

Introduction to the Gen3 Frontend Framework

Gen3 Community Forum
1 November 2023

- Introduction
- Presentation
- Q&A
- Topics for future Gen3 Community Events

Gen3 Frontend Framework

Gen3 Data Commons: Current UI Windmill/data-portal



NIH BioData CATALYST
Powered by Gen3

NIH BioData Catalyst (BDC) supports the management, analysis and sharing of human disease data for the research community and aims to advance basic understanding of the genetic basis of complex traits and accelerate discovery and development of therapies, diagnostic tests, and other technologies for disease risk cancer. The data commons supports cross-project analyses by harmonizing data from different projects through the collaborative development of a data dictionary, providing an API for data queries and downloads, and providing a cloud-based analysis workspace with rich tools and resources.

463596 Views
173 Studies

Define Data Field | Explore Data | Analyze Data

Define Data Field: BDC curates the data in a general way. These curators help the curators better you start knowing. [Learn more](#)

Explore Data: The Exploration Page gives you insights into a color view and other related factors. [Explore data](#)

Analyze Data: Analyze your selected cases using Jupyter Notebooks in our secure cloud environment. [Run Jupyter](#)

MIDBC

Case	Measurements	Sampling Dates	Starts
1	1.0	2013-01-01	2013-01-01
2	1.0	2013-01-01	2013-01-01
3	1.0	2013-01-01	2013-01-01
4	1.0	2013-01-01	2013-01-01
5	1.0	2013-01-01	2013-01-01
6	1.0	2013-01-01	2013-01-01
7	1.0	2013-01-01	2013-01-01
8	1.0	2013-01-01	2013-01-01
9	1.0	2013-01-01	2013-01-01
10	1.0	2013-01-01	2013-01-01

HIAL Data Platform

1,133 Studies

PROJECT TITLE	DATA RELEASE DATE	INITIAL RELEASE DATE	INVESTIGATOR	REVIEWER STATUS	DATA AVAILABILITY
1. Data for Question 1 (Q1) - Research Program Data	2013-01-01	2013-01-01	Dr. John Doe	Approved	Available
2. Data for Question 2 (Q2) - Research Program Data	2013-01-01	2013-01-01	Dr. Jane Smith	Approved	Available
3. Data for Question 3 (Q3) - Research Program Data	2013-01-01	2013-01-01	Dr. Bob Johnson	Approved	Available
4. Data for Question 4 (Q4) - Research Program Data	2013-01-01	2013-01-01	Dr. Alice Brown	Approved	Available
5. Data for Question 5 (Q5) - Research Program Data	2013-01-01	2013-01-01	Dr. Charlie Green	Approved	Available
6. Data for Question 6 (Q6) - Research Program Data	2013-01-01	2013-01-01	Dr. David White	Approved	Available
7. Data for Question 7 (Q7) - Research Program Data	2013-01-01	2013-01-01	Dr. Emily Black	Approved	Available
8. Data for Question 8 (Q8) - Research Program Data	2013-01-01	2013-01-01	Dr. Frank Gray	Approved	Available
9. Data for Question 9 (Q9) - Research Program Data	2013-01-01	2013-01-01	Dr. Grace Blue	Approved	Available
10. Data for Question 10 (Q10) - Research Program Data	2013-01-01	2013-01-01	Dr. Henry Red	Approved	Available

Strengths

- Highly configurable
- Can support a wide variety of different commons
- Tightly coupled with Gen3 services

Weaknesses

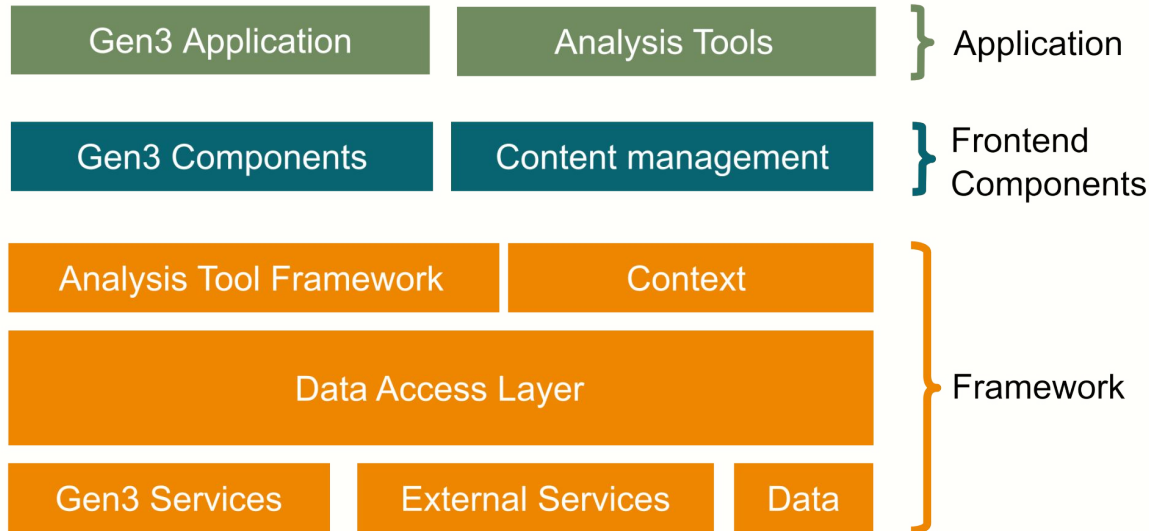
- Monolithic architecture and deployment
- Difficult to extend and configure
- Project/Business logic embedded in the code
- Inadequate support for data movement between pages
- Complex development environment

Introducing the Gen3 Frontend Framework

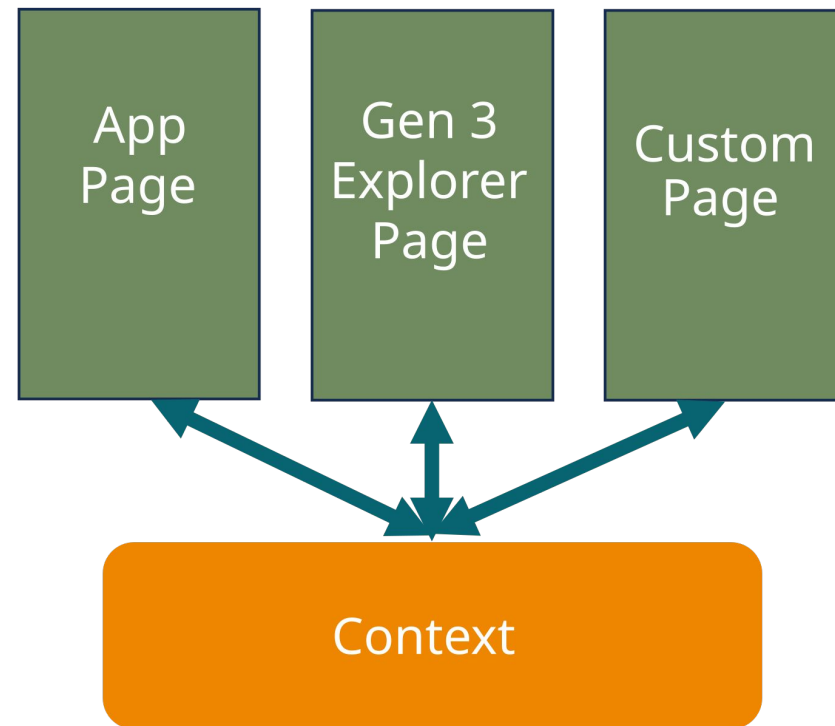
- Replacement for Gen3 data-portal
- Address frontend limitations
- Improved development experience and user experience
- Updated technology stack
- Enhancing:
 - Custom content and applications development
 - Performance
 - Deployment and maintenance

- Provide functions to access Gen3 services
- Introduce concept of Context
- Analysis Tool Framework
- Standardize Components
- Upgraded tech. stack
- Simpler custom custom pages

Gen3 Frontend Framework

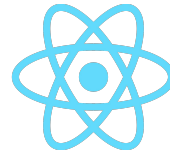


- The concept of the user's context is a powerful feature of the Gen3 Frontend Framework
- Context provides pages and tools with information about:
 - Active cohort
 - Selected studies
 - Active analysis tool
 - AuthN/AuthZ
- Context is available to all pages and analysis tools



- NextJS for full-stack web applications
- React as the UI framework
- Redux-toolkit and SWR
- Written in Typescript (with JavaScript compatibility)
- Theming and styling with Tailwind CSS
- Mantine.dev for component library

NEXT.js



Tailwind CSS



Redux

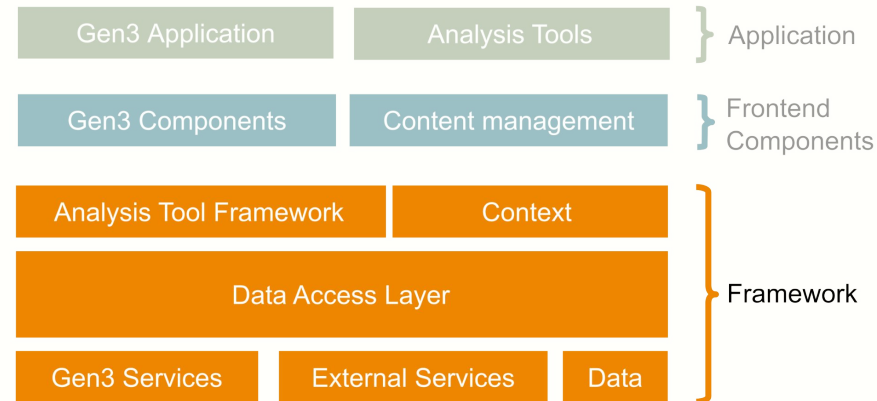


Mantine

- Framework is divided into 2 npm packages and a template
 - Core module **@gen3/framework**
 - Frontend module **@gen3/frontend**
 - Gen3 data commons web application template
- Goals:
 - Reduce code complexity
 - Abstract UI interactions
 - Support customization
 - Simplify deployment

- Provides a data interface to Gen3 services independent of components
- Manages user's context: cohort, selected studies, files, and analysis tools
- Allows future features: user's command history
- Access to Gen3 services via "hooks"
- Abstracted API calls for simplified data retrieval
- Designed to isolate frontend components/web service from Gen3 API changes

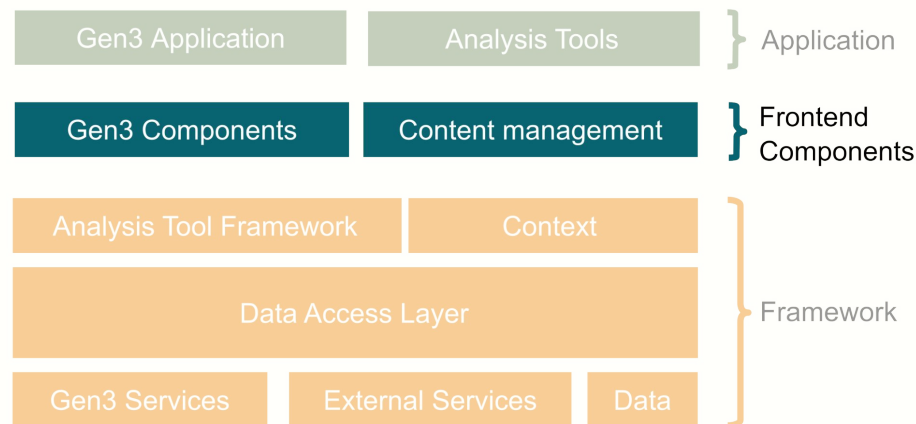
Gen3 Frontend Framework



- Supports the development of custom analysis tools
- Connect to:
 - Gen3 services
 - 3rd-party APIs
 - Other data sources
- Uses context to filter tools that can be applied to current data selection
- Frontend:
 - Support to register apps as plugins
 - Analysis tool page

- Standard Gen3 pages:
 - Discovery
 - Exploration
 - Data Dictionary
 - ...
- Theming and configuration functions
- Gen3 components build using mantine components
- Uses Gen3 services/data via @gen3/framework hooks

Gen3 Frontend Framework



- Commons Specific code is implemented as a functions that:
 - Retrieve
 - Transform
 - Render
- Gen3 Feature accept a function *hook* to override default behavior
- Default hooks are implemented to provide standard behavior
- Tables/charts can be customized by registering custom Cell and Chart components
- Planned provide templates and Developer documentation

Data-portal:

- Discovery page reads data from the Gen3 Metadata Service
- Pulls data from MDS and/or Aggregate MDS
- The complexity/variety of metadata makes configuration complex
- All metadata is loaded into the client to support search

Gen3 Frontend Framework:

- Developers pass a function (e.x. hook) to discovery page to load data/transform data
- Enables data transformation logic to be commons specific

Cell Renderer Example

```
export const LinkedStudyCell = ({
  value: cellValue,
}) : CellRenderFunctionProps<boolean> : Element => {
  const value : boolean = cellValue as boolean;
  return value ? (
    <Badge
      variant="outline"
      leftSection={<CheckCircleOutlined />}
      color="green"
    >
      Linked
    </Badge>
  ) : (
    <Badge leftSection={<MinusCircleOutlined />} color="primary">
      Not Linked
    </Badge>
  );
};

const CommonsCellRenderers : {boolean: {...}, string: {...}} = {
  string: {
    default: WrappedStringCell,
  },
  boolean: {
    LinkedStudyCell,
  },
};

export const registerDiscoveryCustomCellRenderers = () : void => {
  DiscoveryCellRendererFactory.registerCellRendererCatalog(CommonsCellRenderers);
};
```

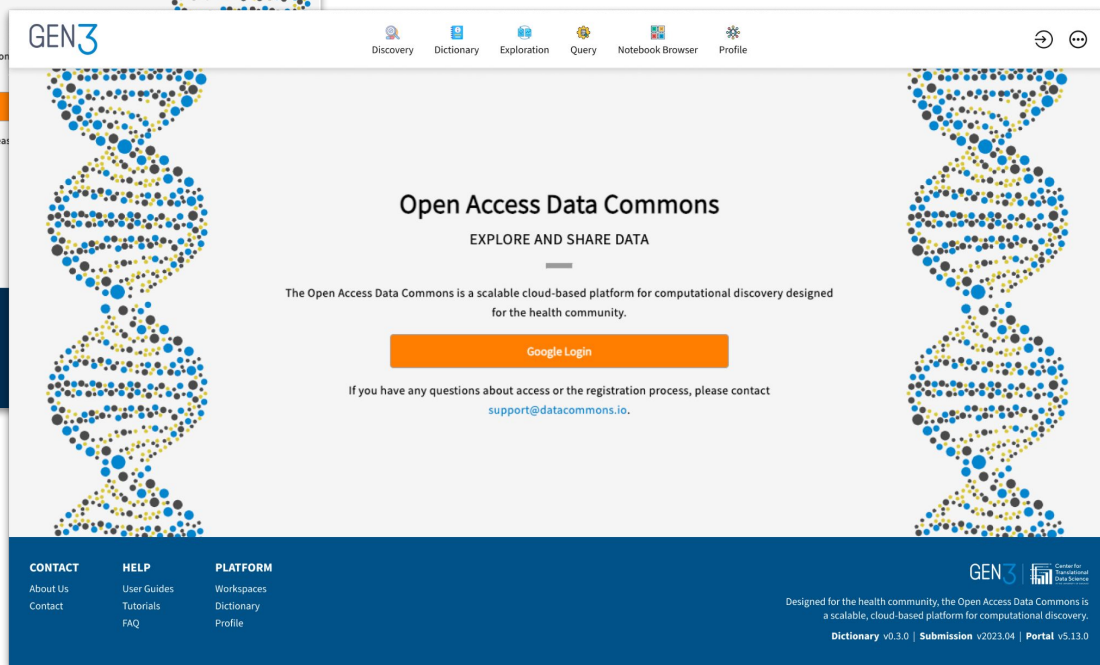
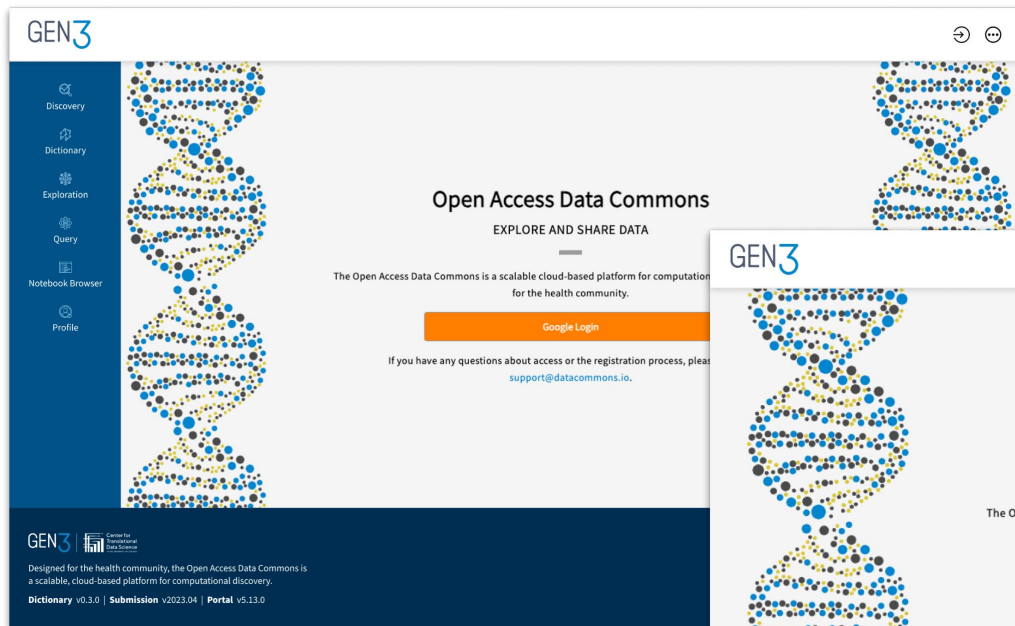
Search, Filter, and Sort icons

Test Name	Test Results Text
COVID-19 COVID-19 COVID-19 COVID-19	NEGATIVE NEGATIVE NEGATIVE POSITIVE
COVID-19	POSITIVE
COVID-19	POSITIVE
COVID-19	POSITIVE
COVID-19 COVID-19 COVID-19	NEGATIVE NEGATIVE NEGATIVE
COVID-19	NEGATIVE
COVID-19	NEGATIVE
COVID-19	NEGATIVE
COVID-19	NEGATIVE
COVID-19 COVID-19 COVID-19 COVID-19	NEGATIVE NEGATIVE NEGATIVE NEGATIVE

Rows per page: 10 | 1-10 of 12,159 | Navigation arrows

- Common location for storing selection: My Data Library
- Analysis tool plugins
- Static content
- Custom pages
- Custom content via markdown
- Context
- Updated site navigation and new UI design
- 508 compliant

New Design/UX



New Design/UX

Biomedical Research Hub
Powered by Gen3

Documentation | Email Support | Cite BRH | email@email.edu | Logout

Discovery | Workspace | Example Analysis | Profile

Link Account from External Data Resources

JCOIN Google Login	NCI-CRDC RAS Login
IDP: jcoin-google	IDP: crdc-ras
Provider URL: https://jcoin.datacommons.io	Provider URL: https://nci-crdc.datacommons.io
Status: Expires in 15 days	Status: Not authorized
Refresh JCOIN Google Login	Authorize NCI-CRDC RAS Login

MIDRC NIH Login	Access Clinical Data - NIH Login
IDP: crdc-ras	IDP: ACD-NIH
Provider URL: https://nci-crdc.datacommons.io	Provider URL: https://accessclinicaldata.niaid.nih.gov
Status: Not authorized	Status: Not authorized
Authorize MIDRC NIH Login	Authorize Access Clinical Data - NIH Login

IBDGC Google Login	OADC Google Login
IDP: ibdgc-google	IDP: oadc-google
Provider URL: https://ibdgc.datacommons.io	Provider URL: https://gen3.datacommons.io
Status: Not authorized	Status: Not authorized
Refresh IBDGC Google Login	Authorize OADC Google Login

Tutorial CANINE Google Login	BioDataCatalyst RAS Login
IDP: canine-google	IDP: bdcat-ras
Provider URL: https://canimedc.org	Provider URL: https://gen3.biodatacatalyst.nih.gov
Status: Not authorized	Status: Not authorized
Authorize Tutorial CANINE Google Login	Authorize BioDataCatalyst RAS Login

AnVIL RAS Login
IDP: anvil-ras
Provider URL: https://gen3.theanvil.io
Status: Not authorized
Authorize AnVIL RAS Login

Browse Data | Documentation | craigbarnes@uchicago.edu | Logout

Discovery | Dictionary | Exploration | Query | Analysis | Workspace | Profile

Current API Keys

[Create an API Key](#)

API Key	Status	Expiration Date	Actions
91c19be3-9369-4444-86be-637c24925542	Active	12/1/2023, 12:21:26 PM	

Rows per page: 10 | 1


Resources

requestor	dictionary_page	create	access	read	read-storage
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				

Resource	requestor	dictionary_page	create	access	read	read-storage
/cedar	REQUESTOR					
/dictionary_page		DICTIONARY PAGE				
/kayako	KAYAKO					
/mds_gateway	REQUESTOR					
/programs/open	FENCE	GUPPY	PEREGRINE	SHEEPDOG	FENCE	

Rows per page: 5 | 1 | 2 | 3 | 4 | 5 | ... | 17

GEN3 Center for Translational Data Science
AT THE UNIVERSITY OF CHICAGO



Exploration
Dictionary
Example Analysis

Table View
Graph View

The Medical Imaging and Data Resource Center (MIDRC) Commons dictionary has **25 nodes** and **454 properties**.

Search Results
1 match in nodes
10 matches in node properties

Case

- Administrative > Case > Type
- Medical History > Dataset > Cases
- Imaging Data > Program > Type
- Data File > Project > File Name

6 more

Search History Clear All

NSAID

- Administrative > Case > Type
- Medical History > Dataset > Cases
- Imaging Data > Program > Type
- Data File > Project > File Name

8 more

avail_mechanism

- Administrative > Case > Type
- Medical History > Dataset > Cases
- Imaging Data > Program > Type
- Data File > Project > File Name

11 more

ADMINISTRATIVE

Case JSON TSV

The collection of all data related to a specific patient or case in the context of a specific dataset or experiment.

Property	Type	Required	Description
case_ids	Array	No	A list of one or more case submitter_ids associated with this data.
submitter_id	String	Yes	A human-readable, unique identifier for a record in the metadata database. It can be used in place of the UUID for identifying or recalling a record (e.g., in data queries or uploads/exports).
projects	Array Object	Yes	A human-readable, unique identifier for a record in the metadata database. It can be used in place of the UUID for identifying or recalling a record (e.g., in data queries or uploads/exports).
case_ids	Array	No	A list of one or more case submitter_ids associated with this data.
contributor	String	No	An entity responsible for making contributions to the resource. Examples of a Contributor include a person, an organization, or a service. Typically, the name of a Contributor should be used to indicate the entity.
coverage	String	No	The spatial or temporal topic of the resource, the spatial applicability of the resource, or the jurisdiction under which the resource is relevant. Spatial topic and spatial applicability may be a named place or a location specified by its geographic coordinates. Temporal topic may be a named period, date, or date range. A jurisdiction may be a named administrative entity or a geographic place to which the resource applies. Recommended best practice is to use a controlled vocabulary such as the Thesaurus of Geographic Names [TGN] (http://www.getty.edu/research/tools/vocabulary/tgn/index.html). Where appropriate, named places or time periods can be used in preference to numeric identifiers such as sets of coordinates or date ranges.

Core Metadata Collection JSON TSV

A collection of data files in a project.

Dataset JSON TSV

A set of metadata and associated data file objects originating from single a research study, clinical trial or patient cohort.

Program JSON TSV

A broad framework of goals to be achieved. (NCIT C52647)

Project JSON TSV

Any specifically defined piece of work that is undertaken or attempted to meet a single requirement. (NCIT C47885)

Visit JSON TSV

Information about a specific visit for a specific case or patient.

MEDICAL HISTORY

Information related to the condition(s) of a case within the context of a particular study

Browse Data ▼ Documentation → Login →

GEN3

- Cases
- Measurements
- Imaging Studies
- Imaging Series

Demographics

Sex Cases

- Female 4,758
- Male 5,399
- Not Reported 2

Race

- American Indian or Ala... 65
- Asian 668
- Black or African Americ... 12,094
- Native Hawaiian or oth... 34
- Not Reported 453
- Other 247

Ethnicity

- Hispanic or Latino 120
- Not Hispanic or Latino 12,159
- Not Reported 654

Age at Index

Min: 0 Max: 11919

0 89 11919

Index Event

- COVID-19 Test 4,458
- First COVID test 12,159
- no data 449

Zip

- 0 405
- 100 1
- 150 1
- 164 2
- 310 669
- 000 1
- 023 1

Covid19 Positive

- No 4,029
- Not Reported 3
- Yes 8,127

Default Clear All

RACE ← AMERICAN INDIAN → ×
BLACK OR AFRICA... → ×
ETHNICITY ← NOT HISPANIC OR... → ×
INDEX EVENT ← FIRST COVID TEST → ×

12,159 Cases

COVID-19 Positive

Sex

Race

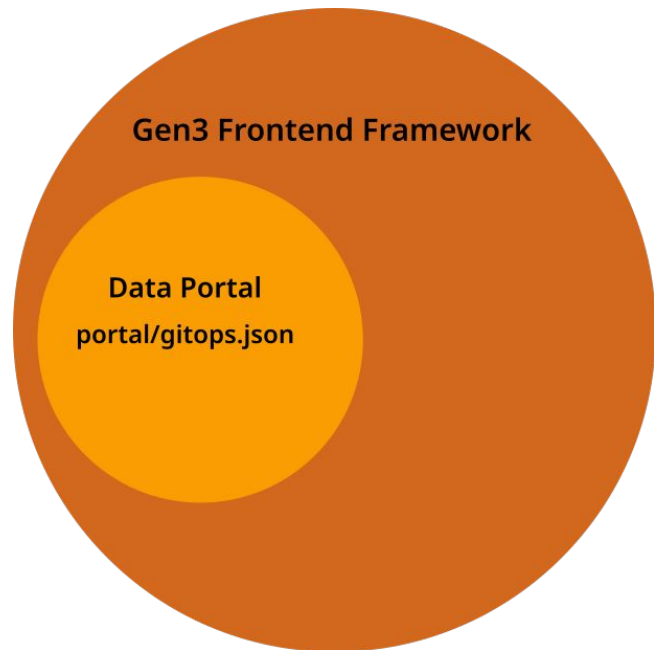
Submitter Id	Sex	Age at Index	Index Event	Race	Ethnicity	Zip	Covid19 Positive	Test Name	Test Results	Test M
10041569-6BdF4pVtE6oZf1hRyCoQ	Female		First COVID test	Black or African American	Not Hispanic or Latino	190	Yes	COVID-19 COVID-19	NEGATIVE NEGATIVE	RFP RFP
10041569-8KdopOe9k6oDcjfYKIDA	Female	22	First COVID test	Black or African American	Not Hispanic or Latino	190	Yes	COVID-19	POSITIVE	RFP
10022779-807cRm8EaohfKuxlppg	Male	55	First COVID test	Black or African American	Not Hispanic or Latino	000	Yes	COVID-19	POSITIVE	RFP
10022779-sKz67LGMUeR9RorpKlBQ	Male	34	First COVID test	Black or African American	Not Hispanic or Latino	701	Yes	COVID-19	POSITIVE	RFP
639127-003983	Female	41	First COVID test	Black or African American	Not Hispanic or Latino	481	No	COVID-19 COVID-19	NEGATIVE NEGATIVE	RFP RFP
639127-002690	Female	53	First COVID test	Black or African American	Not Hispanic or Latino	482	No	COVID-19	NEGATIVE	RFP
10003752-XYEUlMf7ake9aDgkABARdQ	Female	21	First COVID test	Black or African American	Not Hispanic or Latino	606	No	COVID-19	NEGATIVE	RFP
639127-004339	Male	66	First COVID test	Black or African American	Not Hispanic or Latino	482	No	COVID-19	NEGATIVE	RFP
302028-000839	Female	54	First COVID test	Black or African American	Not Hispanic or Latino	US	No	COVID-19	NEGATIVE	RFP
232451-000459	Female	68	First COVID test	Black or African American	Not Hispanic or Latino	US	No	COVID-19 COVID-19	NEGATIVE NEGATIVE	RFP RFP

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Center for Translational Data Science

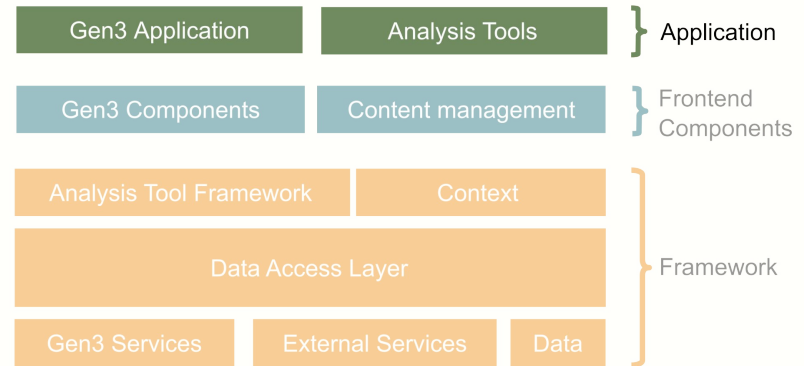
- NextJS application server for Gen3 commons
- Frontend module implements standard Gen3 Features
- Supports access-controlled pages and page sections
- Analysis tool registration with the ATF
- Enables complex site navigation and middleware support

- Built into @gen3/frontend
- Current support: file-based configurations
- Future: database-stored configurations/introspection
- Separate configuration file for each page/application
- Backward compatibility with data-portal but with new capabilities
- Planned: Web-based configuration and validation in the pipeline
- Planned: hybrid data-portal/Gen3FF



- Data common is a git repository:
 - configuration
 - icons
 - custom code and pages
 - content
- Addition pages can be added as NextJS pages, slugs, or Markdown
- Registered Analysis Tools

Gen3 Frontend Framework



- Enable simple way to add commons-specific content
- Addition of custom pages via React JSX or TSX
- Markdown support
- More complex pages:
 - Custom components
 - Analysis tool built using React and Gen3 modules

Color Theming

Color tokens based on USWDS:

- Primary
- Secondary
- Accent
- ...

Command line tool to create:

- 10 shades per color token
- 508 compliant contrasting color

Color tokens are used exclusively in Gen3 front end components/pages

GEN3

Discovery Dictionary Exploration Query Analysis Workspace Profile

Color Palettes

The following theme colors are currently available in this Gen3 Data Commons.

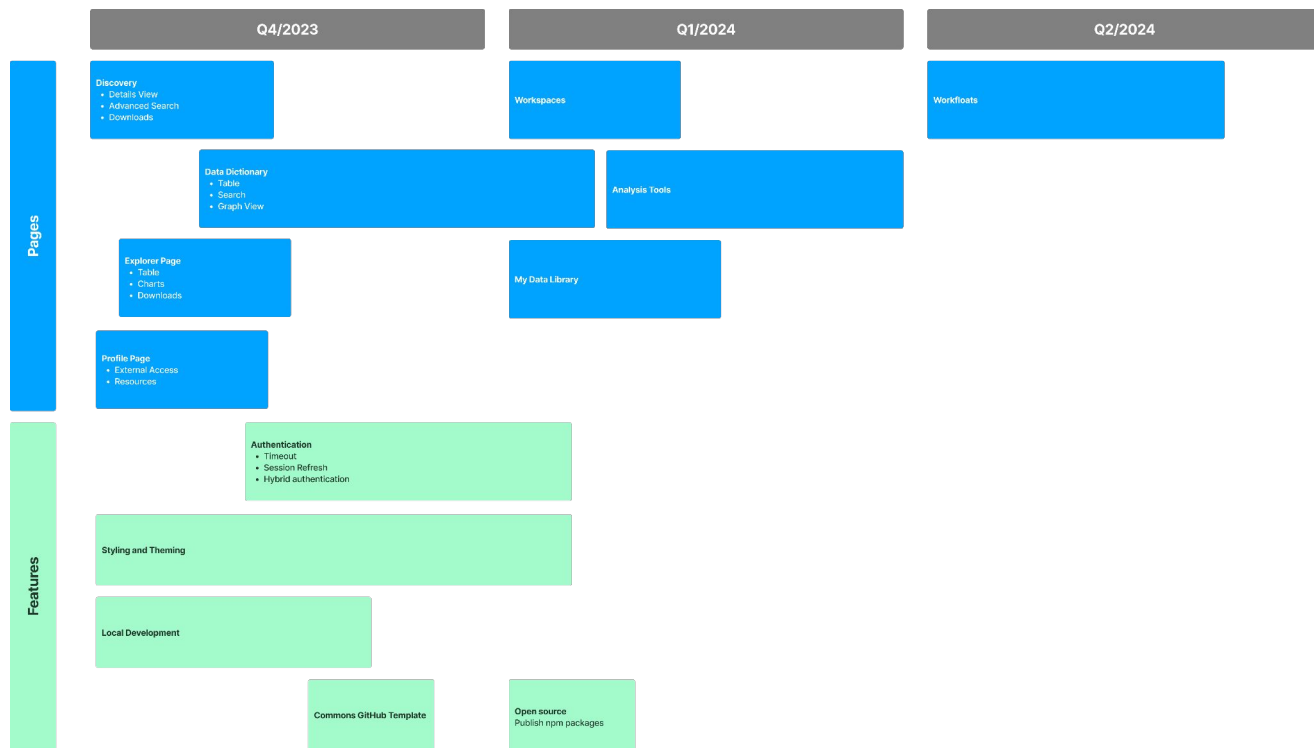
base	max	lightest	lighter	light	base	vivid	dark	darker	darkest	min
primary	max	lightest	lighter	light	primary	vivid	dark	darker	darkest	min
secondary	max	lightest	lighter	light	secondary	vivid	dark	darker	darkest	min
accent	max	lightest	lighter	light	accent	vivid	dark	darker	darkest	min
accent-warm	max	lightest	lighter	light	warm	vivid	dark	darker	darkest	min
accent-cool	max	lightest	lighter	light	cool	vivid	dark	darker	darkest	min
chart	max	lightest	lighter	light	chart	vivid	dark	darker	darkest	min
utility	link	success	warning	error	emergency	info	category1	category2	category3	category4

- Local development using Gen3 Helm charts for Gen3 Services
- Commons site runs as a NextJS development server
- Support development features:
 - hot reloading,
 - debugging w/breakpoints
- Plan to support debug commons
- Provide sample helm configurations and tools to run local development environment

Status and Roadmap

Current:

- Discovery Page
 - Details View
 - Advanced Search
 - Downloads
- Query Page
- Login
- Profile
- Basic theming
- Configuration



- Gen3 frontend framework overcomes current portal limitations
- Enriched user experience
- Easier development and deployment
- Many options for customization
- Facilitates complex data analysis workflows

- **Speakers**

- Robert Grossman - Center for Translational Data Science, University of Chicago
- Craig Barnes - Center for Translational Data Science, University of Chicago

- **Gen3 Forum Steering Committee**

- Robert Grossman - Center for Translational Data Science, University of Chicago
- Steven Manos - Australian BioCommons
- Claire Rye - New Zealand eScience Infrastructure
- Plamen Martinov - Open Commons Consortium
- Michael Fitzsimons - Center for Translational Data Science, University of Chicago

Questions