

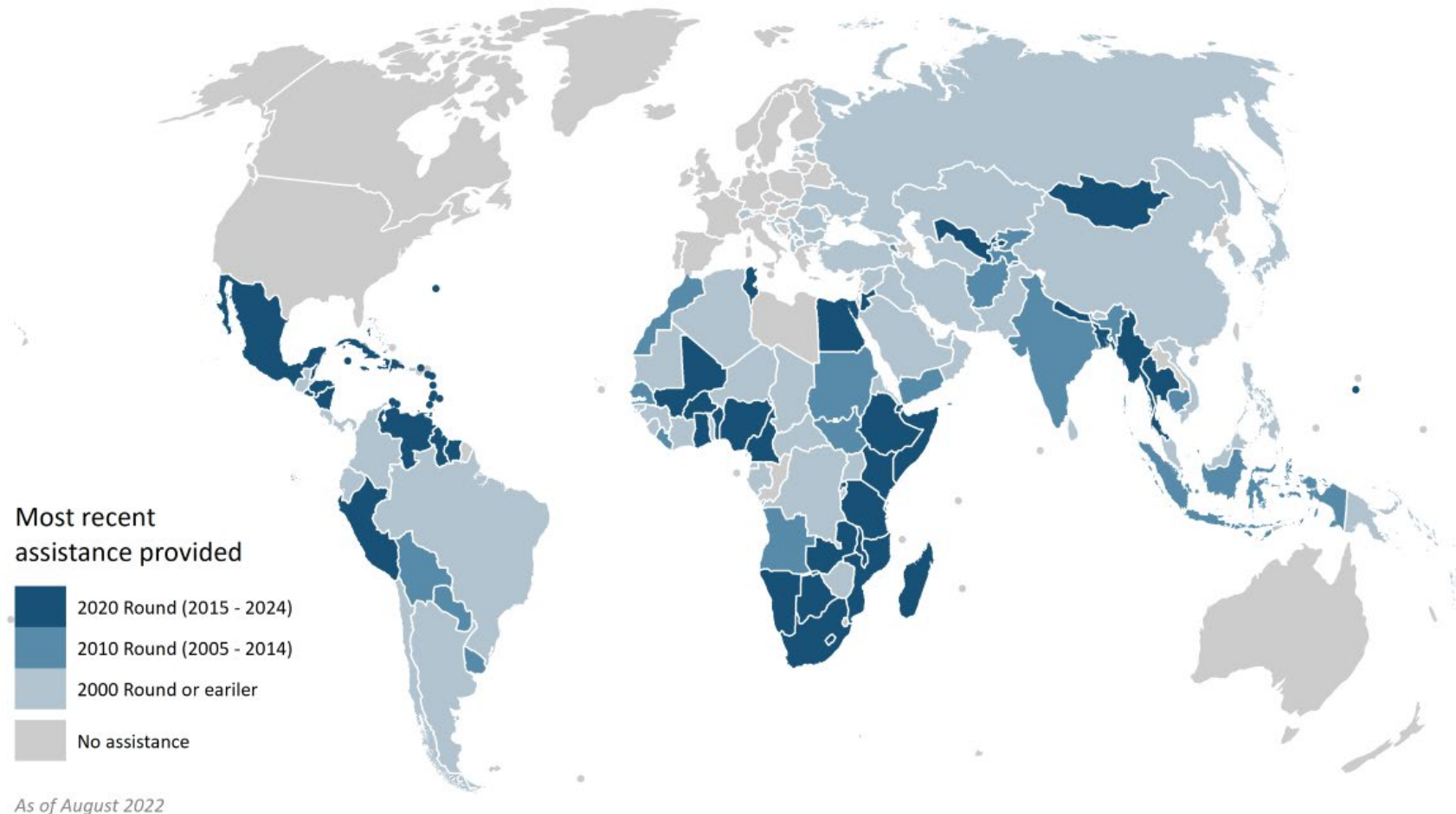
Geospatial Technology and the Census

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This presentation is released to inform interested parties of ongoing research and to encourage discussion of work in progress. Any views expressed on technical issues are those of the author and not necessarily those of the U.S. Census Bureau.

U.S. Census Bureau: Strengthening Global Statistical Capacity

- Capacity building in-country and regionally.
- Working with NSOs and other organizations.
- Technical assistance, training, and workshops related to:
 - Census and survey planning and implementation.
 - Data collection, processing, evaluation, analysis, and dissemination.
- Virtual assistance, especially during COVID-19 pandemic.



Outline

Integrated Mapping Systems

- Overview
- Geospatial work at an NSO

Geospatial Operations in a Census

- Frame, demarcation, operational control, dissemination

Progress and What's Next?

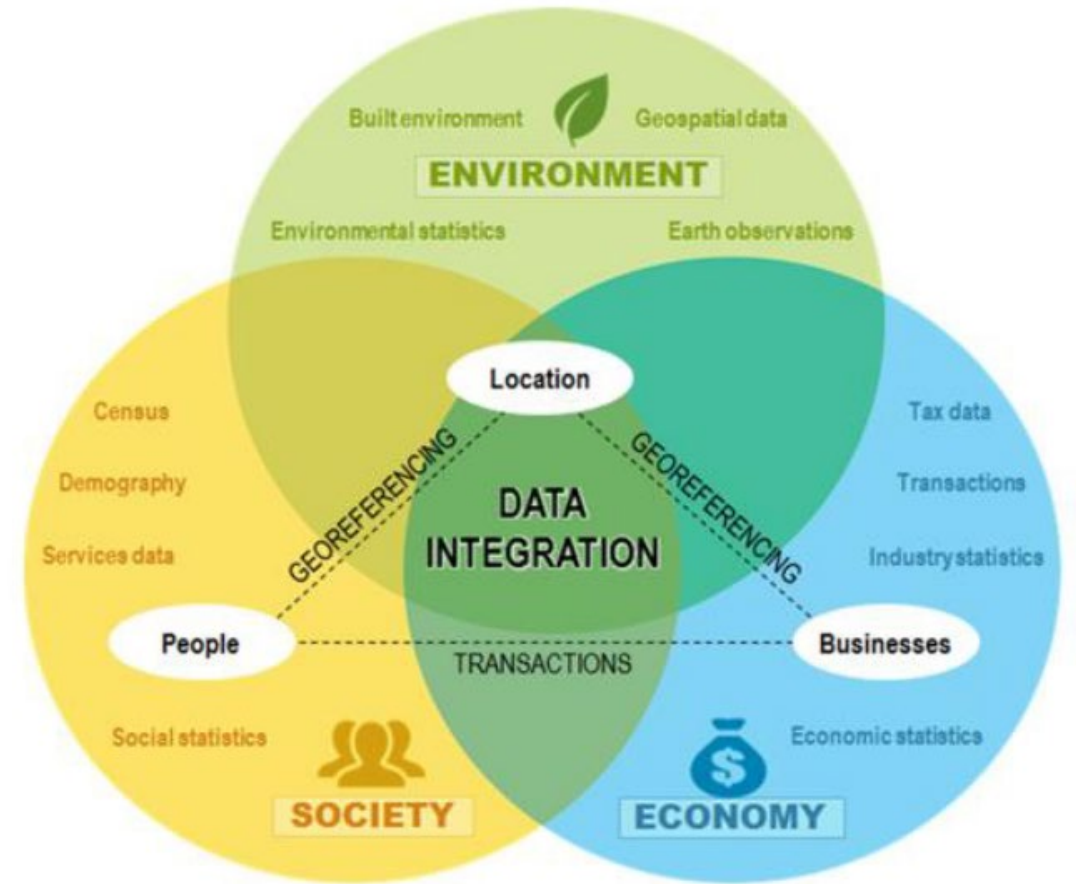
- Directions for the 2030 Round

Integrated Mapping Systems



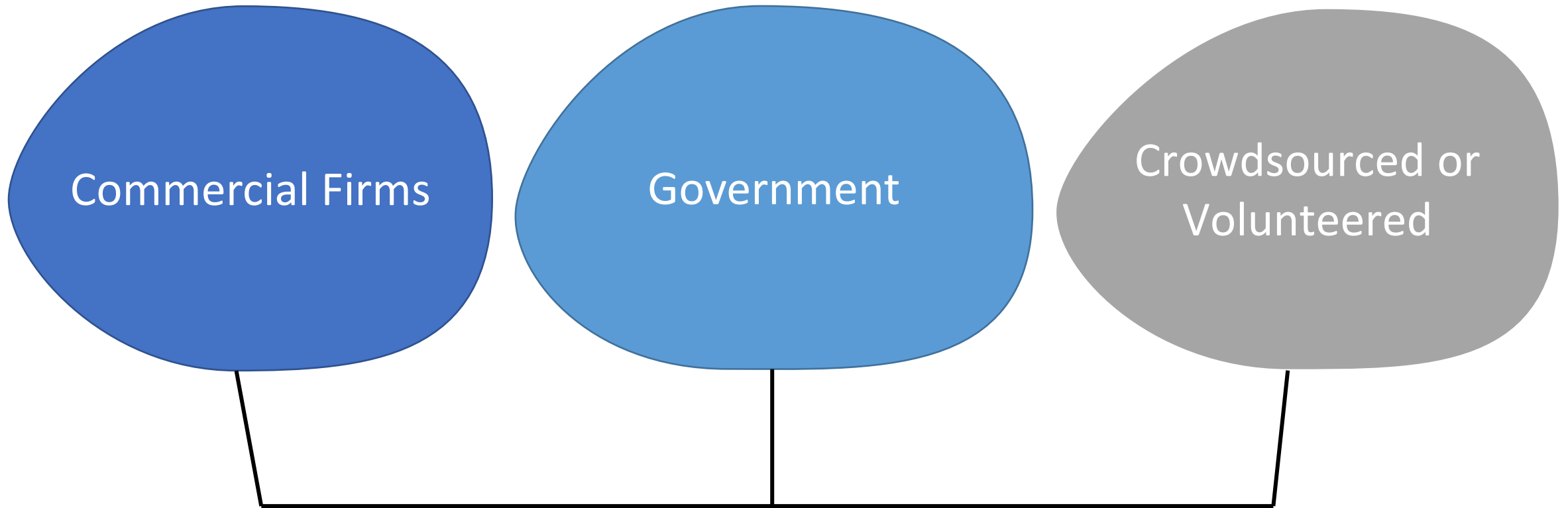
The Big Idea

- Reduce redundant data collection
 - Cost
 - Respondent burden
- Improve data availability and quality
- Enable SDG (and all types of cross-domain) analyses by linking datasets through location



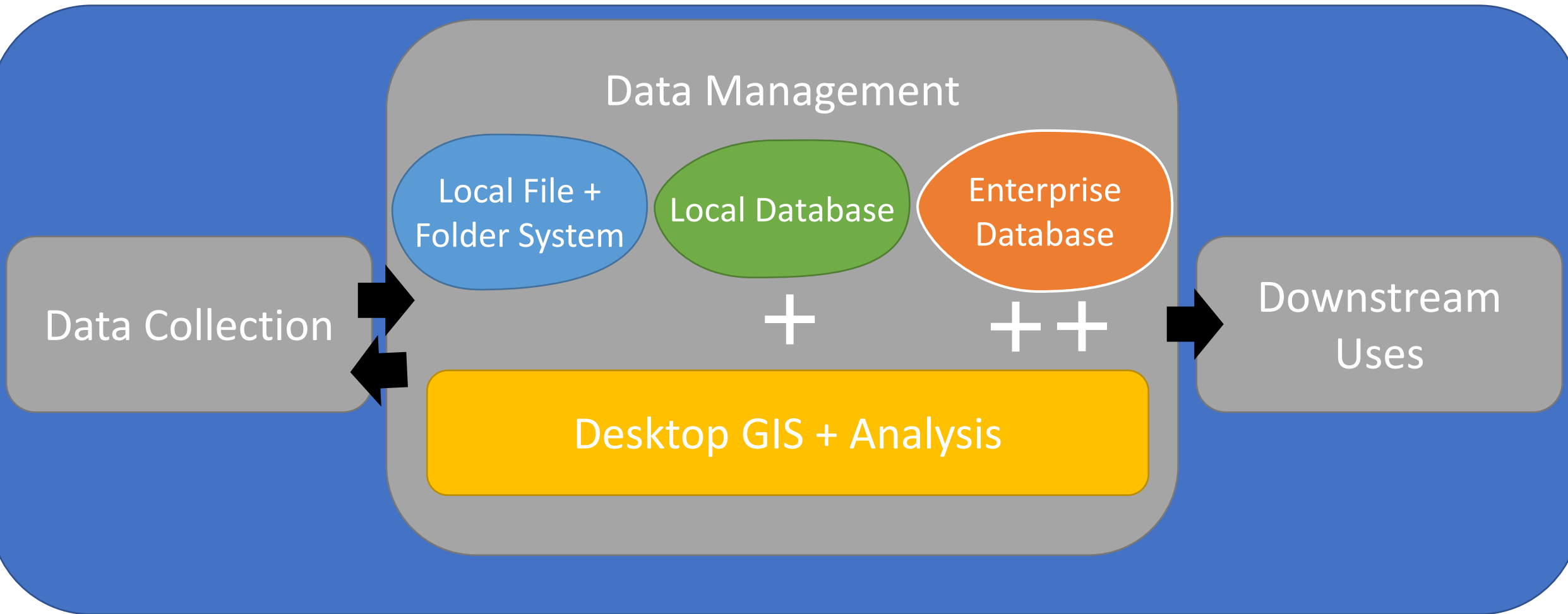
Source: U.N. GGIM. *The Global Statistical Geospatial Framework*. New York. 2019

Data Producers







Useful inputs to a census mapping program *not* maintained by the NSO.

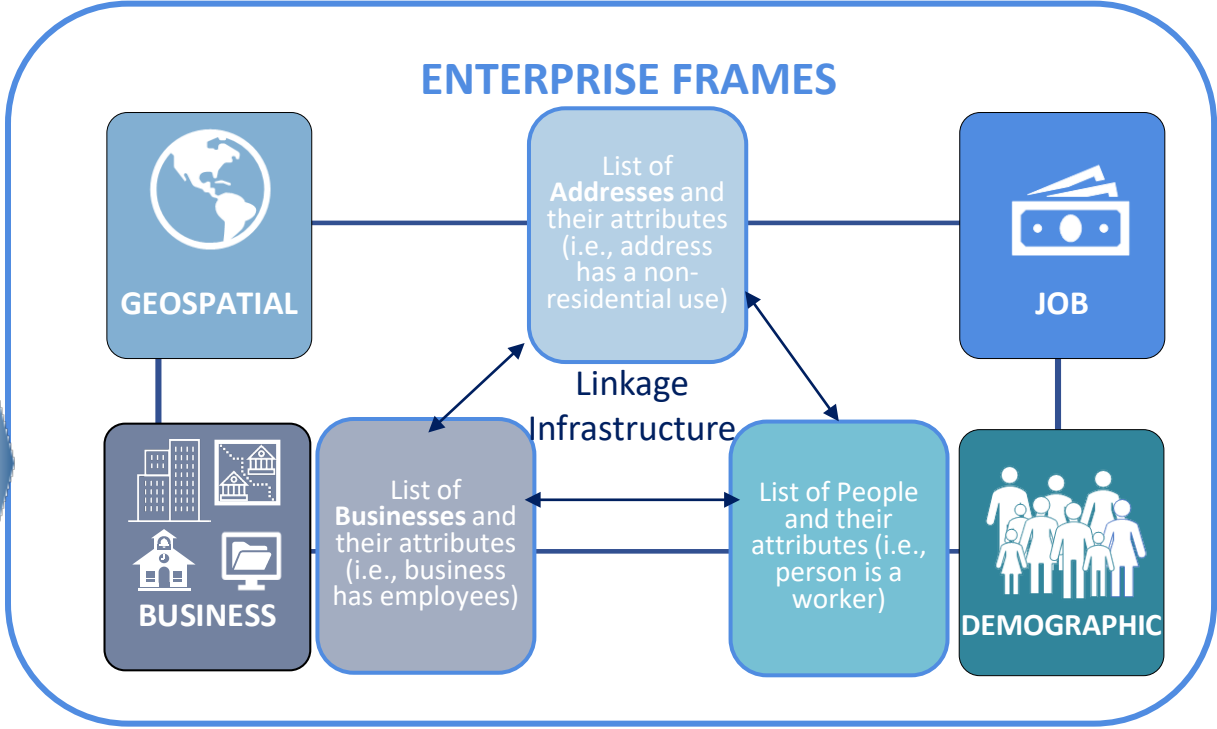
An Integrated Mapping System



Modernizing the Census Bureau's Statistical Foundation: 'FRAMES'

Data Input Categories

-  ADMIN RECORDS
-  CENSUS/SURVEY
-  PUBLIC RECORDS
-  THIRD PARTY



Programmatic and Research Activities

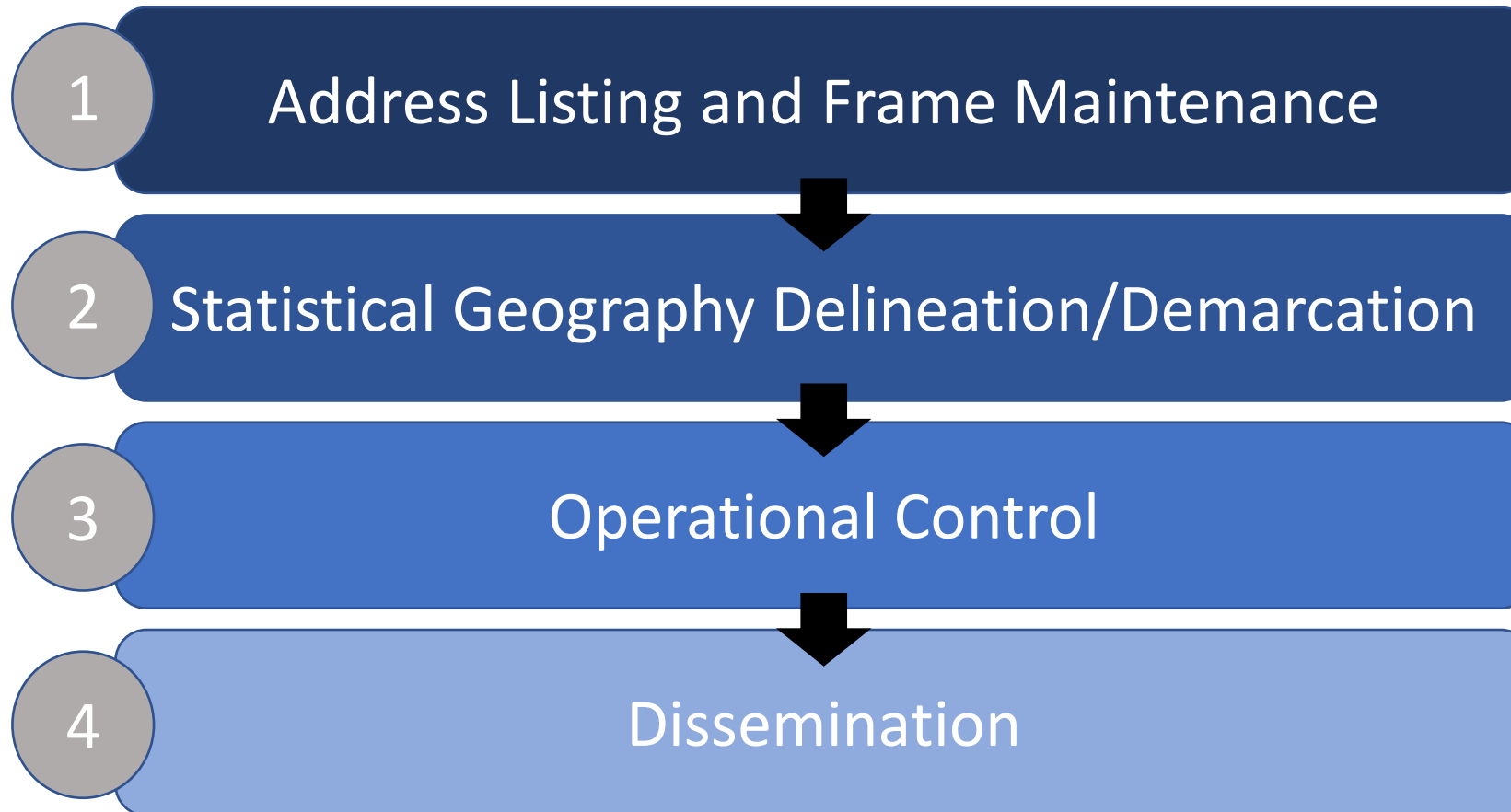
-  ENTERPRISE INITIATIVE SUPPORT
-  SAMPLING FRAMES
-  QUALITY IMPROVEMENT RESEARCH
-  DATA PRODUCTS
-  DATA EXTRACTS

Geospatial Work in a Census

The Census: An Important Geospatial Opportunity

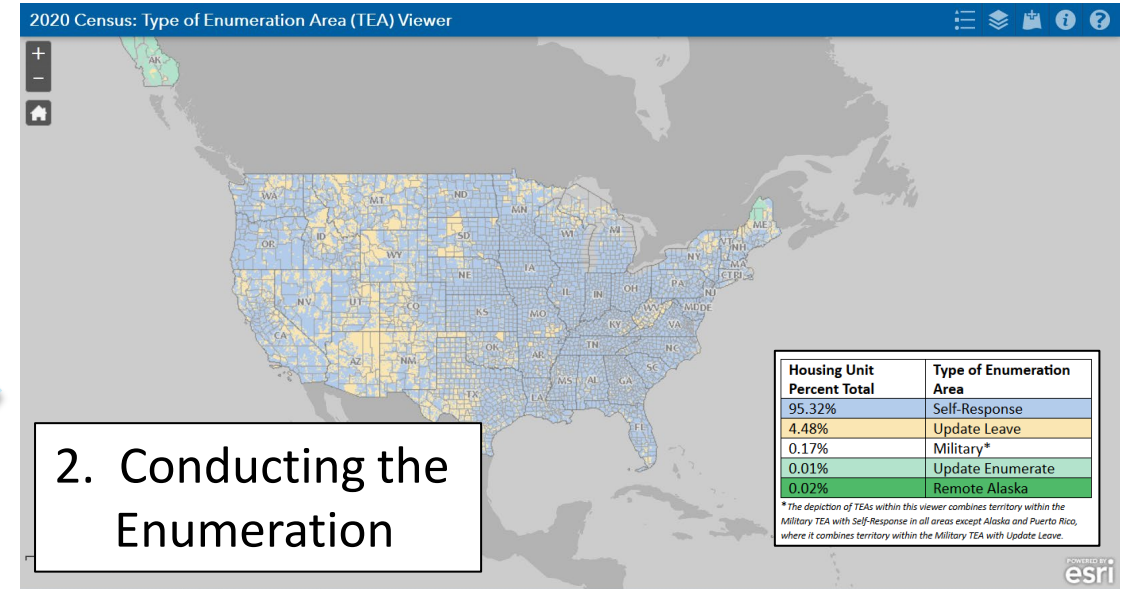
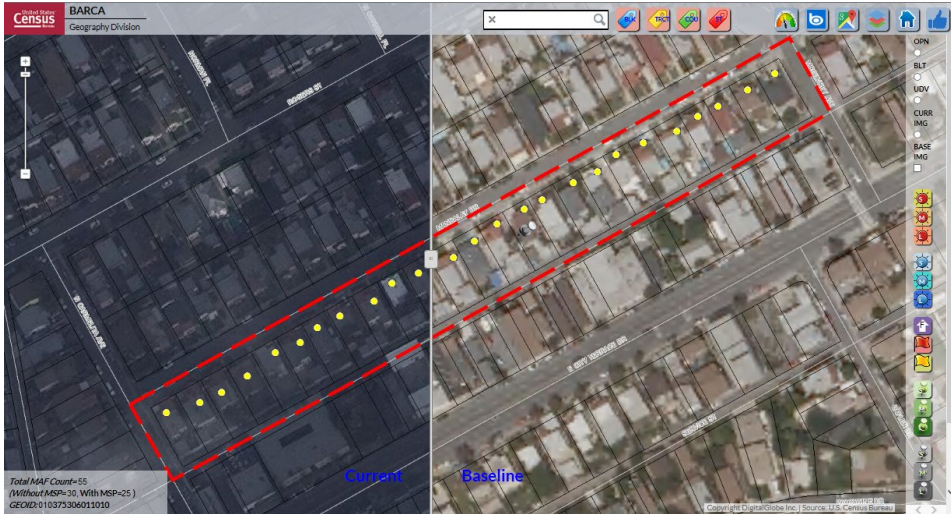
- Censuses produce a wealth of geospatial information and can form the foundation of a **national spatial data infrastructure (NSDI)**.
 - E.g., **physical features, legal/statistical boundaries, and dwellings.**
- Opportunity to **formally delineate** areas that may never have been mapped, including areas with hard-to-count populations.
- Allows data users to observe patterns and trends at a level of geographic detail otherwise not possible with surveys.
 - **Margin of error** in surveys for small geographic areas can be too large for meaningful analysis.
 - If implemented well, the census is also more representative of populations than emerging data sources (e.g., social media, cellular phones).

Geospatial Data for Census Operations



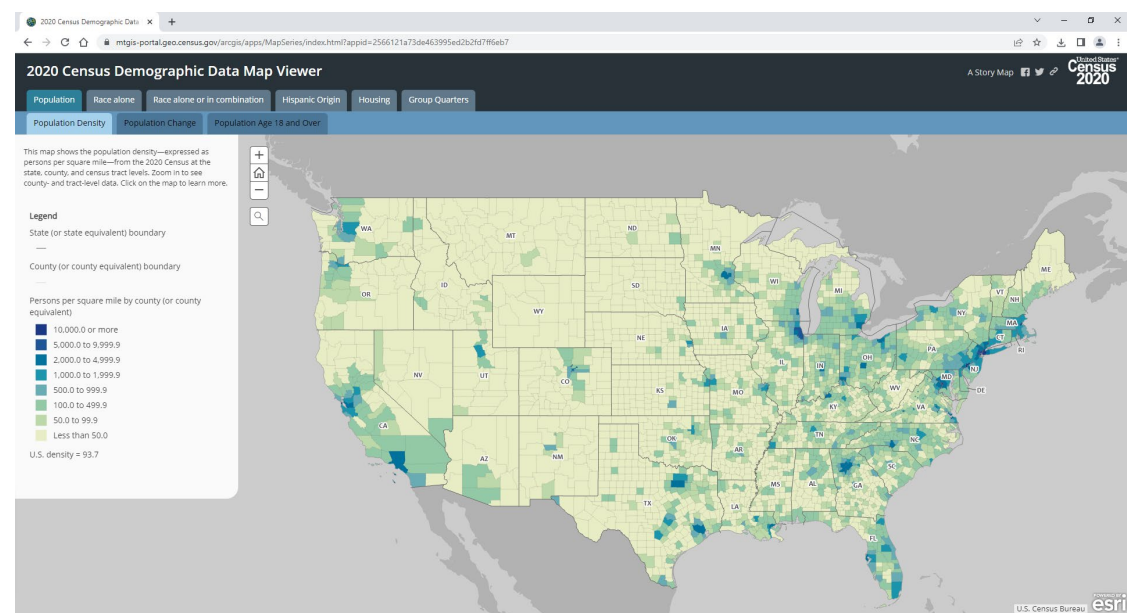
2020 U.S. Census

Geography is the Cornerstone of the Census (and surveys)!



2. Conducting the Enumeration

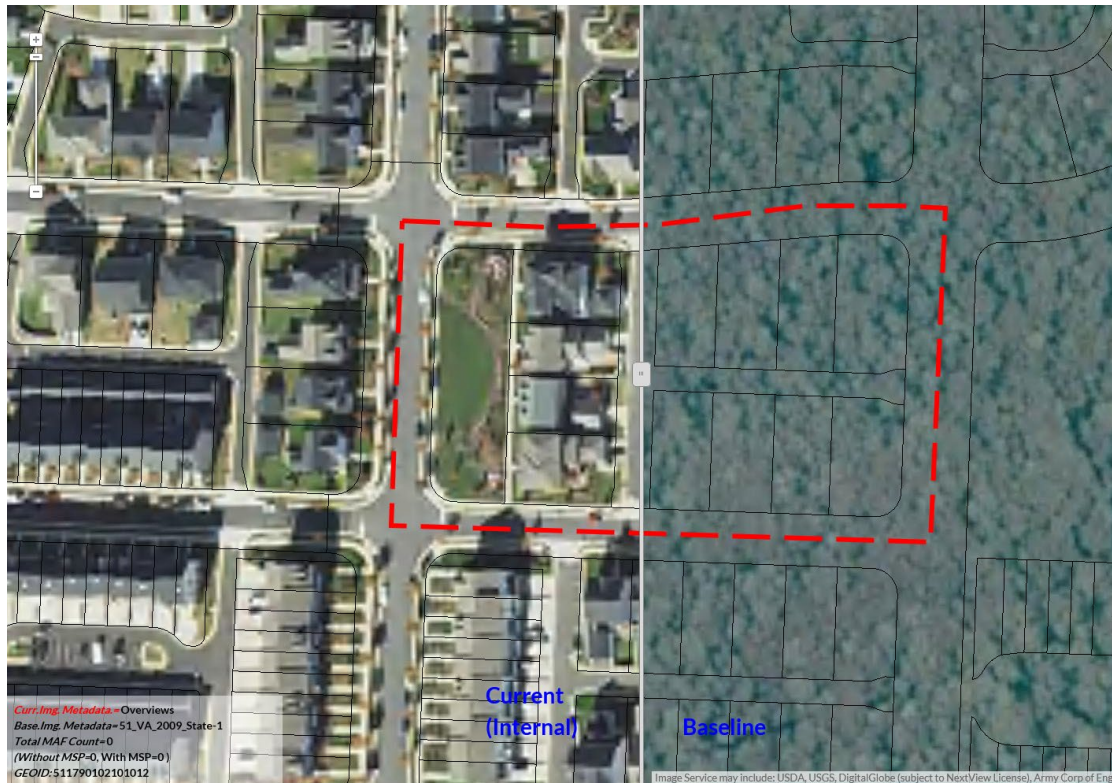
1. Establishing Where to Count



3. Tabulating and Disseminating Results

1. Establish and Maintain a Frame

2010 Census MAF



v.

2020 Census MAF

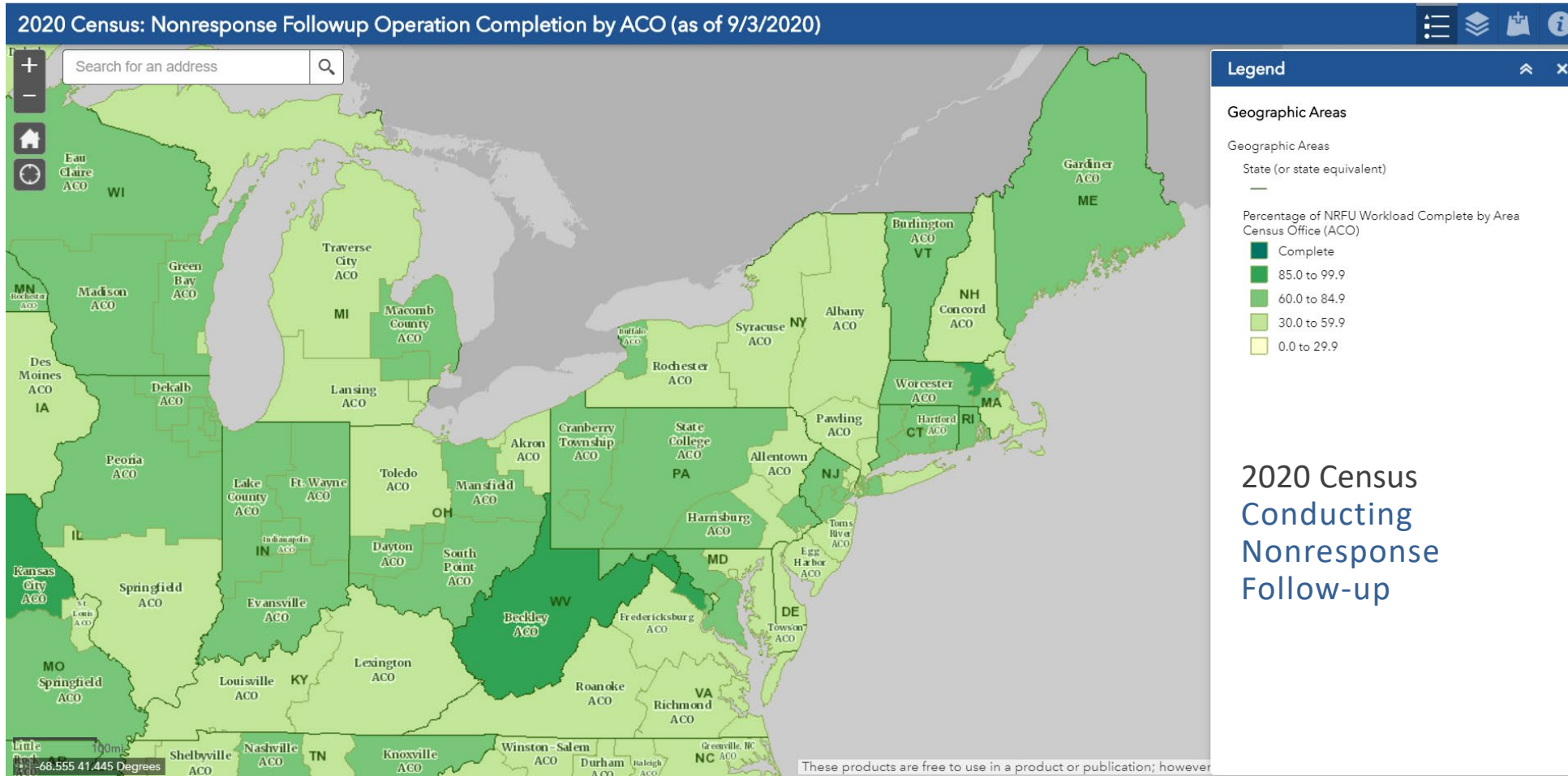


2. Demarcate Statistical Geography

- Conflation and interpretation of physical features and pre-existing statistical geography if they exist
- Estimation of the number of housing units
- Digitization of collection geography boundaries
- Enforcement of correspondence rules between statistical and administrative geography



3. Geospatially Enabled Operational Control



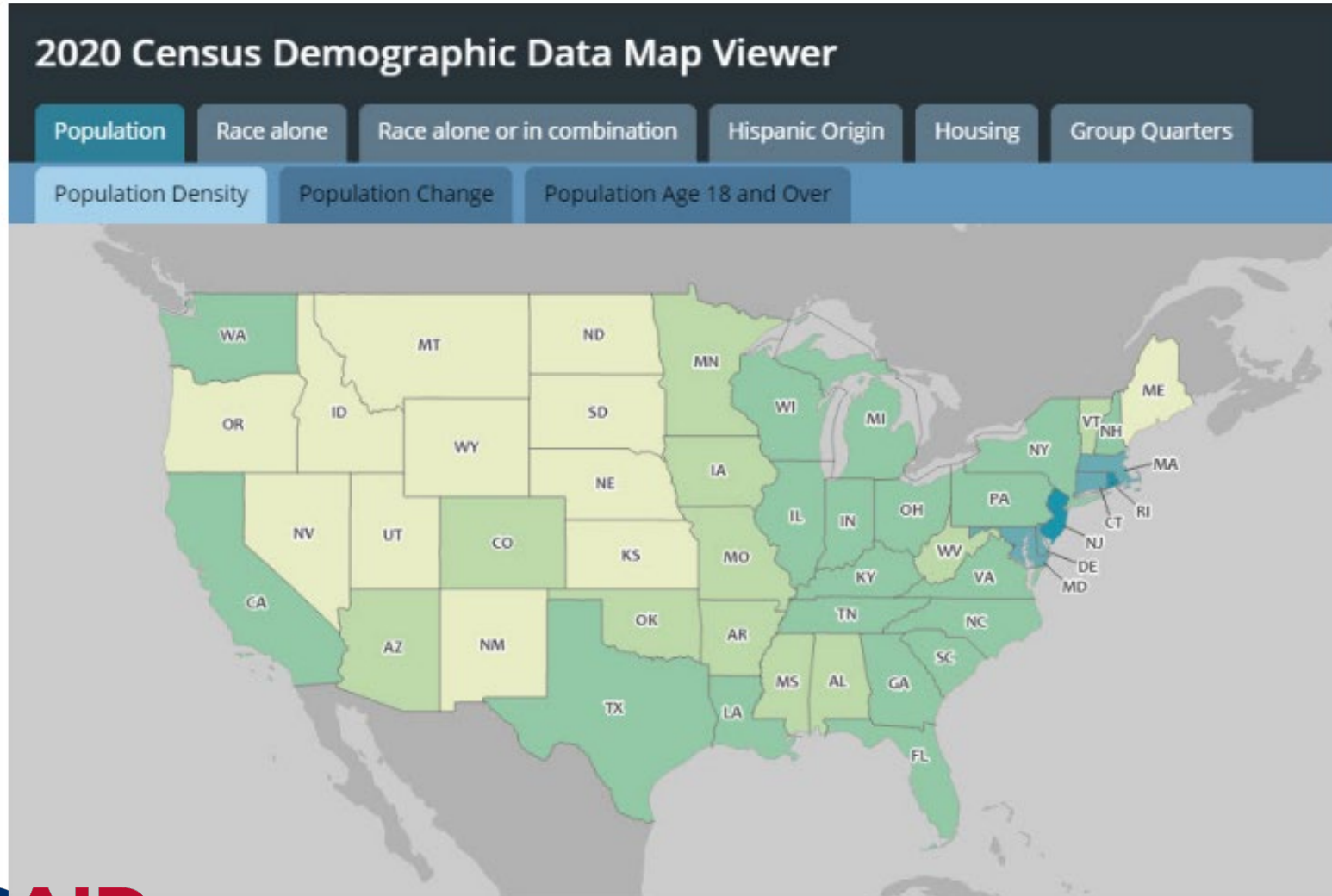
Source: U.S. Census Bureau



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4. Dissemination



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Geospatial Progress and What's Next?



A Timeline of Data Collection Technology Adoption at the U.S. Census Bureau

1950s/60s

Heavily paper driven, door-to-door enumeration; early computerization (e.g., UNIVAC).

1970s/80s

Increased mechanization; mail-out/mail-back questionnaires; small spatial databases.

1990s/2000s

Master Address File/TIGER development and integration (advanced spatial database); laptop questionnaires (some surveys).

2010s

Internet response; tablet/smartphone questionnaires; optimized field workforce management; more extensive geospatial data management.

2020s

Unified statistical frame (housing/business), more sophisticated privacy protection, continuous update of frame and features.

Rapid Adoption

leapfrog

verb \ˈlēp-ˌfrɒg, -ˌfræg\

to move ahead of or beyond (someone or something) in a very quick and sudden way

Merriam-Webster.com

- Some NSOs **gradually** incorporated new electronic technologies into the census process over the course of 100+ years.
- LMIC NSOs have the opportunity to **leapfrog** this gradual approach and **rapidly** adopt new technology in one or two census cycles...
 - ... and most are taking advantage of this opportunity!

Vision for the Future

Enabling Continuous Updates

People

Process

Technology

2010



Largest workforce in history leveraged to canvas the U.S. and Puerto Rico

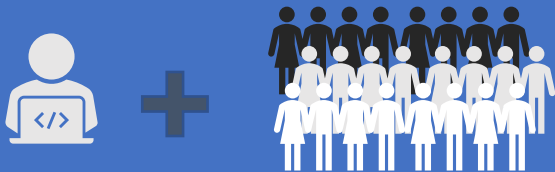


In-person verification and update of 156 million records; Collected GPS points in person; processed address data from USPS and realigned all roads



Field Data Collection Automation (FDCA) limits functionality to addresses and features for canvassing

2020



Reengineered field operations include more automation and remote activities, which reduced the number of field workers

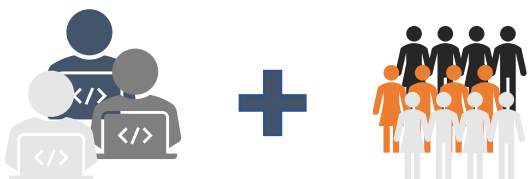


In-Office Address Canvassing improves efficiency; deeper utilization of partner-provided address and spatial data to make MAF/TIGER updates more accurate and frequent



Listing and Mapping Application (LiMA) increases functionality to enable enumerators to capture data on tablets, on-the-spot

2030



Optimization of workforce allows GEO to focus on strategic innovation initiatives with increased enterprise-level impacts

public partners



Less restrictive validation with higher accuracy through individuals and public partnerships; commercial sources may fill gaps in federal, tribal, state and local sources



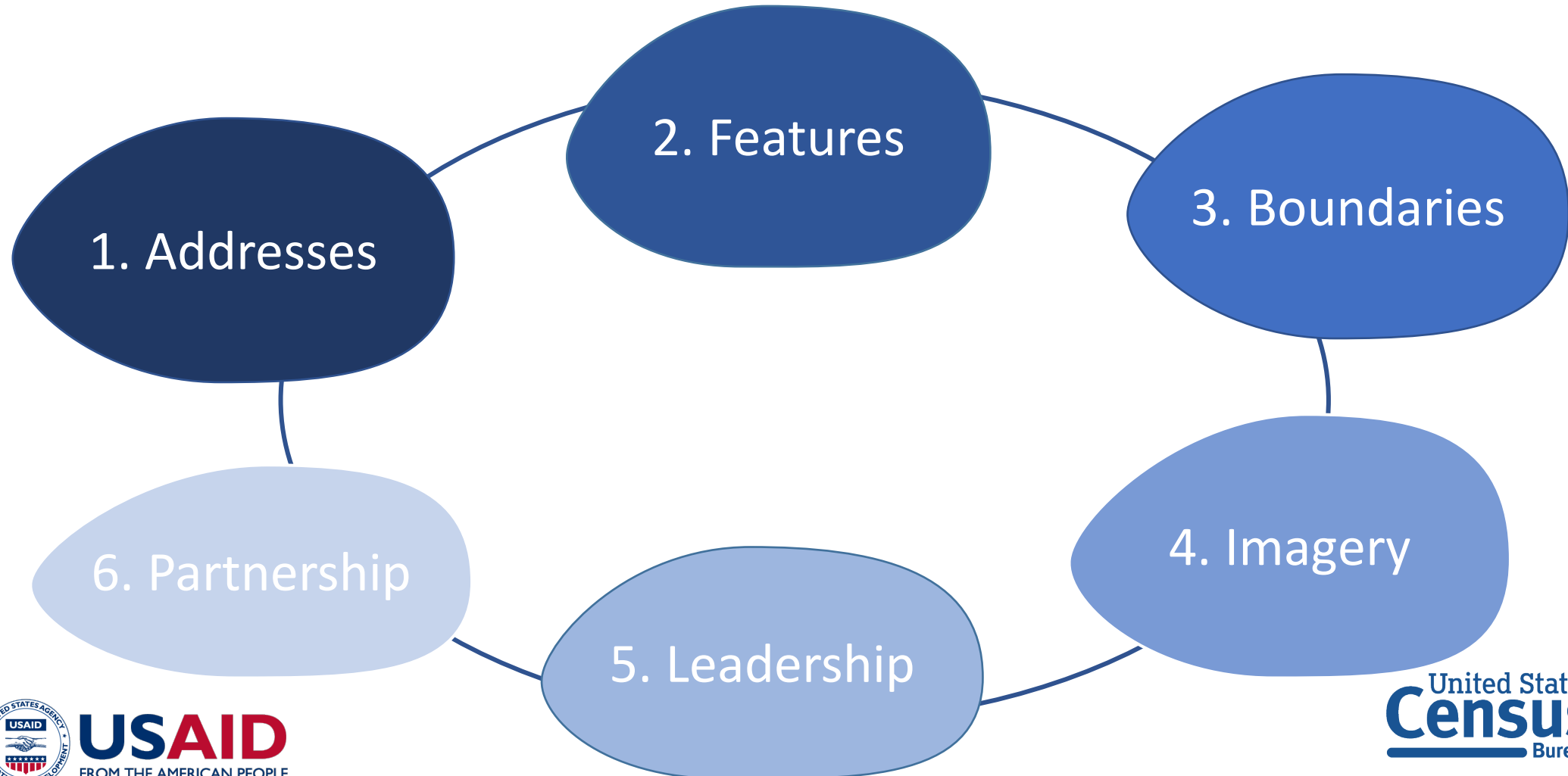
Enlist broader support to reduce cost of custom engineering and elevate functionality that also meets GEO standards



Vision for the Future

6 Cornerstones

Looking Ahead



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Vision for the Future

Cornerstone 1: Addresses

Looking Ahead

- ❖ Continue incorporating address data from other government partners, including the postal service.
- ❖ Start continual In-Office Address Canvassing throughout the decade.
- ❖ Conduct ongoing intercensal updates for all types of residences, including housing units, group quarters, temporary housing, and in special administrative areas (e.g. self-governing entities or territories).
- ❖ Explore greater contributions to the government-wide U.S. national address database.

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Cornerstone 2: Features

Looking Ahead

- ❖ Identify where feature changes are occurring on the landscape and acquire appropriate source material to enable these updates within our system, products, and services.
- ❖ Continue on-going road feature update within our system, products, and services.
- ❖ Improve representation and spatial quality of non-road features (hydrographic, rail, etc.) within our system, products, and services.

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Cornerstone 3: Boundaries

Looking Ahead

- ❖ Continue surveying state and local governments for updated administrative and statistical boundaries, and conduct nonresponse follow up.
- ❖ Continue leadership of the cross-government National Boundary Group.
- ❖ Continued coordination between federal agencies to integrate national and international boundaries.
- ❖ Consider the possibility of intercensal update of statistical geographic areas.
- ❖ Assess need for new types of geographic areas for data tabulation (e.g., gridded data) as well as changes to concepts to keep pace with needs of analysts and policy makers (e.g., settlement classifications such as urban, suburban, rural, exurban).

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Cornerstone 4: Imagery

Looking Ahead

- ❖ Continue use of satellite and aerial imagery for change detection and system update.
- ❖ Expand imagery expertise within the Census Bureau and integration of imagery with existing products and services.
- ❖ Explore integration of other remote sensing sources, such as LiDAR, into change detection and system update.
- ❖ Continue to advocate for open access to national satellite and aerial imagery sources within the federal community.

Vision for the Future

Cornerstones 5 & 6: Leadership & Partnership

Looking Ahead

- ❖ Provide geospatial subject matter and policy leadership in engagements with partners, and national and international organizations.
 - ❖ Expand staffing structure necessary to support these leadership positions and responsibilities.
-
- ❖ Maintain relationships with tribal, federal, state, and local governments.
 - ❖ Explore mechanisms for more efficiently sharing data amongst these organizations

Human and IT Resources

- Commitments to modernization should be appropriate to actual and potential staff skill level.
- Don't over-commit staff.
- Plan for training, other surveys, and census preparations.
- Plan for realistic training
 - Can a GIS analyst become a web application developer?
 - Can a statistical clerk become a database administrator?
 - Individuals with technical expertise in web design may not easily transition to database programmers.

Conclusion

- Geography is integral to censuses.
- Geospatial technology can make censuses more efficient and cost effective.
- Geospatial analysis and data products can provide new insights for decision makers and the public.
- Geospatial data are widely available but can be highly complex and difficult to use without specialized expertise.
- The U.S. Census Bureau is available to share its expertise with you on any census geography topics.

Thank you!

Questions?

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