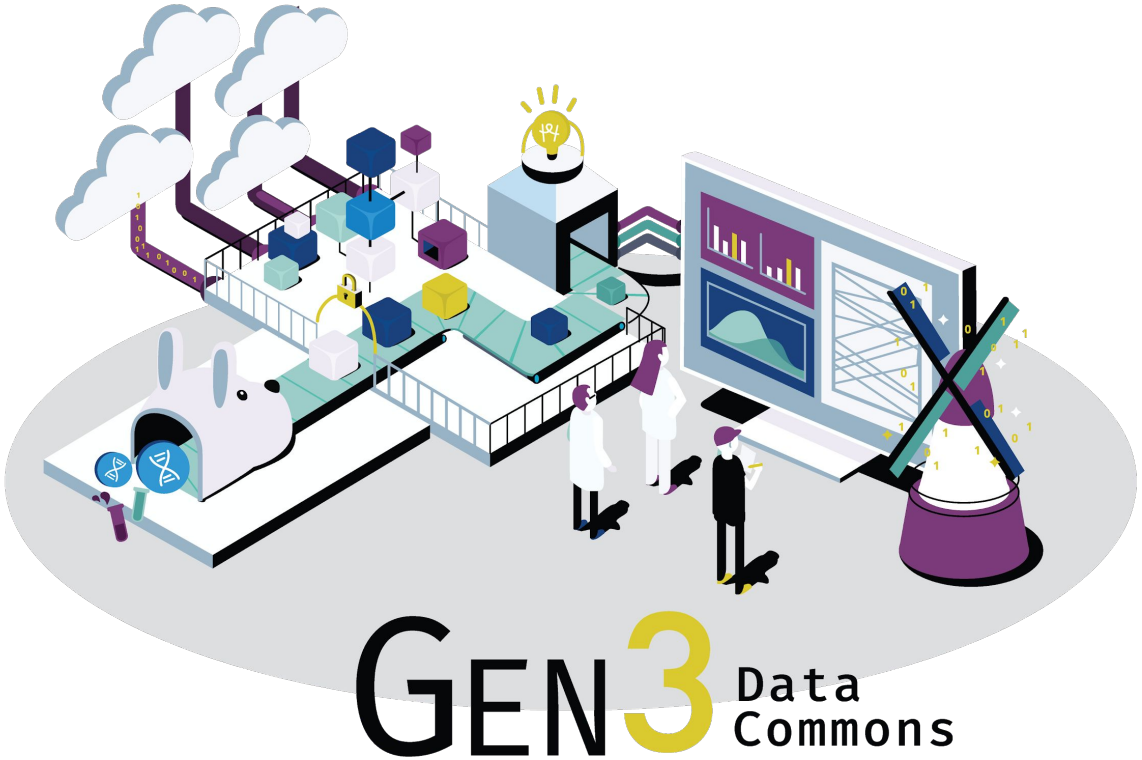
Introduction to Gen3 Data Commons

Michael Fitzsimons, PhD
Director of User Services and Outreach
Center for Translational Data Science
University of Chicago

Agenda

1. Overview of Gen3
2. Who are Gen3 users?
3. Gen3 Features
4. Demo
5. Questions



GEN3 Data Commons

Data commons co-locate data, storage and computing infrastructure with commonly used software services, tools & apps for analyzing and **sharing data** to create a resource for the research community.*

*Robert L. Grossman, Allison Heath, Mark Murphy, Maria Patterson and Walt Wells, A Case for Data Commons Towards Data Science as a Service, IEEE Computing in Science and Engineer, 2016.

Overview of Setting Up a Gen3 Data Commons

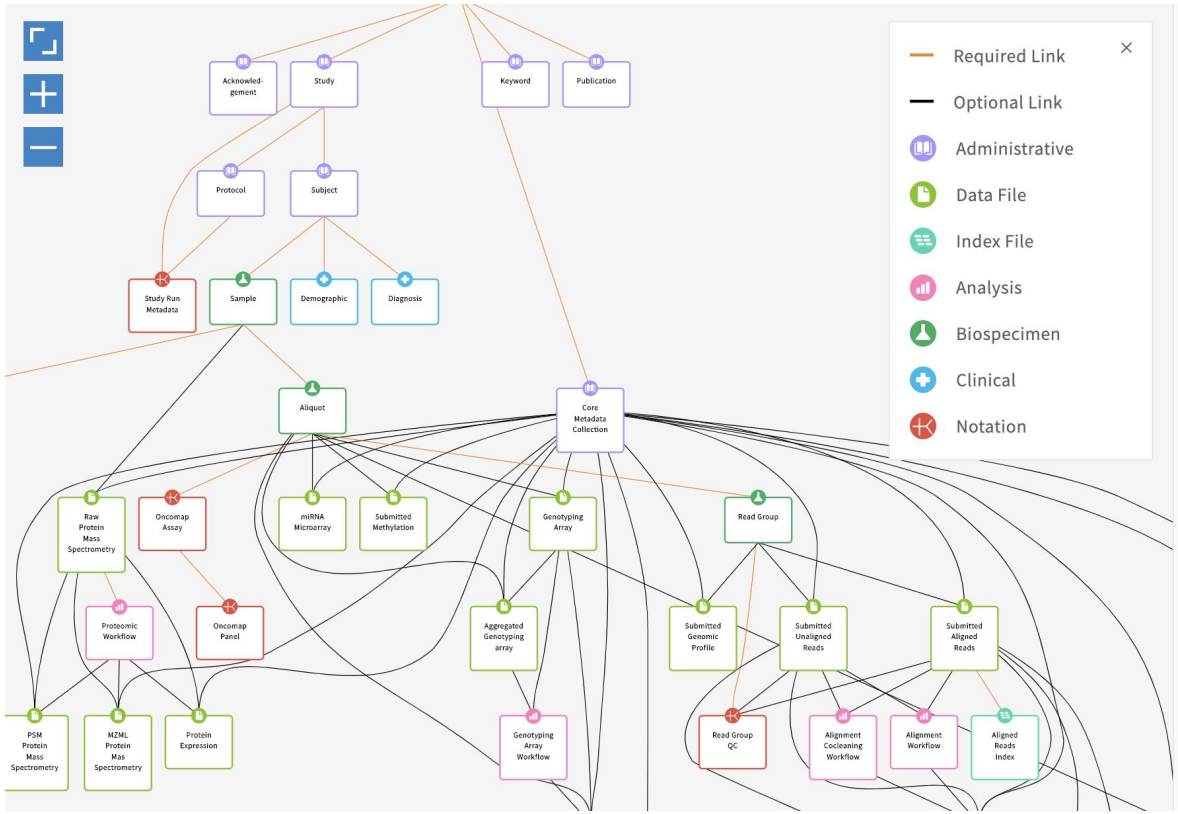
1. Define a data model
2. Use the Gen3 software to auto generate a commons with an API
3. Load data into the commons via the API or through the Data Submission Portal
4. Explore the data with the Data Exploration Portal
5. Analyze the data using Jupyter notebooks
6. Encourage your community to develop their own apps over your commons API

Who are the Gen3 Users?

1. **Users**: Researchers, Scientists, Clinicians who contribute or consume data from a data commons
2. **Developers:** Create Gen3 applications, resources & services
3. **Operators**: Projects that want to operate a Gen3 data commons or interoperate with other Gen3 data commons

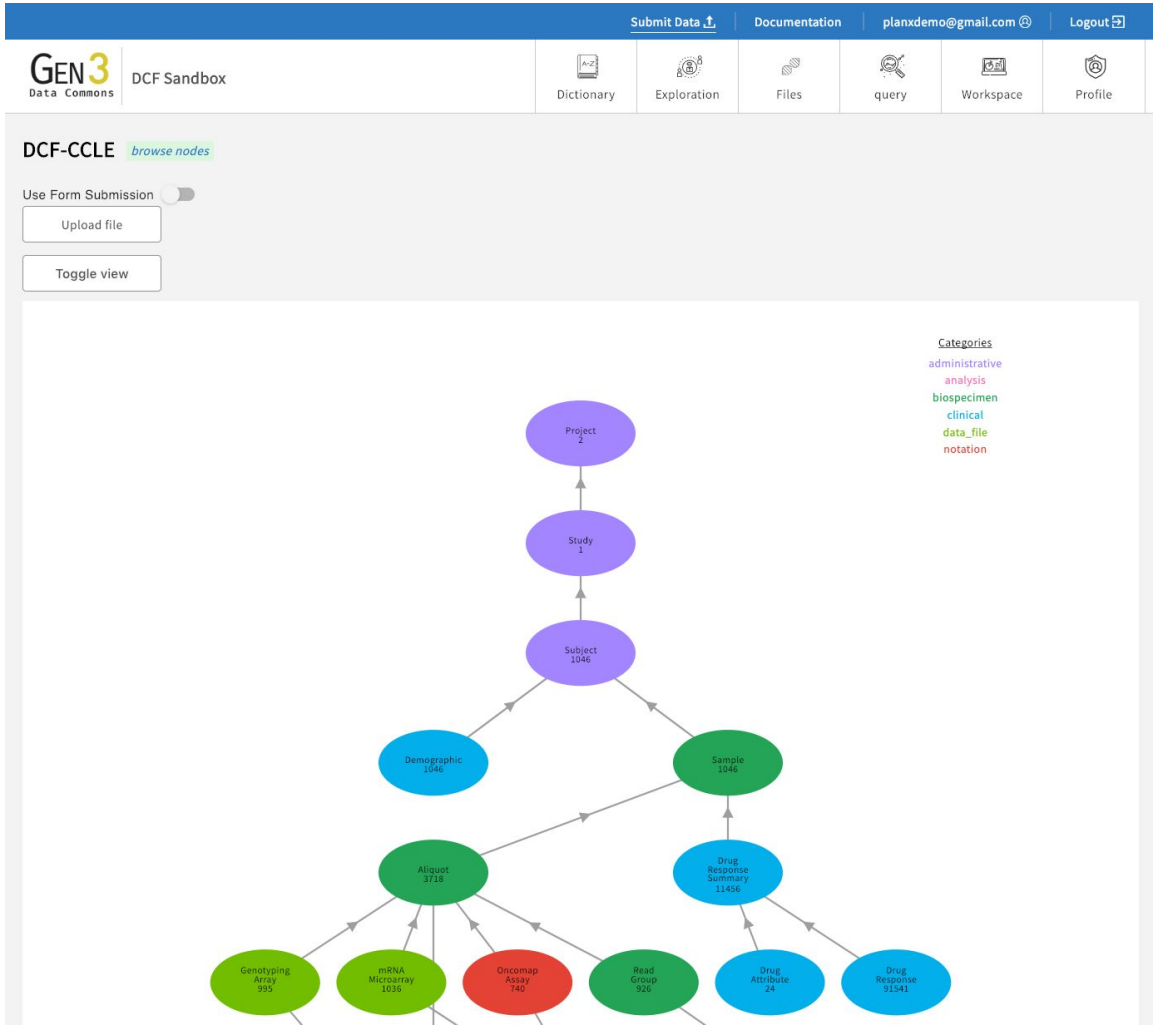
Data Model

- Graph model captures relationship between subjects, clinical, biospecimen, and molecular data
- Data dictionary defines rules for the structured data
- Leverages external terminology standards (eg. NCIt)



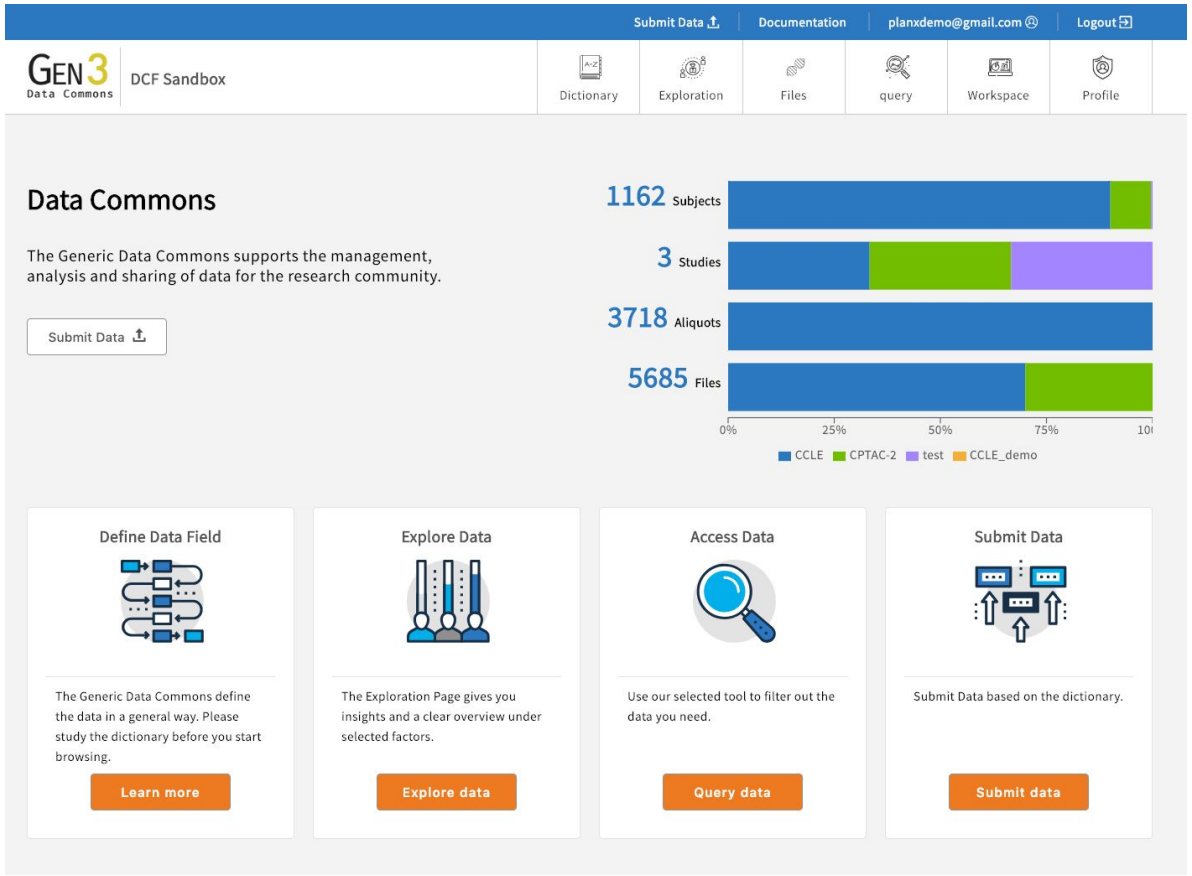
Data Submission

- Sheepdog imports data compliant with the data model and assigns a digital ID to each record and object
- Data curated into graphical data model
- Submission of structured data can be performed through the API or a UI



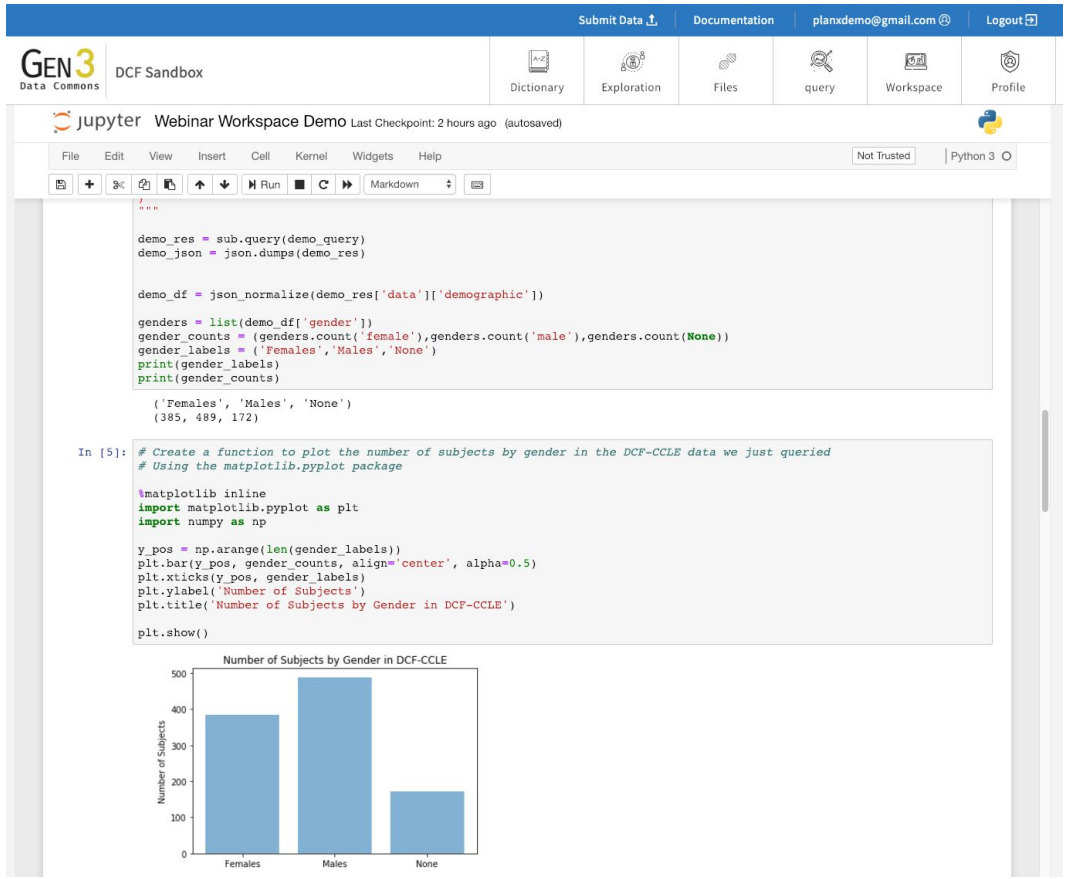
Data Portal – Explore Data & Create Cohorts for Analysis

- Windmill is a data portal for data submission, data search and query, data exploration and data analysis
- Example of app built over a Gen3 data commons



Analyze Your Data

- Lightweight workspaces for analysis and visualization
- Jupyter notebooks powered by Python or R
- Looking to expand to RStudio and Galaxy

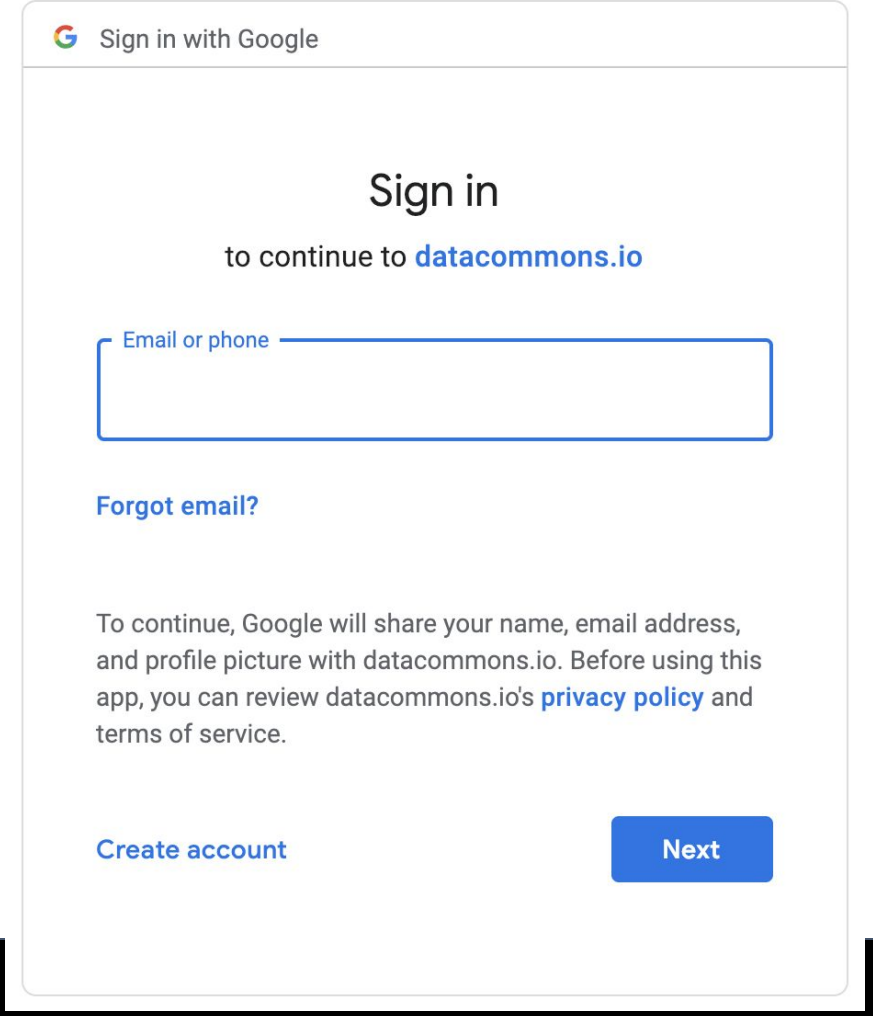


Digital ID Service

- IndexD provides permanent data GUIDs (globally unique IDs) for data objects
- Supports multiple URLs for files
- Minimal metadata is md5 hash and object size
- IndexD supports GA4GH DRS API and its own API for read/write

Authentication and Authorization

- Fence separates controlled access resources from the outside world and allows only trusted entities to enter
- Identity providers supported by Fence:
  - Google, eRA Commons, InCommons, eduGain, …
- Fence utilizes OpenID Connect (OIDC) to generate tokens for clients and directly to a user



Gen3 APIs

- OpenID Connect (OIDC) for Auth
- IndexD API - GA4GH DRS standard
- GraphQL API for querying submitted data
- Supports app and commons development

Query graph

GraphiQL ▶ Prettify History

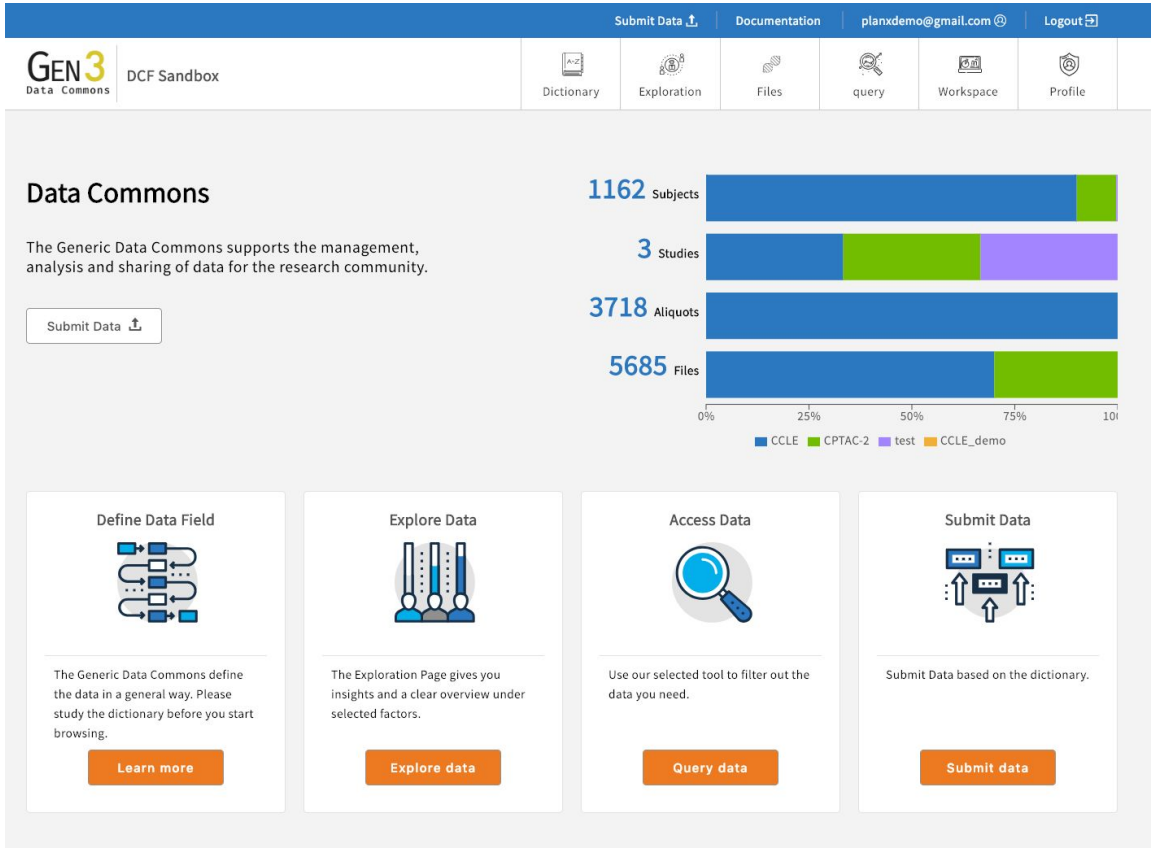
```
1  {
2    subject(project_id: "DCF-CCLE") {
3      id
4      submitter_id
5      demographics {
6        gender
7      }
8    }
9  }
10
```

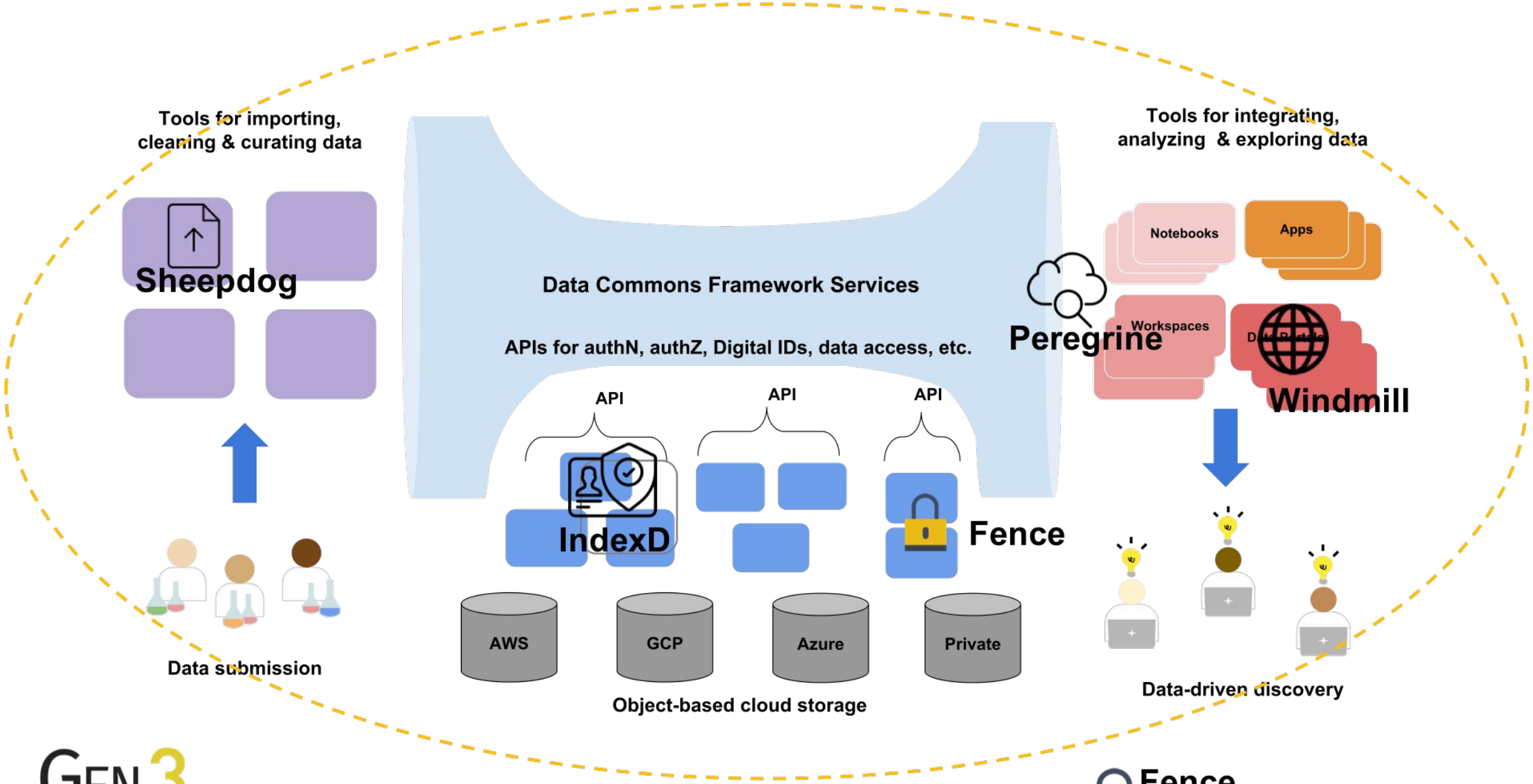
QUERY VARIABLES


```
{
  "data": {
    "subject": [
      {
        "demographics": [
          {
            "gender": "female",
            "year_of_birth": null
          }
        ],
        "id": "2dd84f5d-28cc-455a-b71e-38919c30055f",
        "submitter_id": "ZR7530_BREAST_subject"
      },
      {
        "demographics": [
          {
            "gender": "female",
            "year_of_birth": null
          }
```

Summary of Gen3 Features

- Authentication/Authorization
- Data Model
- Data Submission
- Digital ID Service
- API
- Data Portal
- Analysis

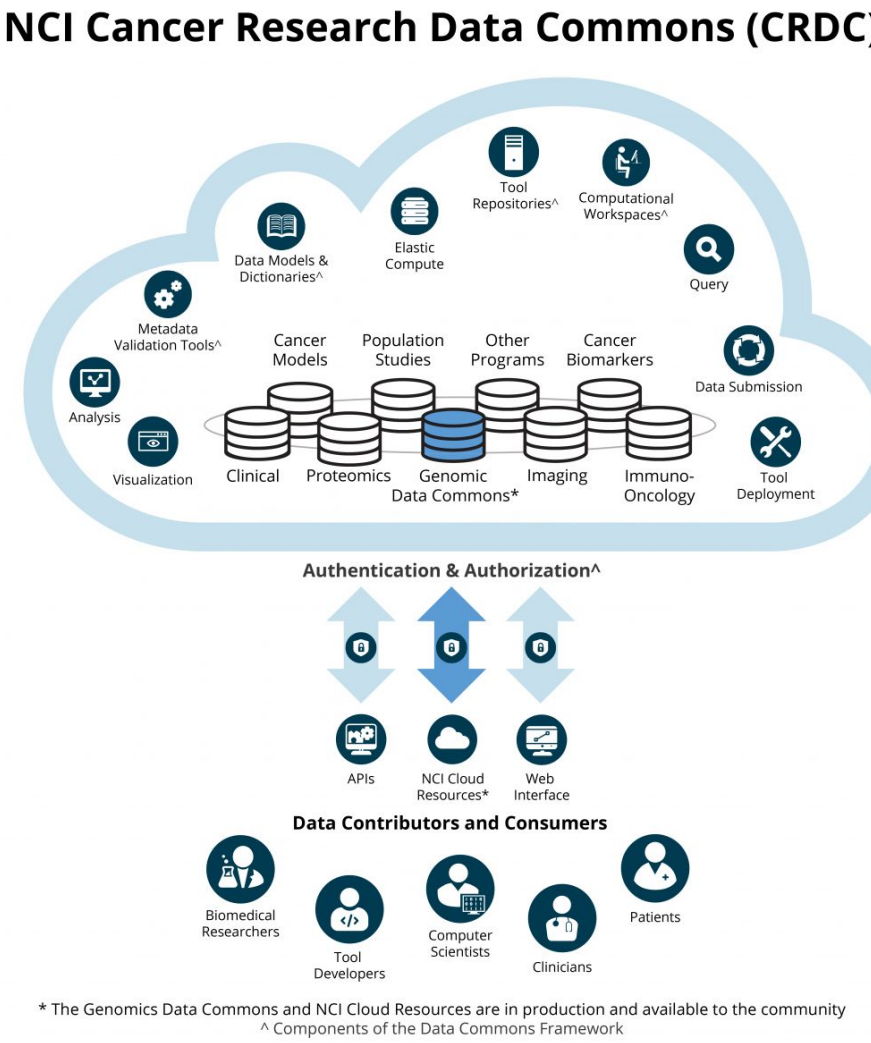




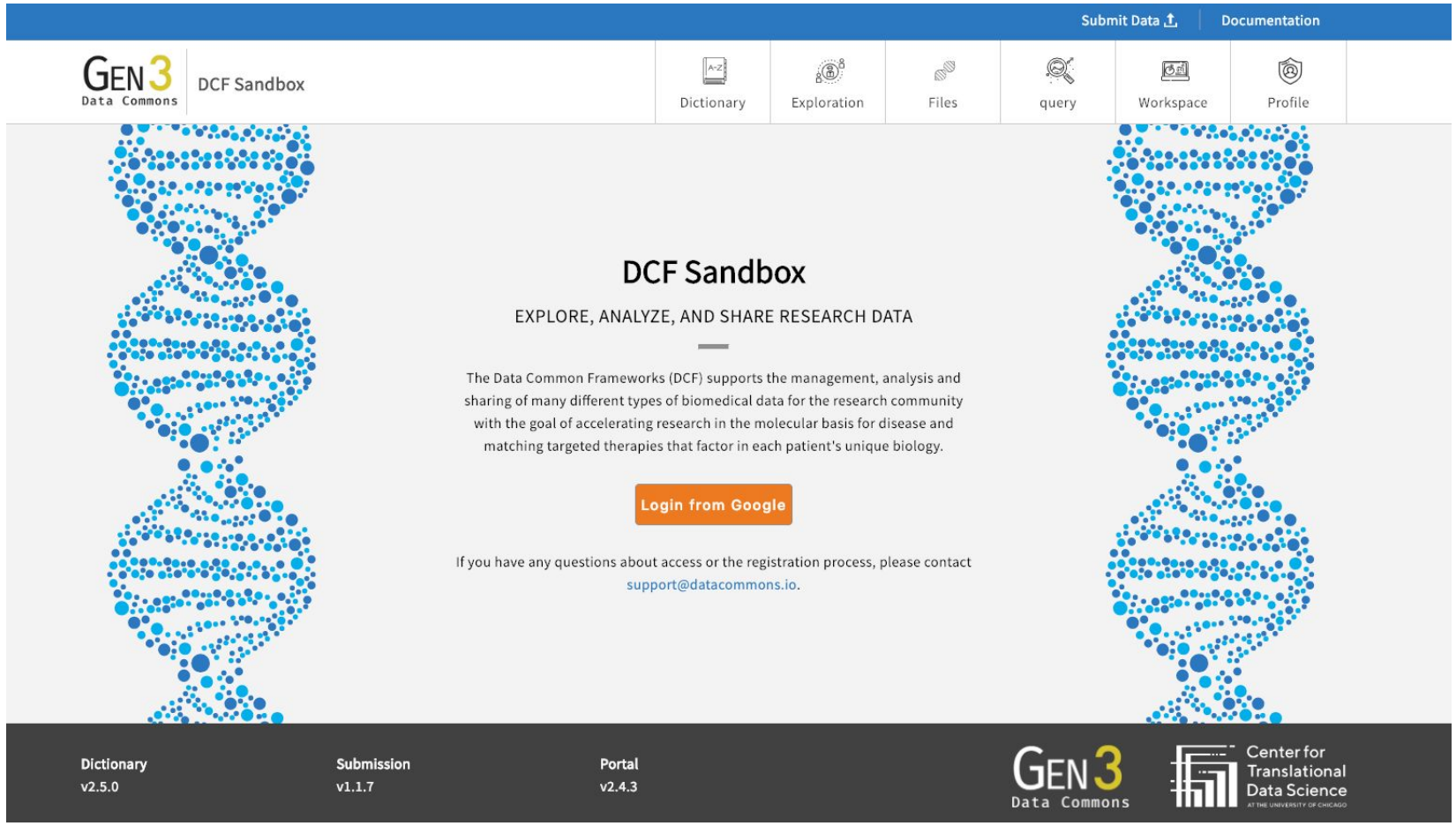
Fence

GEN 3
Data Commons

Cancer Research Data Commons



Demo


Submit Data
Documentation
GEN3 Data Commons
DCF Sandbox
Dictionary
Exploration
Files
query
Workspace
Profile
DCF Sandbox
EXPLORE, ANALYZE, AND SHARE RESEARCH DATA
The Data Common Frameworks (DCF) supports the management, analysis and sharing of many different types of biomedical data for the research community with the goal of accelerating research in the molecular basis for disease and matching targeted therapies that factor in each patient's unique biology.
Login from Google
If you have any questions about access or the registration process, please contact support@datacommons.io.
Dictionary
v2.5.0
Submission
v1.1.7
Portal
v2.4.3
GEN3 Data Commons
Center for Translational Data Science

How can I learn more?

github.com/uc-cdis

gen3.org

Slack Gen3 Community (ask us for an invite!)

dcf-support@datacommons.io

ctds.uchicago.edu

Contribute to the Gen3 Open Source Community

https://github.com/UC-cdis

Selected Data Commons Using Gen3

NIH NATIONAL CANCER INSTITUTE
Cancer Research Data Commons

Gabriella Miller Kids First
PEDIATRIC RESEARCH PROGRAM

DataSTAGE
NIH National Heart, Lung, and Blood Institute

NIAID DATA HUB PILOT

BRAINCOMMONS

NIH National Human Genome Research Institute

AnVIL