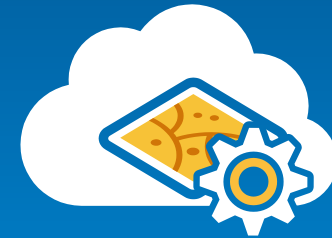
- **On premises**

- Need to geocode behind a firewall for security/privacy reasons
- need to maintain your own reference data



- **Online**

- Users who want to consume a ready-to-use geocoding service



Geocoding On-Premises

- Users that need to geocode behind a firewall for security/privacy reasons
- Users that maintain their own reference data

What you need:

- Hardware/Device to host data and locators
- ArcGIS Software
- Locator Files and Reference Data or a Private Geocoding Service



Options

- Obtain or create reference data, build your own locator
- Use locators in Esri's ready to use street data product, **StreetMap Premium**
 - North America
 - Latin America
 - Europe
 - Australia/New Zealand
 - Japan

<http://www.esri.com/data/streetmap/comparison>

License by:

Continent
Country
State/Province
(US/Canada)



| | NAVTEQ North America | TomTom North America | NAVTEQ Latin America | NAVTEQ Europe | TomTom Europe | NAVTEQ Australia/New Zealand | IPC |
|-----------------|--|--|--|---|--|------------------------------|-------------------------------------|
| Coverage | North America | North America | Latin America | Europe | Europe | Australia (New Zealand) | Japan |
| Version | 2011 | 2011 | 2010 | 2010 | 2010 | 2012 | 2012 |
| Current Release | 2011 Release 2 | 2011 Release 3 | 2010 Release 1 | 2010 Release 1 | 2010 Release 1 | 2012 Release 1 | 2011 Release 1 |
| Update Schedule | Quarterly | Quarterly | Annual | Semi-Annually | Semi-Annually | Annually | Annually |
| Delivery | DVD | DVD | DVD | DVD | DVD | DVD | DVD |
| Format | FGDB, SDC | SDC, FGDB | FGDB | FGDB, SDC | SDC | FGDB | FGDB |
| Addressing | Down to Address Point Level for US, Canada, Mexico | Down to Address Point Level for US, Canada, Mexico | Coverage Varies Down to Address Point for many LATAM Countries | Coverage Varies Down to Address Point Level for many European Countries | Coverage Varies Down to Street Address Level for many European Countries | Down to Address Point Level | Address Point Level to the Building |
| Routing | Historic Traffic Data, Trucking Restrictions, Driving Directions | Historic Traffic Data, Trucking Restrictions, Driving Directions | Historic Traffic Data, Trucking Restrictions, Driving Directions | Historic Traffic Data, Trucking Restrictions, Driving Directions | Historic Traffic Data, Trucking Restrictions, Driving Directions | Basic Routing, Driving | Basic Routing, Driving |

Geocoding On-Line – the ArcGIS Online World Geocoding Service

- Ready-to-use world geocoding service
- Covers:
 - the planet at Admin/Populated places level
 - 105 countries supported at address precision
 - 55 countries down to address point



Numbers to remember for batch geocoding:

40 credits for every **1,000** geocodes

2.4 credits per

10 MB of stored feature services/month

Which option is for me?

I am a user based in the US that needs to geocode **tens of millions of US addresses per year**, which option is right for me?

On premises option may be best **IF**

Volume of geocodes expected



Cost of credits consumed using the ArcGIS Online World Geocoding Service

Which option is for me?

I am a global, enterprise organization that needs to geocode **addresses worldwide**, what should I use?



World Geocoding Service IF

your geocoding region extends beyond

StreetMap Premium availability

North America

Europe

Japan

Latin America

Australia/New Zealand

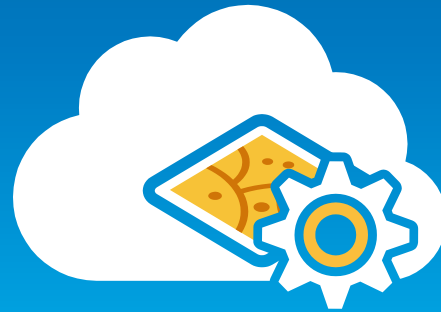
Which option is for me?

I need to geocode **millions of North American** addresses per month, yet I have a hundred records for **other countries** I need geocoded as well, what should I use?



Hybrid!

StreetMap Premium + World Geocoding Service



Geocoding: A Hybrid Approach

Doug Geverdt, US Census Bureau,
Governments Division



Organizational Context

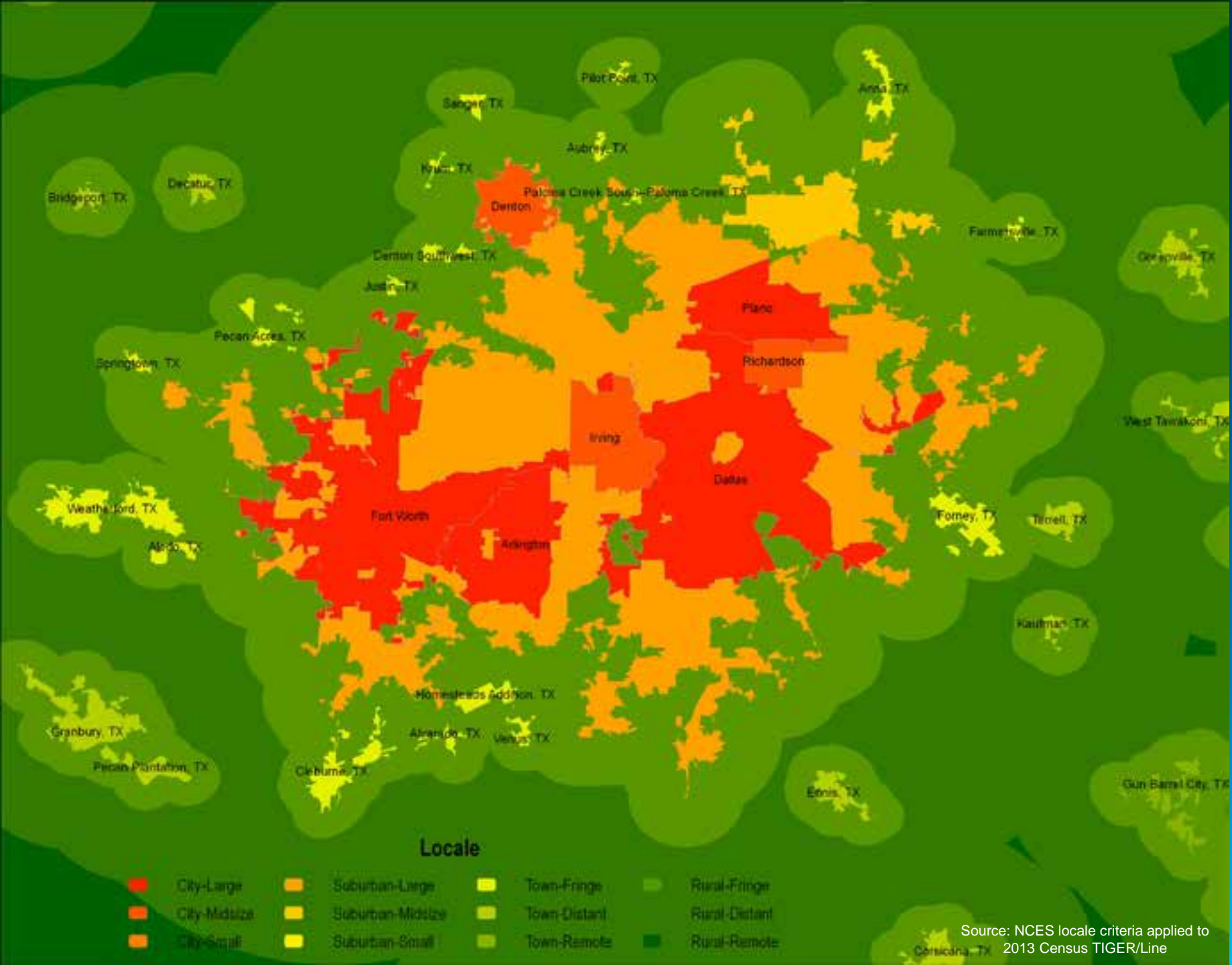
- **Census Bureau - substantial collaboration with other federal agencies**
- **Support U.S. Dept. of Education's National Center for Education Statistics (NCES) (more than a dozen projects, large and small)**

Education Demographic and Geographic Estimates project (EDGE)

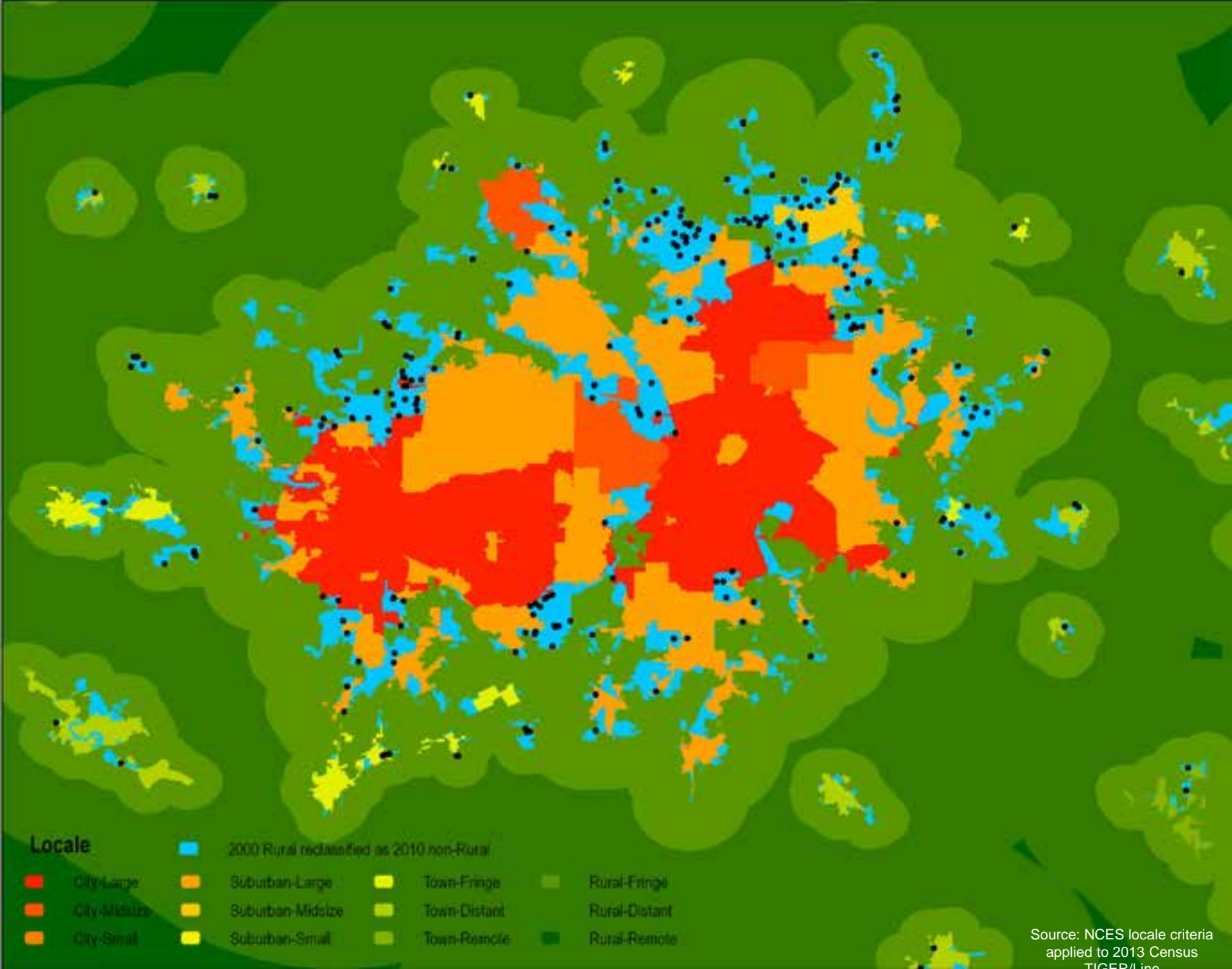
Create custom demographic and geographic data products to help NCES identify and report on the conditions of education in the U.S.

- **Demographic (custom tabulations from American Community Survey)**
 - School district demographics for school-age children
 - Experimental school-level estimates
- **Geographic**
 - School address geocodes
 - Other geographic associations (county, Congressional District, etc.)
 - Locale indicators

NCES Locale Geography



Urban Change: Rural to Non-Rural Schools (2000-2010)



Source: NCES locale criteria applied to 2013 Census TIGER/line

Operational Context

- **One-person operation**
- **Limited budget and time**
- **Cyclical but unstable product schedule**
- **Low volume (max file size 100k cases)**
- **High need for spatial accuracy**
- **Results – publicly available**
- **IT environment:**
 - Project-level: ArcGIS and SAS for analysis/review
 - Enterprise-level: ESRI site license; high bar to approve new software

Needs:

Low cost

Low hassle

Spatially accurate

Distributable

Basic Workflow

- **Receive and review annually updated address files**
- **Geocode (multiple sources) and integrate results**
- **Synthesize current-year results with prior-year data**
- **Review, edit, and finalize results (file curation)**
- **Create indicators and supplemental associations**
- **Geo data elements delivered and included in primary data products**

Solutions

- **Phase 1 (2007): ArcWeb Services**

- Online flexibility, Cost effective (low volume), multiple sources

- **Phase 2 (2010): ArcGIS Online**

- Increase manual review with AGO base layers, Public search (Google Earth, Wikis, etc.)

- **Phase 3 (2013): StreetMap Premium (SMP) and ArcGIS Online**

- Better value for unpredictable volume, more control/flexibility, multiple sources

- **Phase 4 (future): Increasingly Multi-Modal**

- Current automated resources (SMP+AGO), systematic manual review, federal sources, local level respondents (district personnel, students)

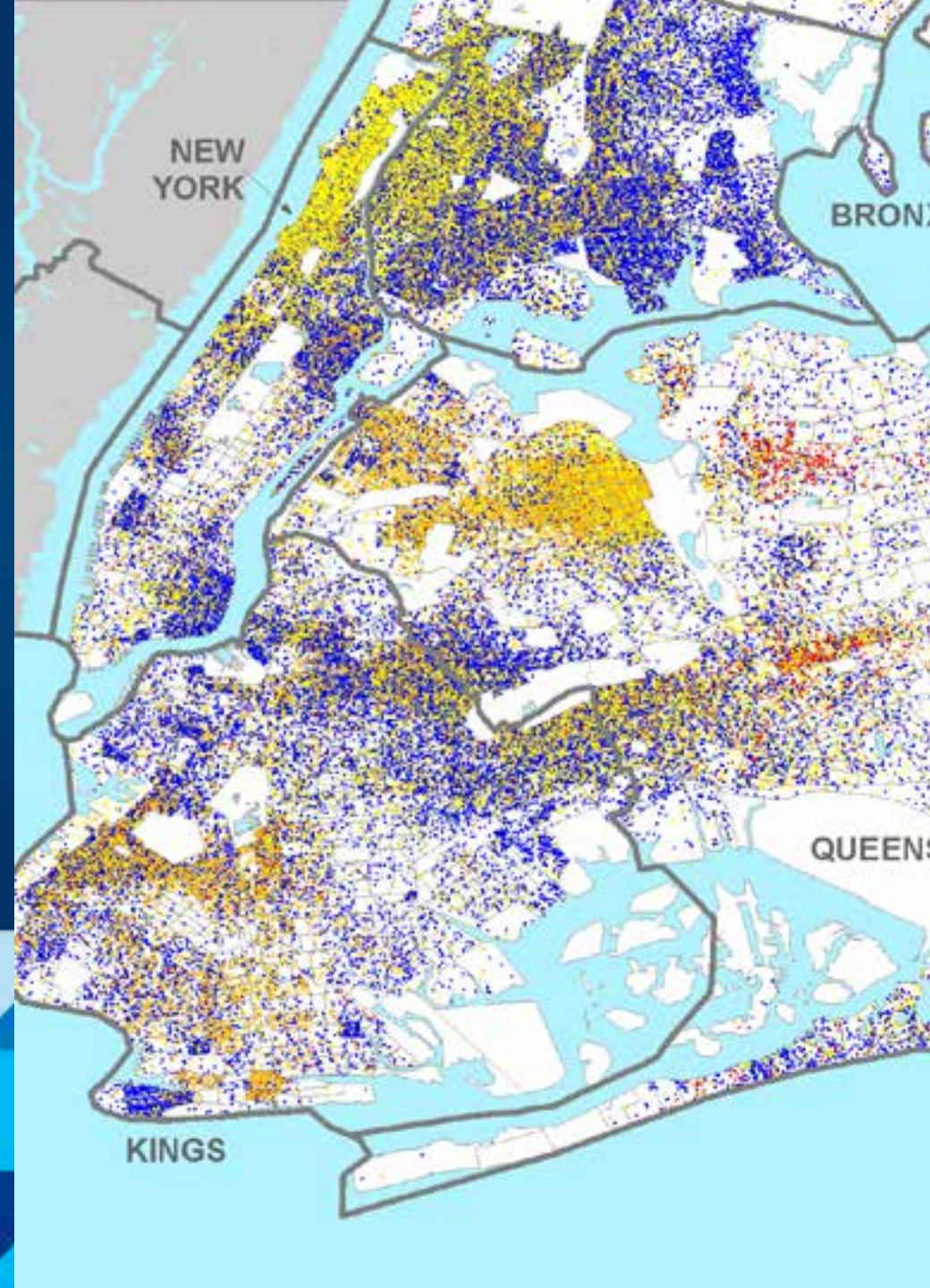
Challenges

- **Improving address quality**
- **Improving positional accuracy**
 - 'Rooftop' result may not be building footprint
 - 'Address' point may be parcel centroid worse than old point
- **Interpreting year-to-year location changes for stable addresses**
- **Explaining the role of good geo data for good demographic analysis**
- **Managing assumptions and expectations about automated geocoding**

**How to spend less time
to get better data
so we have more time to use it**

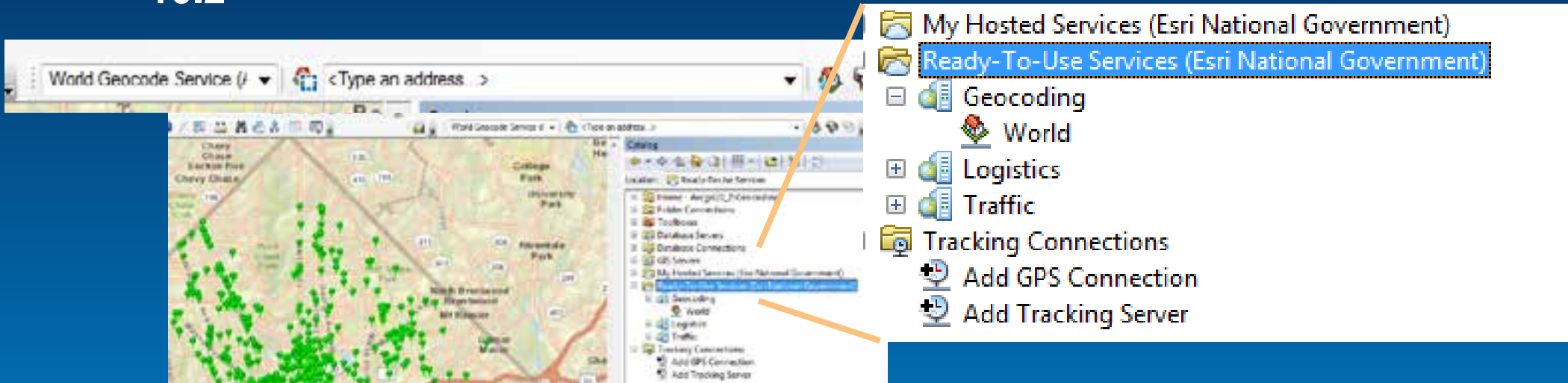
Geocoding: A Hybrid Approach

Doug Geverdt, US Census Bureau,
Governments Division



Accessing the World Geocoding Service - Desktop

- 10.2



- 10.1



Accessing the World Geocoding Service – Web Apps

ArcGIS REST API

Resource Center

- THE ArcGIS REST API
- Services from Esri
- Accessing services
- Maps
- Geocoding
- Overview
- Single

Batch geocode authentication

Services from Esri

In order to access the batch geocoding functionality provided by the world geocoding service in your own applications, you need an [ArcGIS Online subscription](#). Once you have made a request, you need to provide the identity of named users from your subscription. Each successful request to the services incur service credits which are debited from your [ArcGIS Online service credits link](#) provides details about service credits for the geocoding service.

Providing authentication credentials to ArcGIS Online

As a developer, you can provide authentication credentials in one of two ways—by prompting end users to enter their authenticated login or by storing credentials with the application.

Prompting end users to sign in

You can use the Identity Manager component in the client APIs to manage the login process. The Identity Manager simplifies the process of working with secure resources by appending it to the request.

If you are using the [ArcGIS API for JavaScript](#) to build your application, you can include the [IdentityManager](#) dijit in your application to handle authentication. The IdentityManager dijit handles authentication for subsequent REST requests made from within that client session using the [esri.request](#) object will automatically be part of that authenticated session. Using the IdentityManager dijit in JavaScript web applications that are hosted within [arcgis.com](#). Similar facilities are available in the other client SDKs.

Storing credentials with the application

You can hardcode the credentials in your application and use the REST API to obtain an access token in exchange for the application credentials. It is your responsibility to store the credentials on the server and implementing a proxy service. For example, the ArcGIS API for JavaScript provides an example of how to implement such a [proxy page](#).

Authentication using the REST API

To access the secured services Esri provides, you must pass a token as a parameter in your REST requests. [Accessing services provided by Esri](#) describes this process.

Sign

Batch Geocoding in ArcGIS Online

My Content

1 Office
2 Redlands
3 D.C.
4 Boston
5 Charlotte
6 Denver
7 Minneapolis
8 Olympia
9 Philadelphia
10 San Antonio
11 St. Louis
12 Albany
13 Anchorage
14 Atlanta
15 Chicago
16 Columbus
17 Honolulu, HI
18 Houston
19 Kansas City
20 Nashville
21 New York
22 Sacramento, CA
23 Seattle

Folders

NEW DELETE

| | |
|---|----------------------------|
| Anchorage, AK | 907-644-8470 Satellite Off |
| 3650 Brookside Parkway Alpharetta, GA 30022 | 770-777-1490 Satellite Off |
| 221 North LaSalle Street Chicago, IL 60601 | 312-609-0966 Satellite Off |
| 7775 Walton Parkway New Albany, OH 43054 | 614-933-8698 Satellite Off |
| 1357 Kapiolani Boulevard Honolulu, HI 96814 | 808-947-0993 Satellite Off |
| 11200 Westheimer Rd Houston, TX 77042 | 713-401-0658 Satellite Off |
| 8700 State Line Road Leawood, KS 66206 | 913-383-8235 Satellite Off |
| 321 Billingsly Court Franklin, TN 37067 | 615-599-4120 Satellite Off |
| 75 Broad Street New York City, NY 10004 | 212-349-3700 Satellite Off |
| 1600 K Street Sacramento, CA 95814 | 916-448-2412 Satellite Off |
| 100 South King Street Seattle, WA 98104 | 206-749-0533 Satellite Off |

Add Item

Add an item from your computer or reference an item on the Web.

The item is:

File: Office_Locations.csv

Supported Items

Title:

Tags:



| | | | | |
|--|--|------------------|----------|-------------|
| | | Office_Locations | Features | Feb 8, 2014 |
| | | Office_Locations | CSV | Feb 8, 2014 |

Registering your own Geocoding Service in ArcGIS Online

The image shows a composite of screenshots from the ArcGIS Online interface. At the top left, a 'SIGN IN' button is circled in red. Below it, the 'Land and Natural Resources' organization page is visible, with 'EDIT SETTINGS' and 'INVITE USE' buttons also circled in red. A navigation menu on the right side of the page has 'Groups' and 'Utility Services' circled in red. The main focus is the 'Add Geocoder' dialog box, which is open over the 'Geocoding' settings page. The dialog box contains the following fields and options:

- Geocoder URL:** A text input field with an example: `http://gisserver.domain.com/arcgis/rest/services/World/GeocodeServer`.
- Geocoder Name:** A text input field with the value 'My Geocoder'.
- Placeholder Text:** A text input field with the value 'Find address or place'.
- Allow place finding:** A checkbox that is currently unchecked.
- Allow batch geocoding:** A checkbox that is currently unchecked.

At the bottom right of the dialog box, there are 'OK' and 'CANCEL' buttons.

<http://gisserver.domain.com/arcgis/rest/services/World/GeocodeServer>

What's else is new?

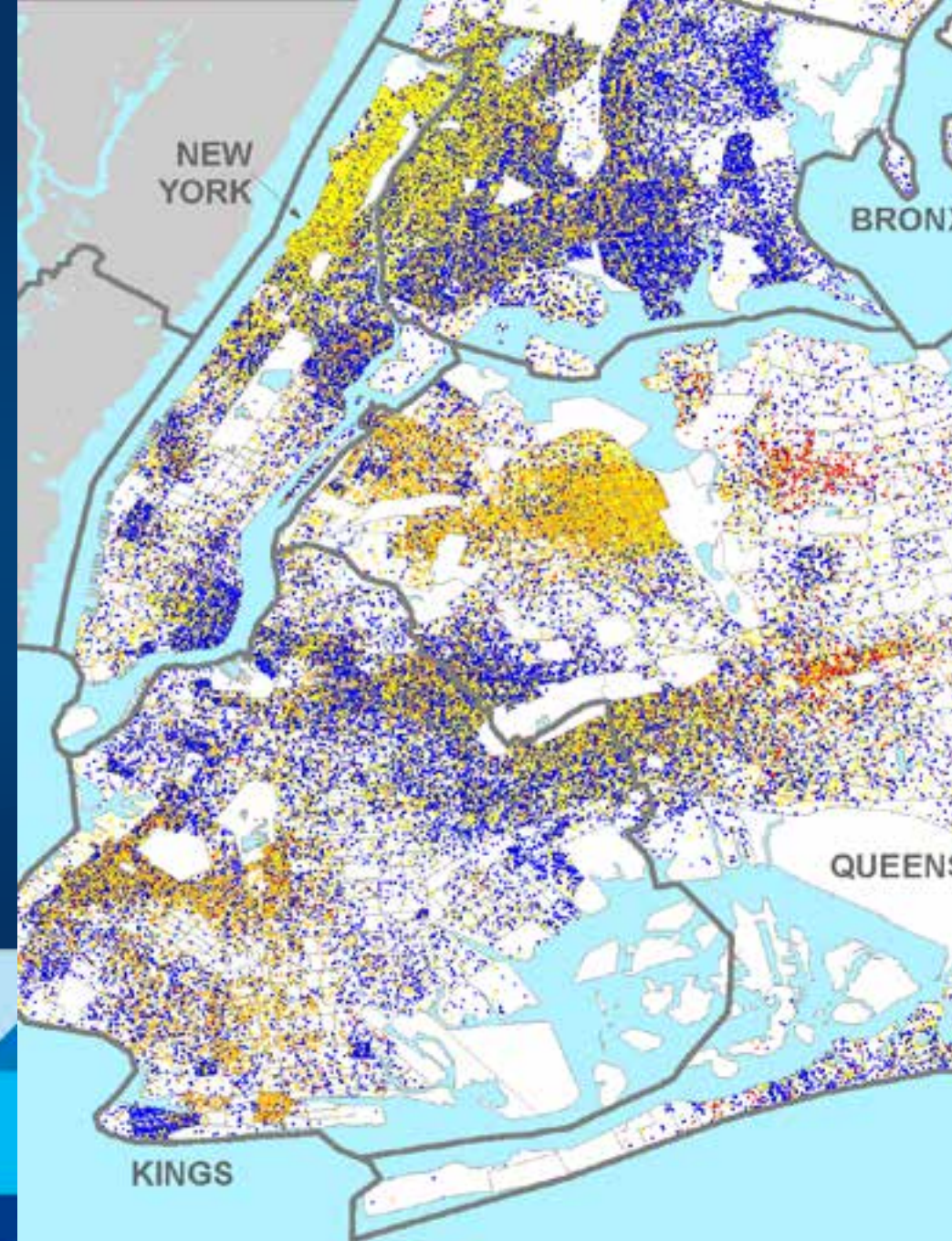
- **Location can be used to provide local context for Geosearch or “Interactive geocoding”**
- **Web Apps can leverage the center of the map or the IP location**
- **Mobile Apps can leverage the GPS location**

A peek into the future...

- **Interactive re-matching capabilities in ArcGIS Online!**

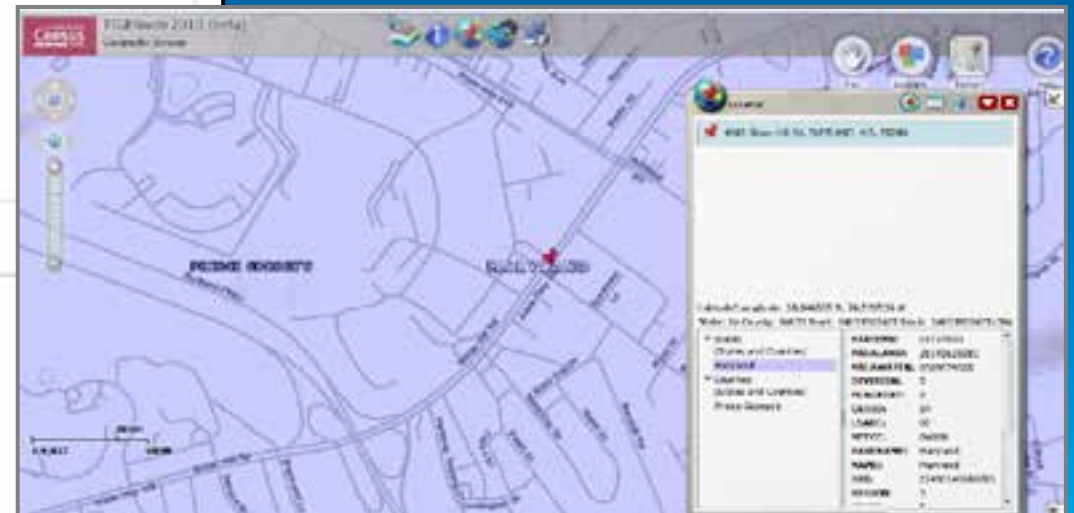
Geocoding Services Capability Update

Chuck Whittington, US Census Bureau,
Geography Division



Geocoding Service Functional Core Capabilities

- **Single Address Geocoding through a web service**
 - **Input: House Number, Street Name, City, State and/or Zip Code**
 - **Returns matched address, lat/long, state, county, tract, and block codes**



Geocoding Service Functional Core Capabilities

- Geography Look-up Service
 - Input: Lat/Long coordinate
 - Returns State, County, Tract, Block. Will add other geographies in the future

FIND LOCATIONS USING...

One Line
Address
Address Batch

FIND GEOGRAPHIES USING...

One Line
Address
Address Batch
Geographic Coordinates

ABOUT DATA...

Benchmarks
Vintages

Find Geographies Results

X:
Y:
Benchmark:
Vintage:

Input:
X: 100.99182 F: 31.842098
Benchmark: TAB10_AR (1)
Vintage: Census 2010 (TAB10) (1)
Geographies:

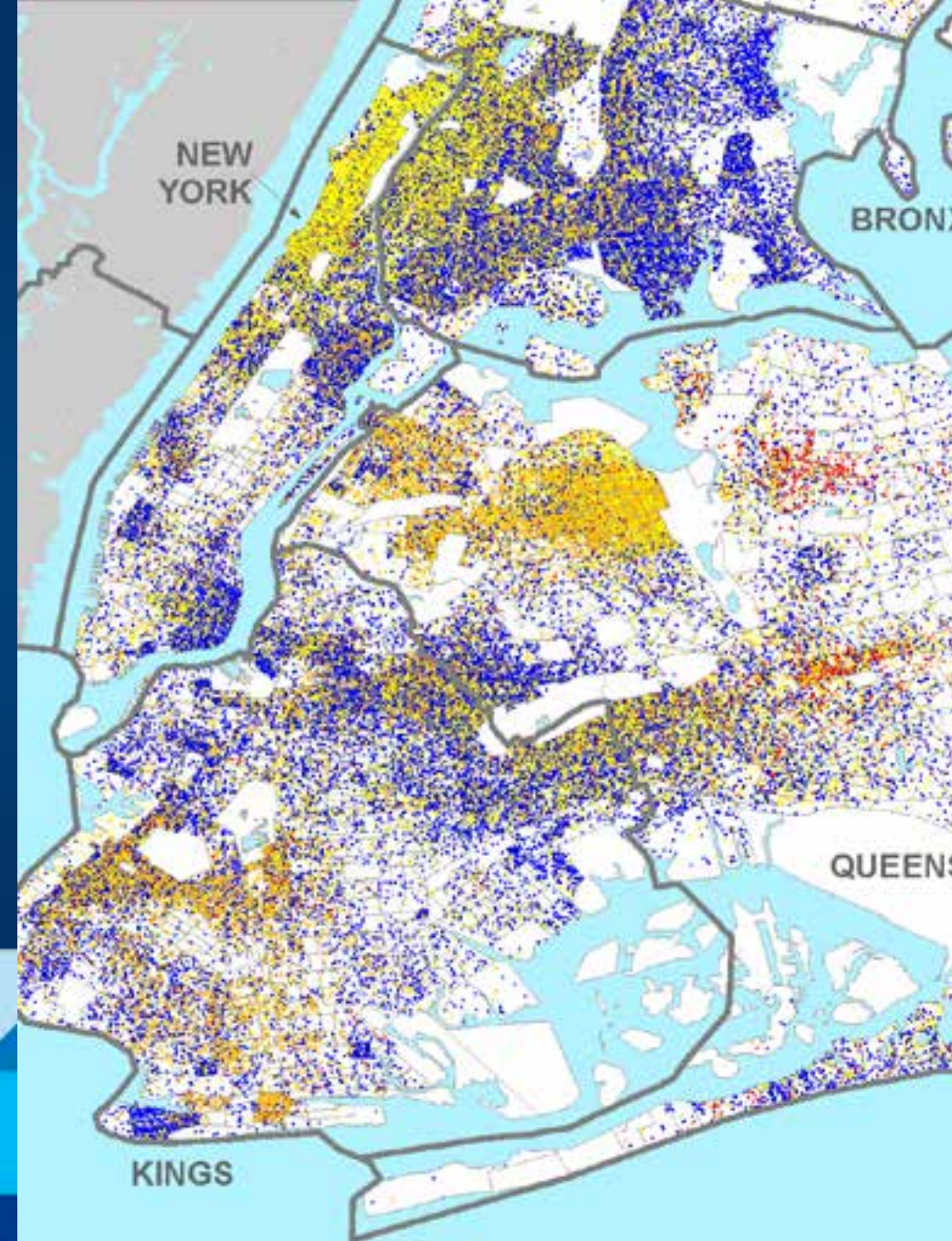
Census Block:
BLKCRP: 1
FURCSTAT: 0
STATE: 48
AREAWATER: 0
NAME: Block 1345
LSADC: 9K
CENTLON: -100.9954281
HJ100: 0
BLOCK: 1345
BASENAME: 1345
INTPLAT: +31.8420988
POP100: 21
MTFCC: 05040
COUNTY: 431
GEOID: 484319501001345
CENTLAT: +31.8411878
INTPLON: -100.9937623
AREALND: 99421
OBLCCID: 0918064
TRACT: 999109

Current Status

- **Completed internal production release of Address Range based service – supporting 2014 Census site test recruiting and applicant geocoding**
- **Refine requirements, architecture and design**
- **External facing – Address Range based service initial release in March 2014**
- **MAF based service – FY14 starting planning for implementation of the solution**

Geocoding Services Capability Update

Chuck Whittington, US Census Bureau,
Geography Division





Understanding our world.