A New Model for International, Privacy-Preserving Data Science

PEPR Conference, 6/03/2024

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Curtis Mitchell, Emerging Technology Fellow @ xD

United States™ Census Bureau

xD is an emerging technologies group that's advancing the delivery of data-driven services through new and transformative technologies.

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Agenda

The US Census Bureau's Mission and Commitment to Privacy

How the Census Bureau Conducts Data Collaborations

Testing New Collaboration Methods with the UN PET Lab

Lessons Learned So Far & Future Goals

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1. The Census Bureau's Mission and Commitment to Privacy

The Census Bureau's Mandate and Mission

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The United States census is mandated under **Article I Section 2** of the United States Constitution

Census Bureau Mission

The Census Bureau's mission is to **serve as the nation's leading provider of quality data** about its people and economy.

We honor **privacy**, protect **confidentiality**, share our expertise globally, and conduct our work openly.

Privacy Laws at the Census Bureau

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Title 13

Private information is **never published**

Personal information **cannot be used against respondents** by any government agency or court

Census Bureau employees are **sworn to protect confidentiality** and uphold Title 13.

Title 26

Defines how the IRS shares **tax data** with the Census Bureau, and how the Bureau **protects and restricts disclosure** of that data

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2. How the Census Bureau Conducts Data Collaborations

Federal Statistical Research Data Centers (FSRDCs)

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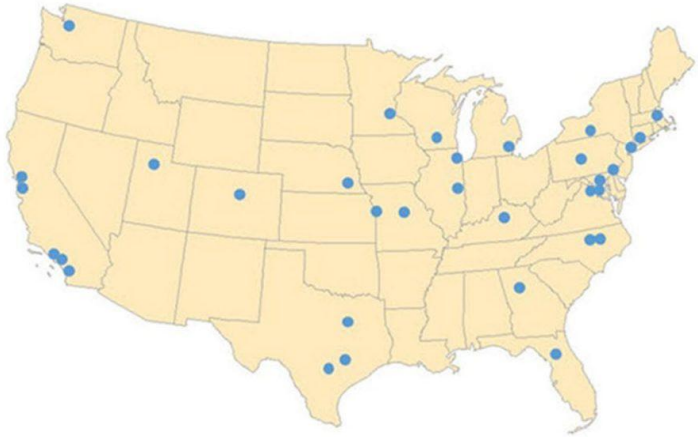
- FSRDCs provide **secure environments** supporting qualified researchers using **restricted-access data** while protecting respondent confidentiality
- Researchers must obtain **Special Sworn Status** (SSS) to protect confidential information
- 33 facilities around Continental US



Options for International Data Sharing with Census Bureau

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- International data collaborations are handled on a **case-by-case** basis and usually require establishing a **data-sharing agreement**
- Data is often **aggregated** and already shared with international bodies such as the UN and OECD
- Data that crosses international borders is frequently **subject to export controls** that restrict sharing with other nations or foreign entities
- Monthly trade data can be obtained on the **USA Trade platform** maintained by the Census Bureau
- Different rules and protocols apply to other types of data (health, immigration, etc.)

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3. Testing New Collaboration methods with the UN PET Lab

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Private Linkage for Enhanced InternAtional Data ExchangeS (PLEIADES)

Objective: Demonstrate international, privacy-preserving data join

Data Phases: **1.** open trade data from UN Comtrade, **2.** synthetic data, **3.** private data

Partners:

UN PET Lab
United Nations
Privacy Enhancing Technologies Lab

Istat | Istituto Nazionale di Statistica

Statistics Canada | Statistique Canada

OpenMined

How OpenMined's PySyft Enables Secure Data Analysis

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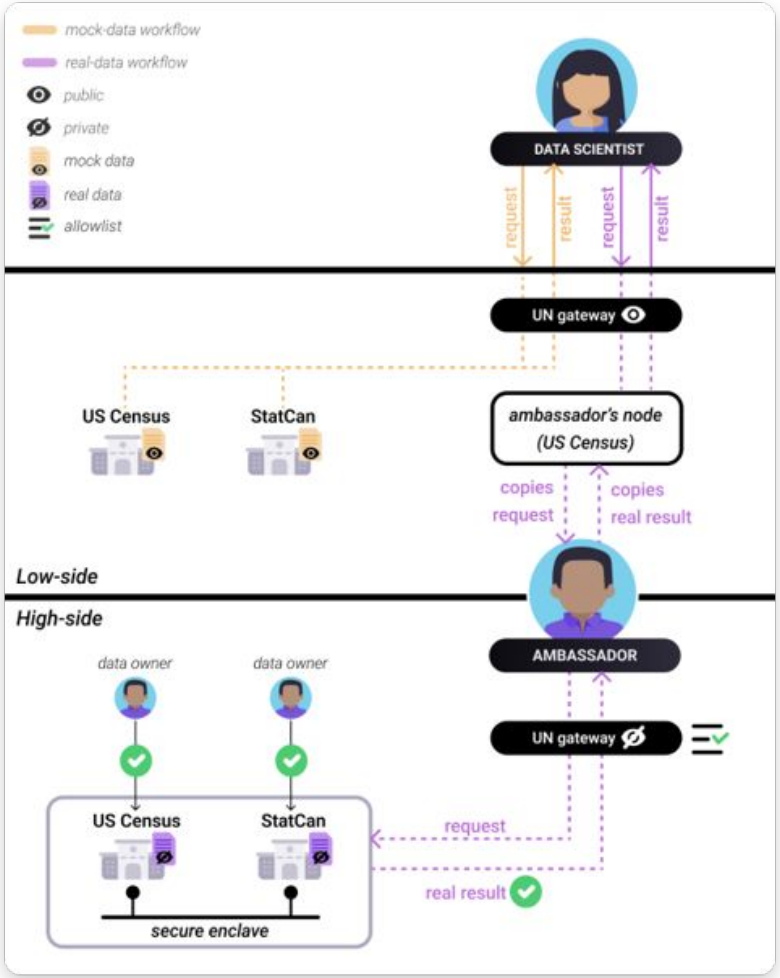
"Perform data science on data that **remains in someone else's server**"

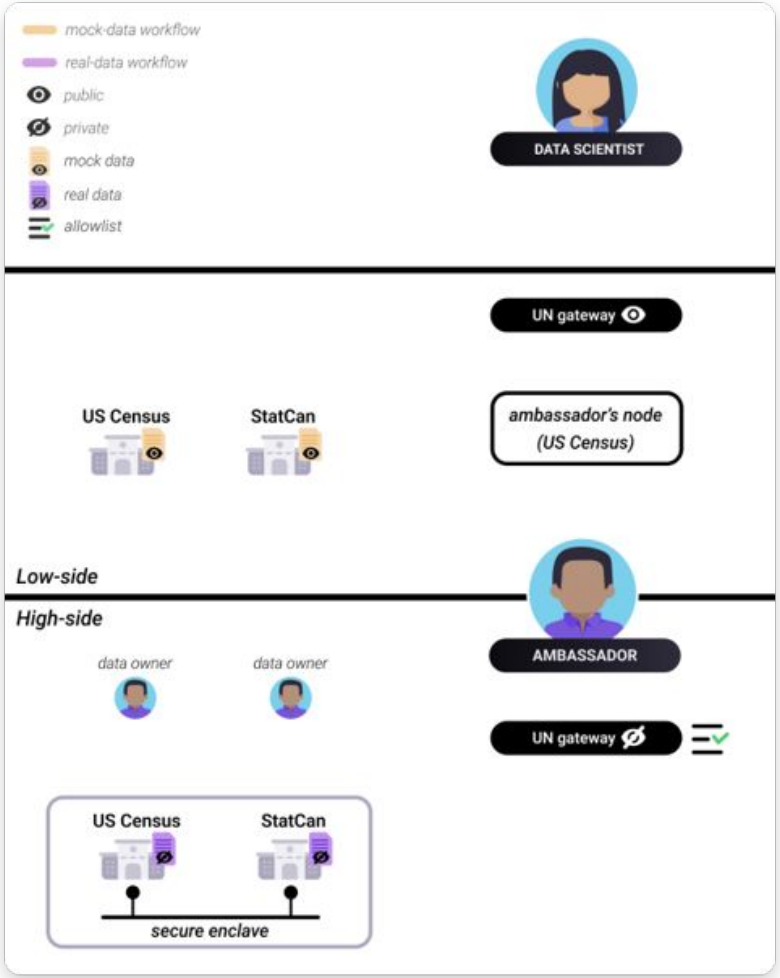
Key Terms:

- **Data Owner** - **Providers of datasets** to be accessed via secure computation
- **Data Scientist** - End users who are **submitting code to get results** from the data owner's datasets
- **Ambassador** – Optional **intermediary** between data scientists and data owners
- **Domain Server** - Enables, with safeguards, the data scientist to submit code and **the data owner to review and approve/deny requests** to run that code on private datasets
    - **Low-Side Domain** - **public** and discoverable
    - **High-Side Domain** - **private** and gated
- **Gateway Server** - **Acts as a bridge between domains, data scientists, and data owners** to enable analysis between multiple participants

PySyft Data Flow



PySyft Data Flow



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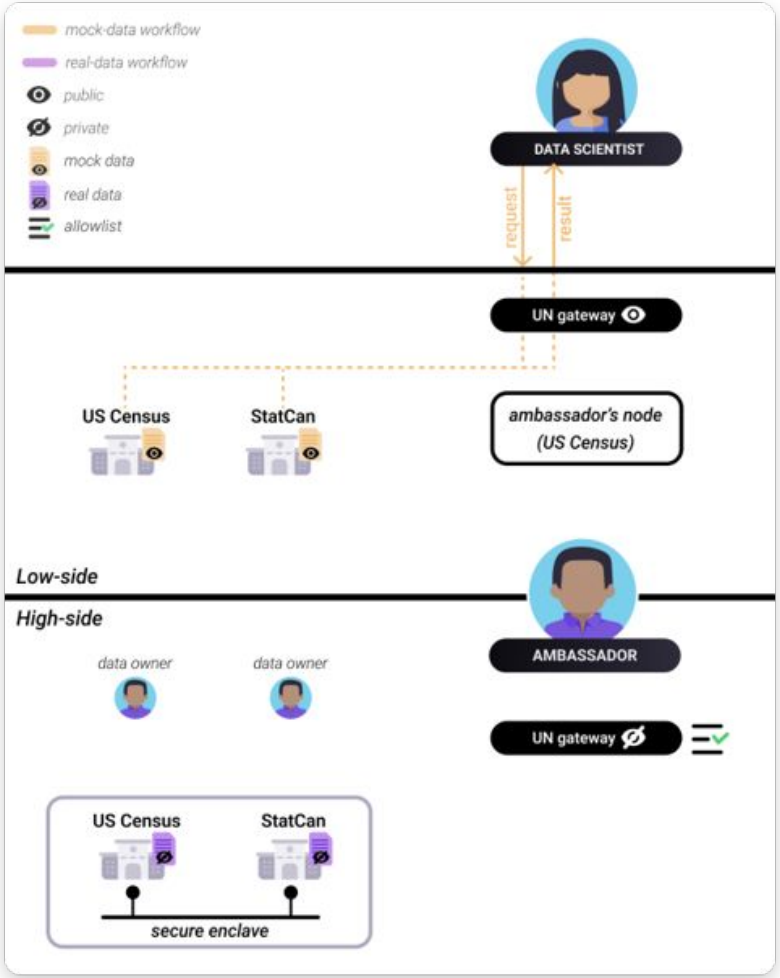

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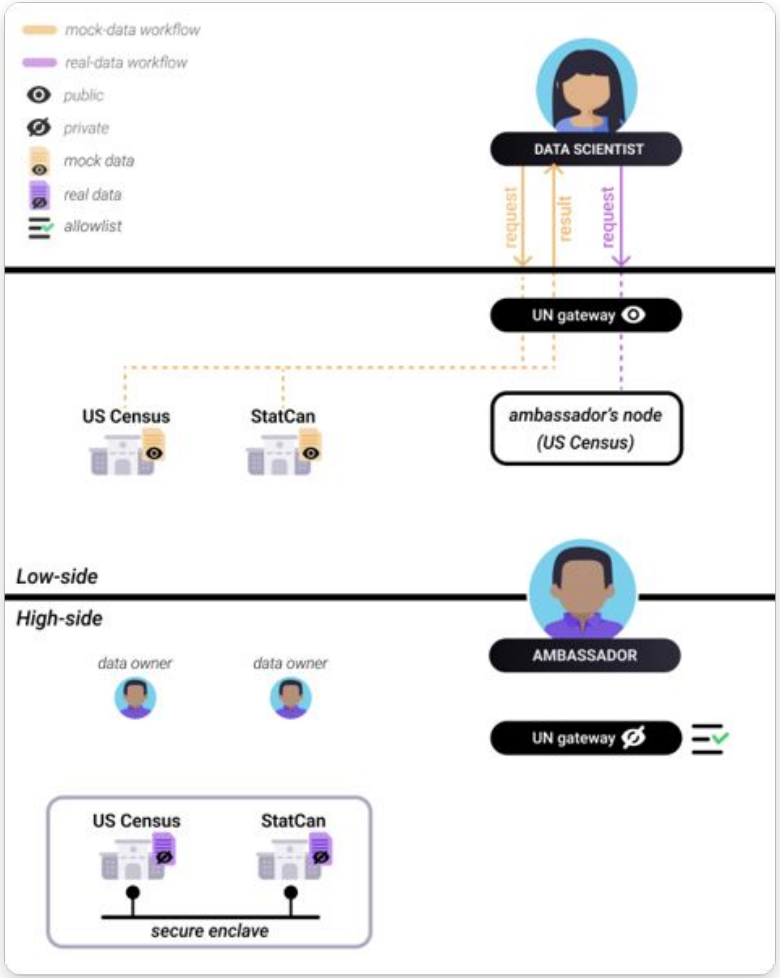

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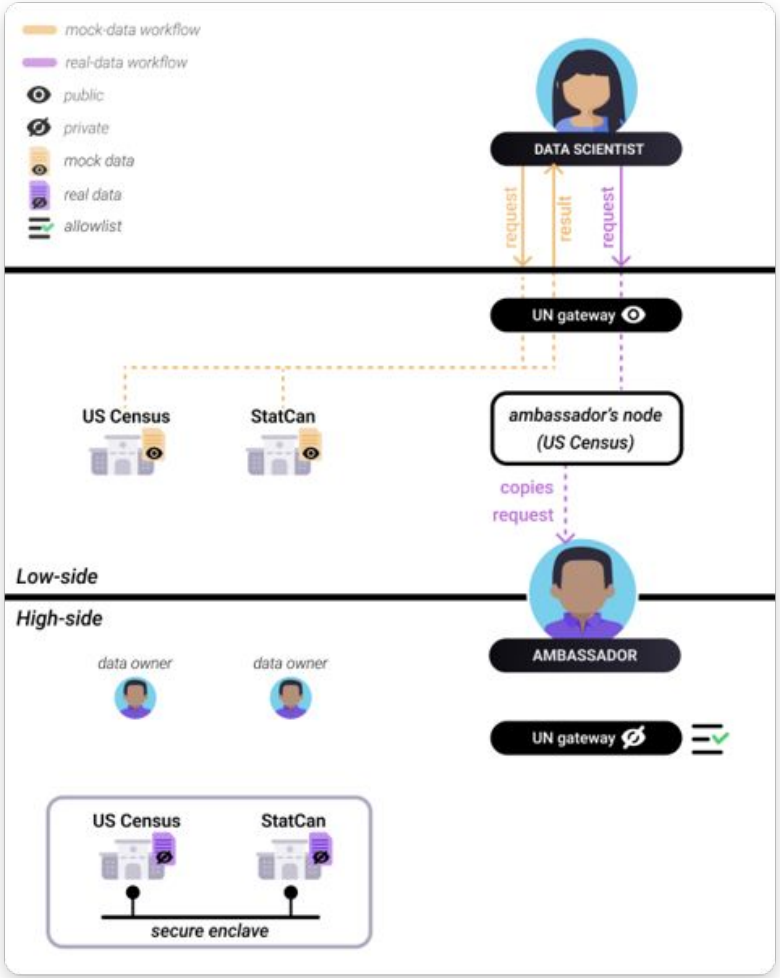

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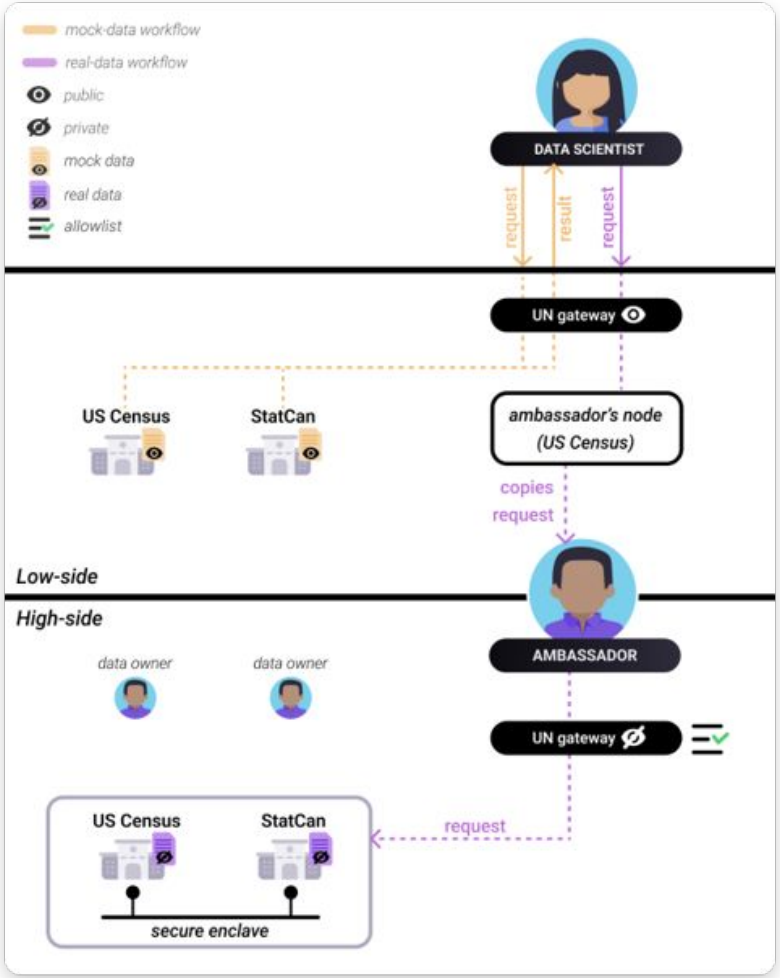

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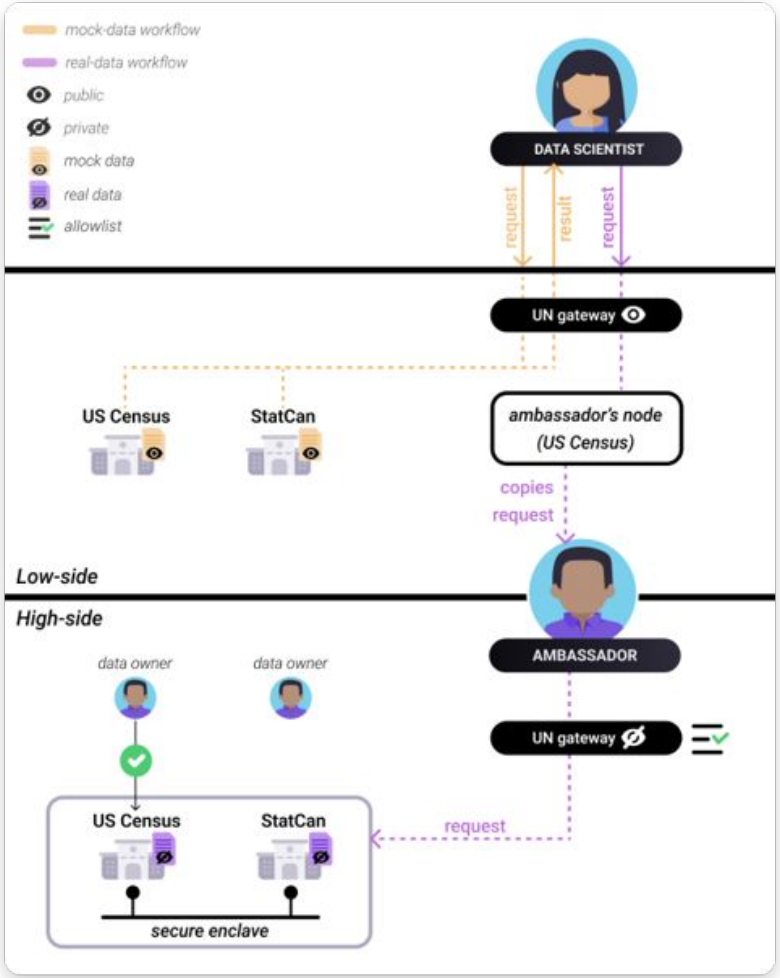

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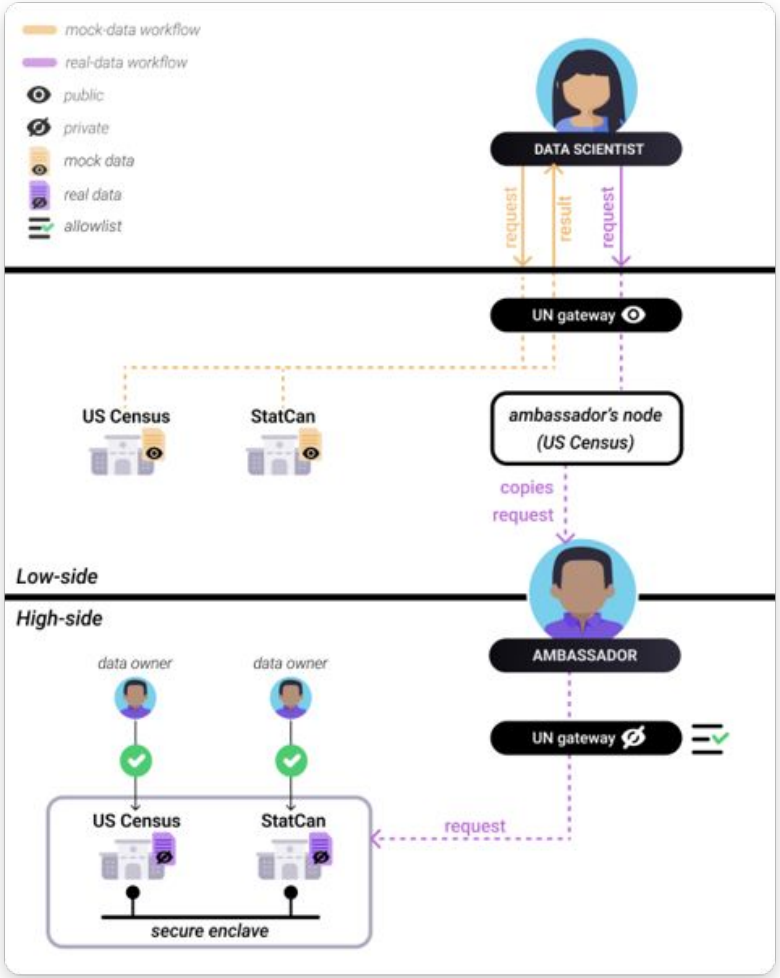

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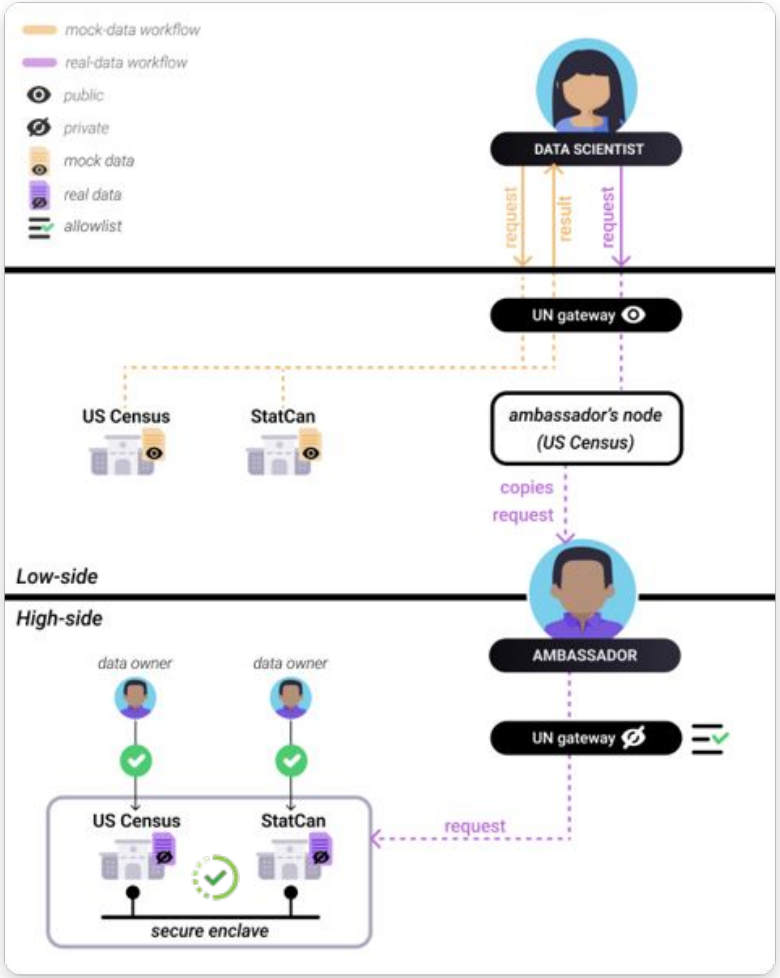

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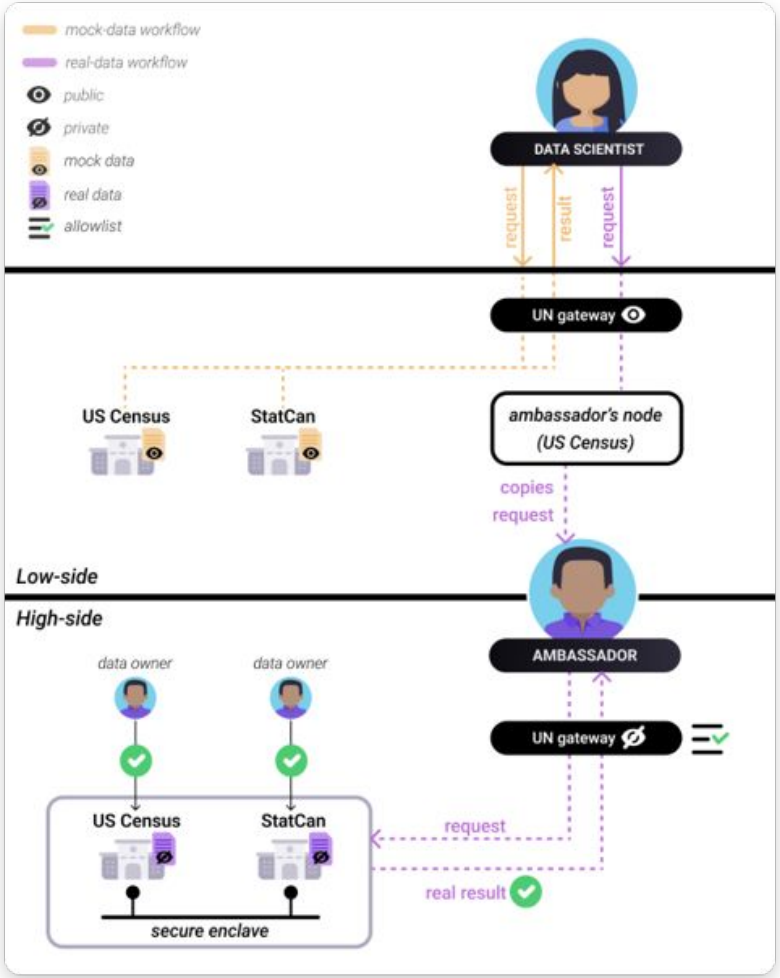

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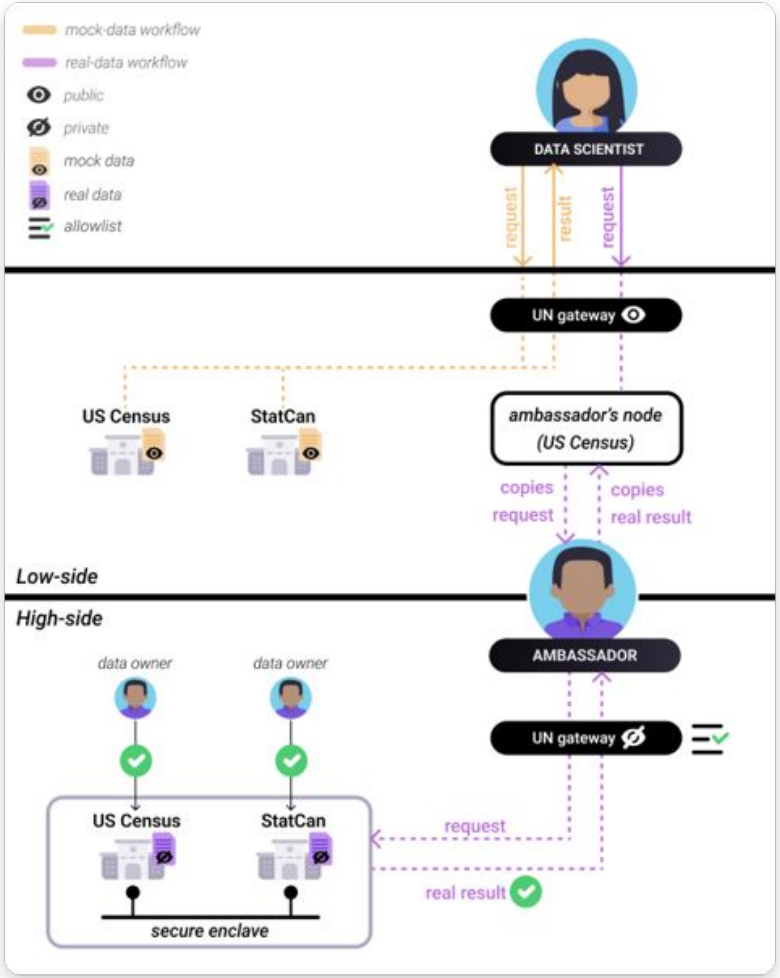

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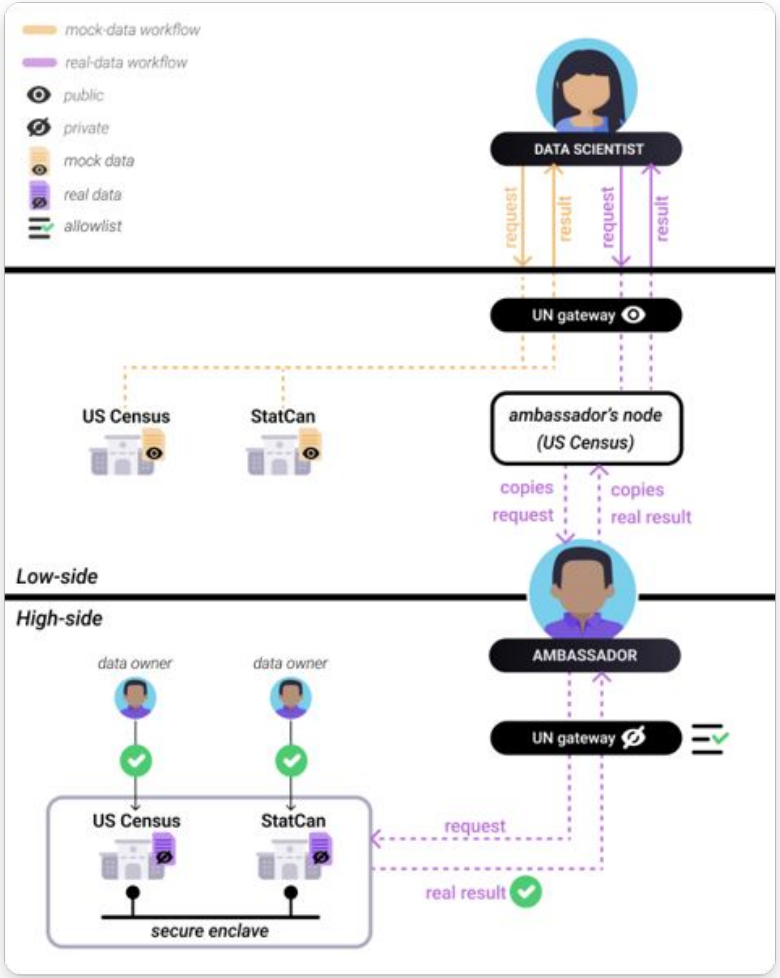

Comparing Traditional Census Collaboration Methods with PySyft

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Traditional Methods

- Require access to **FSRDC** or creating a formal **data-sharing agreement**
- FSRDC access requires **SSS** (not guaranteed)
- **Export controls** and laws such as **Title 13** limit what data is available outside of the United States
- Some **aggregate data** is available via online platforms such as USA Trade Online

PySyft

- Private **data is hosted on internal domain servers** and is directly accessed only by data owners, **guaranteeing mutual secrecy** for both data owners
- The high-side **domain server is part of a restricted network** accessible only by contributing organizations
- **Code can be executed directly on private data, subject to review and approval** by data owners, lowering barriers for data scientists

4. Lessons Learned So Far & Future Goals

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Current Project Status

- Demo joins on open data achieved between **Istat – StatCan** (February) and **Census – StatCan** (May), concluding phase 1

- Census Bureau instance of PySyft hosted on **Cloud.gov**

- **Working on white paper** to be published on Census Bureau research portal

Lessons Learned

- PETs are promising, although current implementations are often still in **pre-production development**
- Deploying PETs systems requires **rethinking how government digital infrastructure is deployed**
- Working with and selling PETs requires **rethinking how we talk about privacy and security** with data, e.g., what does data "access" mean in the context of PETs?

Future Directions and Ideas

- Move towards phase 2: synthetic data based on private data
- Continuing and growing partnerships with **trade data exchanges**
- Exploring pilot projects for other types of data, such as **public health data**
- Perform PySyft join with other PETs such as **differential privacy**
- **Exploring deployment and infrastructure options** for data security, compute flexibility, and cost-savings
- Explore opportunities for **new and updated government policies** related to PETs usage

Links

Census Bureau: https://www.census.gov

xD homepage: https://xd.gov

- xD Emerging Technology Fellowship: https://www.xd.gov/apply

UN PET Lab: https://unstats.un.org/bigdata/task-teams/privacy

UN Comtrade data hub: https://comtradeplus.un.org

StatCan: https://www.statcan.gc.ca

Istat (English site): https://www.istat.it/en

OpenMined: https://openmined.org

- PySyft (Github repository): https://github.com/OpenMined/pysyft

Cloud.Gov: https://cloud.gov

Thank you!