

# Introduction to the Gen3 Frontend Framework

Gen3 Community Forum  
1 November 2023

# The Agenda

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

# Gen3 Frontend Framework

# Gen3 Data Commons: Current UI Windmill/data-portal



The image displays two screenshots of the Gen3 Data Commons interface. The top screenshot shows the BioData CATALYST homepage, featuring a summary of 46,3596 samples and 173 studies, with a pie chart showing their distribution across various sources. Below this are three main navigation tabs: 'Define Data Field', 'Explore Data', and 'Analyze Data'. The bottom screenshot shows the HEAL Data Platform, displaying a list of 1,133 studies across various research projects, with detailed information and filters for each study entry.

## Strengths

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

## Weaknesses

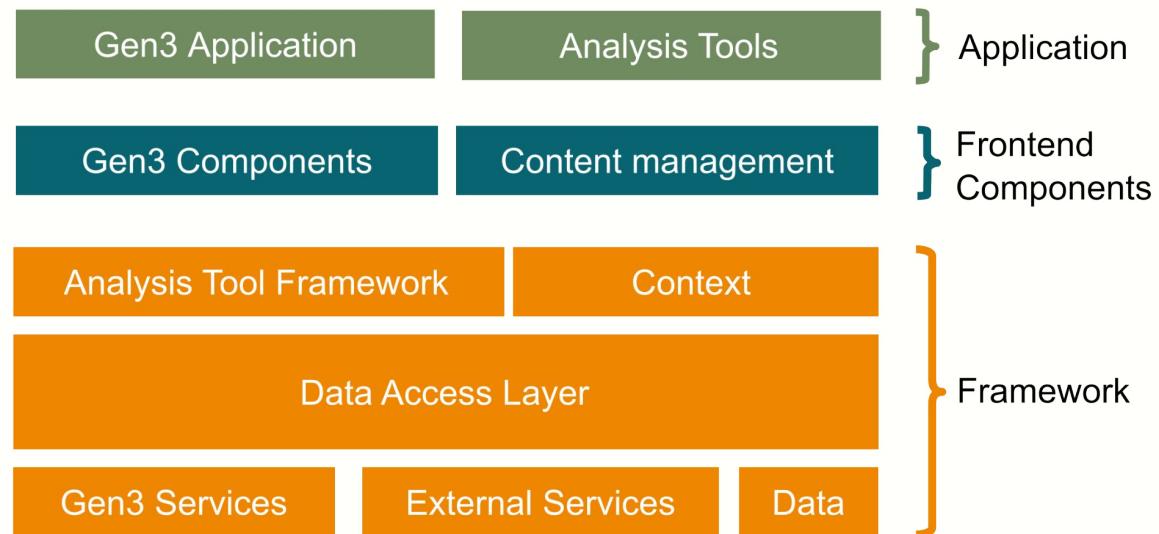
- Monolithic architecture and deployment
- Difficult to extend and configure
- Project/Business logic embedded in the code
- Inadequate support for data movement between pages
- Complex development environment

## 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

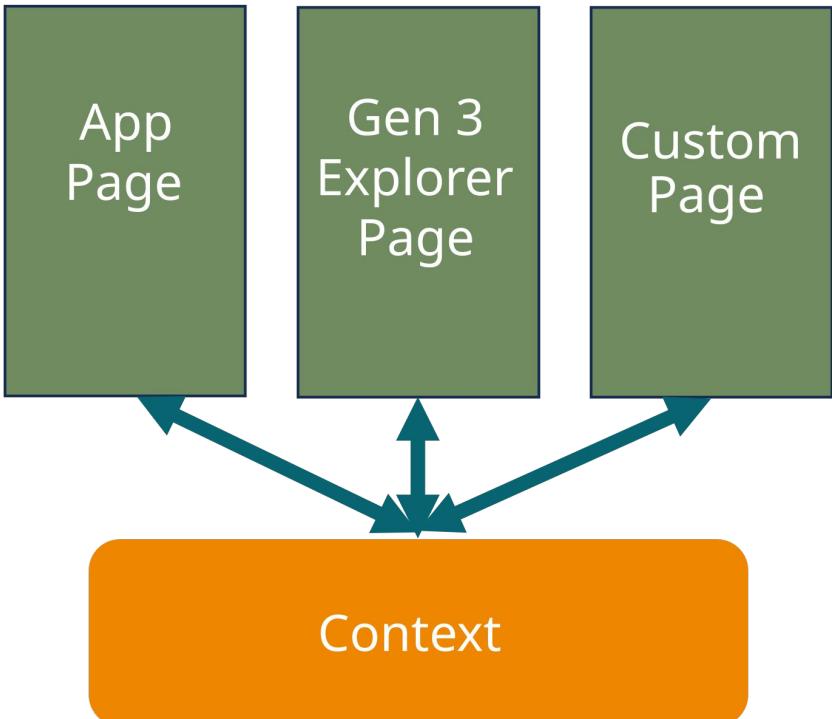
- Provide functions to access Gen3 services
- Introduce concept of Context
- Analysis Tool Framework
- Standardize Components
- Upgraded tech. stack
- Simpler custom pages

## Gen3 Frontend Framework



# Context

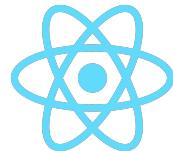
- The concept of the user's context is a powerful feature of the Gen3 Frontend Framework
- Context provides pages and tools with information about:
  - Active cohort
  - Selected studies
  - Active analysis tool
  - AuthN/AuthZ
- Context is available to all pages and analysis tools



# Framework Technology Stack

- 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



Mantine

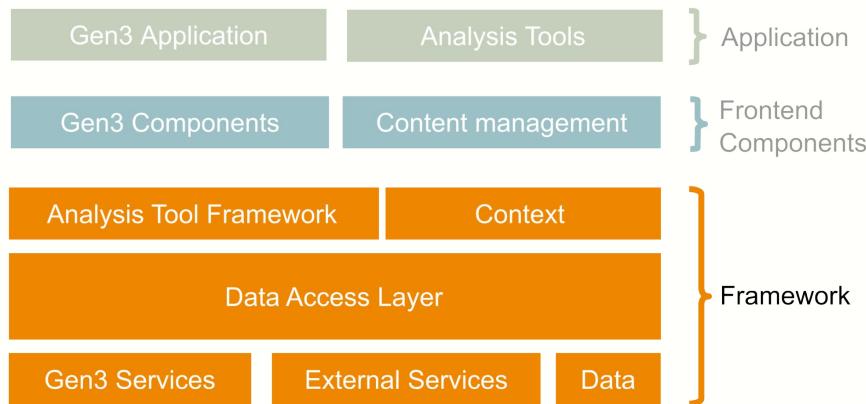
# Framework Modules

- 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

# Core Module: @gen3/framework

- 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



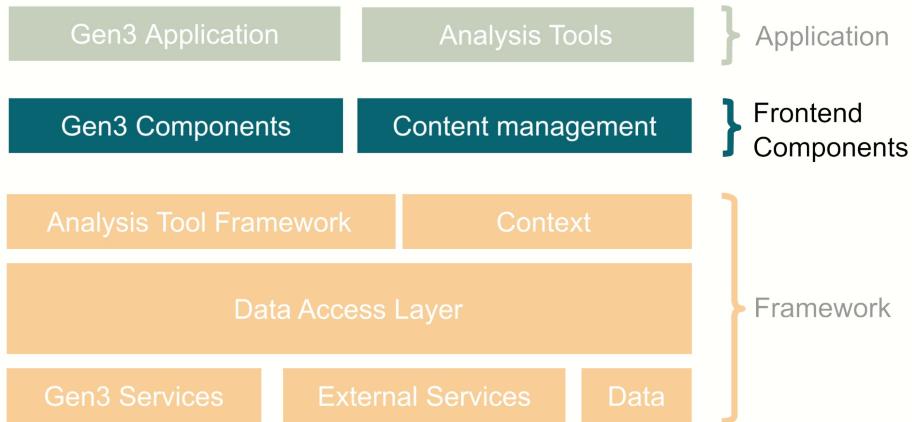
# Analysis Tool Framework (ATF)

- 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

# Frontend Module: `@gen3/frontend`

- 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



- 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

# Discovery Page Data Hook Example



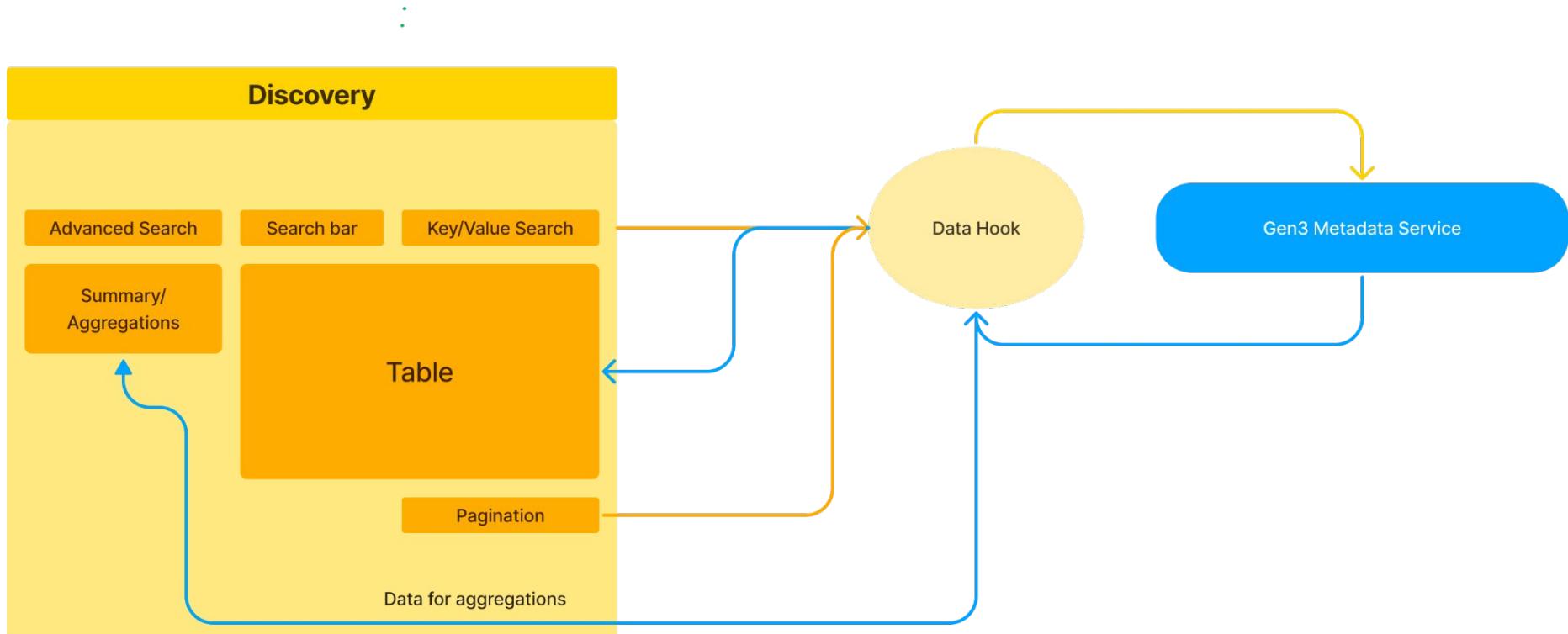
## Data-portal:

- 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

# Discovery Page Data Hook Example



# 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 leftSection={<MinusCircleOutlined />} color="primary">  
      Not Linked  
    </Badge>  
  );  
};  
  
const CommonsCellRenderers : {boolean: {...}, string: {...}} = {  
  string: {  
    default: WrappedStringCell,  
  },  
  boolean: {  
    LinkedStudyCell,  
  },  
};  
  
export const registerDiscoveryCustomCellRenderers = () : void => {  
  DiscoveryCellRendererFactory.registerCellRendererCatalog(CommonsCellRenderers);  
};
```

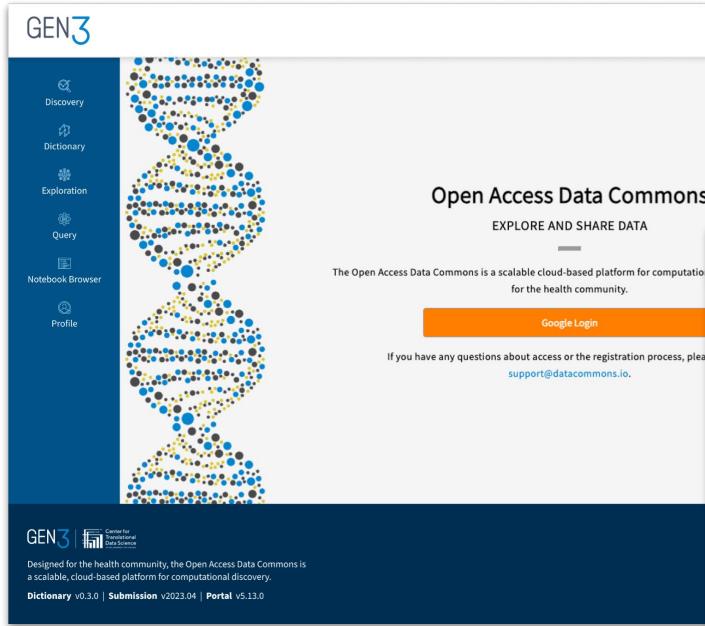
Test Name ↑↓	Test Results Text ↑↓
COVID-19	NEGATIVE
COVID-19	NEGATIVE
COVID-19	POSITIVE
COVID-19	NEGATIVE

# New Features

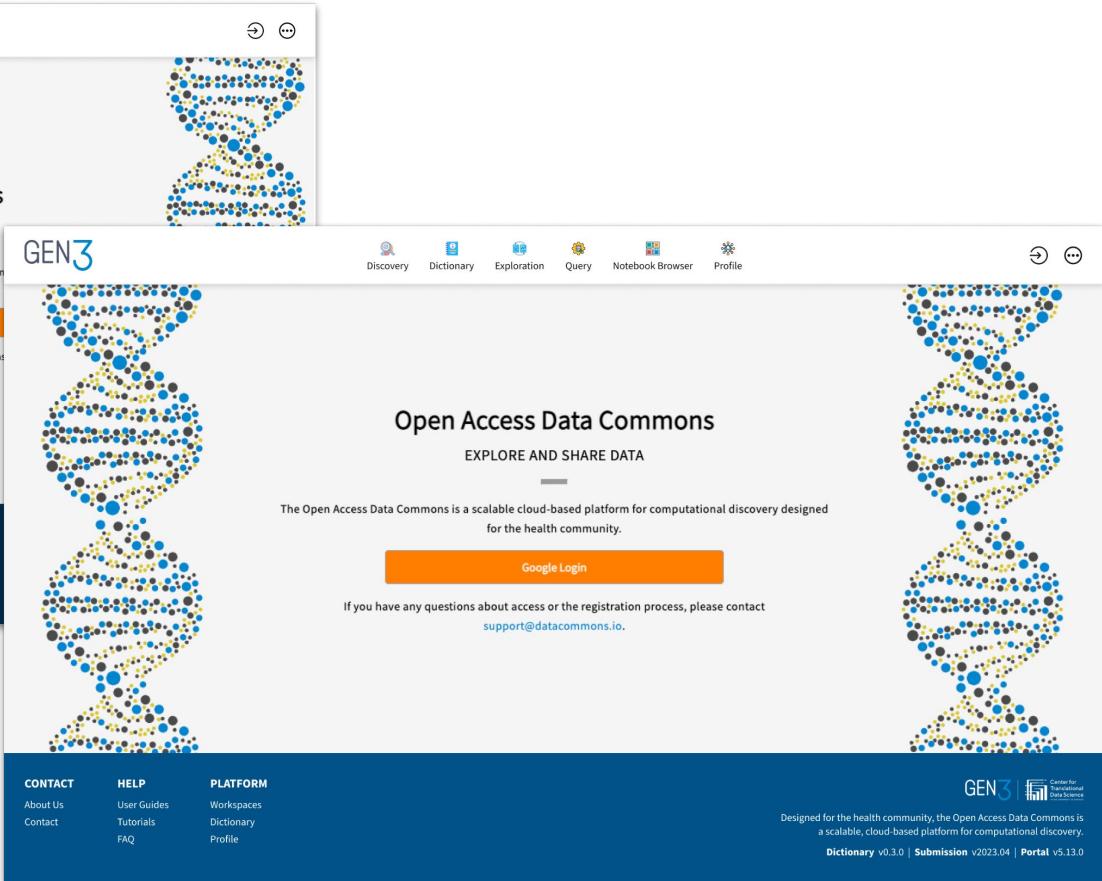
- Common location for storing selection: My Data Library
- Analysis tool plugins
- Static content
- Custom pages
- Custom content via markdown
- Context
- Updated site navigation and new UI design
- 508 compliant

# New Design/UX





The screenshot shows the previous version of the Open Access Data Commons website. The header features a dark blue navigation bar with the "GEN3" logo on the left and a search icon on the right. Below the header is a large DNA helix graphic composed of colored dots. The main content area has a white background with the title "Open Access Data Commons" and a sub-section "EXPLORE AND SHARE DATA". A text block describes the platform as a scalable cloud-based platform for computational discovery designed for the health community. An orange "Google Login" button is centered below the text. At the bottom, there is a dark blue footer bar containing the "GEN3" logo, the text "Center for Translational Data Science", and copyright information: "Designed for the health community, the Open Access Data Commons is a scalable, cloud-based platform for computational discovery." and "Dictionary v0.3.0 | Submission v2023.04 | Portal v5.13.0".



The screenshot shows the updated version of the website. The header now has a light gray background with the "GEN3" logo on the left and a set of icons for "Discovery", "Dictionary", "Exploration", "Query", "Notebook Browser", and "Profile" on the right. The main content area is identical to the old design, featuring the "Open Access Data Commons" title, "EXPLORE AND SHARE DATA" section, and the descriptive text about the platform. The orange "Google Login" button is present. The footer is also identical to the old design, with the "GEN3" logo, "Center for Translational Data Science" text, and the same copyright information at the bottom.

# New Design/UX

Documentation | Email Support | Cite BRI | email@email.edu @ | Logout ☰

Biomedical Research Hub  
Powered by Gen3

Discovery Workspace Example Analysis Profile

#### Link Account from External Data Resources

**JCOIN Google Login**

IDP	jcoin-google
Provider URL	<a href="https://jcoin.datacommons.io">https://jcoin.datacommons.io</a>
Status	Expires in 15 days

[Refresh JCOIN Google Login](#)

**NCI-CRDC RAS Login**

IDP	crdc-ras
Provider URL	<a href="https://nci-crdc.datacommons.io">https://nci-crdc.datacommons.io</a>
Status	Not authorized

[Authorize NCI-CRDC RAS Login](#)

**MIDRC NIH Login**

IDP	crdc-ras
Provider URL	<a href="https://nci-crdc.datacommons.io">https://nci-crdc.datacommons.io</a>
Status	Not authorized

[Authorize MIDRC NIH Login](#)

**Access Clinical Data - NIH Login**

IDP	ACD-NIH
Provider URL	<a href="https://accessclinicaldata.niaid.nih.gov">https://accessclinicaldata.niaid.nih.gov</a>
Status	Not authorized

[Authorize Access Clinical Data - NIH Login](#)

**IBDGC Google Login**

IDP	ibdgc-google
Provider URL	<a href="https://ibdgc.datacommons.io">https://ibdgc.datacommons.io</a>
Status	Not authorized

[Refresh IBDGC Google Login](#)

**OADC Google Login**

IDP	oadc-google
Provider URL	<a href="https://gen3.datacommons.io">https://gen3.datacommons.io</a>
Status	Not authorized

[Authorize OADC Google Login](#)

**Tutorial CANINE Google Login**

IDP	canine-google
Provider URL	<a href="https://caninedc.org">https://caninedc.org</a>
Status	Not authorized

[Authorize Tutorial CANINE Google Login](#)

**BioDataCatalyst RAS Login**

IDP	bdcat-ras
Provider URL	<a href="https://gen3.biodatacatalyst.nihlib.nih.gov">https://gen3.biodatacatalyst.nihlib.nih.gov</a>
Status	Not authorized

[Authorize BioDataCatalyst RAS Login](#)

**AnVIL RAS Login**

IDP	anvil-ras
Provider URL	<a href="https://gen3.theanvil.io">https://gen3.theanvil.io</a>
Status	Not authorized

[Authorize AnVIL RAS Login](#)

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	<a href="#">Edit</a>

Rows per page: 10 | 1 | >

#### Resources

Resource	create	access	read	read-storage
/cedar	<a href="#">REQUESTOR</a>			
/dictionary_page		<a href="#">DICTIONARY PAGE</a>		
/kayako			<a href="#">KAYAKO</a>	
/mds.gateway	<a href="#">REQUESTOR</a>			
/programs/open				<a href="#">FENCE</a> <a href="#">GUPPY</a> <a href="#">PEREGRINE</a> <a href="#">SHEEPDOG</a>

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

GEN3 Center for Translational Data Science at the University of Chicago

# New Design/UX

The screenshot shows the MIDRC Data Commons interface. At the top, there are tabs for 'Table View' and 'Graph View'. Below this, a search bar contains the query 'Case'. The main content area is titled 'ADMINISTRATIVE' and displays a list of properties for the 'Case' entity. Each property row includes columns for 'Property', 'Type', 'Required', and 'Description'. Buttons for 'JSON' and 'TSV' download are also present. The 'Dictionary' tab is currently selected. At the bottom, there is a section titled 'MEDICAL HISTORY'.

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 (TOGN) ( <a href="http://www.getty.edu/research/tools/vocabulary/tgn/index.html">http://www.getty.edu/research/tools/vocabulary/tgn/index.html</a> ). 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	A collection of data files in a project.		
Dataset	A set of metadata and associated data file objects originating from single a research study, clinical trial or patient cohort.		
Program	A broad framework of goals to be achieved. (NCIT C52647)		
Project	Any specifically defined piece of work that is undertaken or attempted to meet a single requirement. (NCIT C47885)		
Visit	Information about a specific visit for a specific case or patient.		

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

# New Design/UX

Cases Measurements Imaging Studies Imaging Series

Demographics

COVID Tests

Medications

Procedures

Conditions

Race

Ethnicity

Age at Index

Index Event

Zip

Covid19 Positive

Default Clear All

COVID-19 Positive

Sex

Race

12,159 Cases

Submitter Id

Sex

Age at Index

Index Event

Race

Ethnicity

Zip

Covid19 Positive

Test Name

Test Results Text

Test Me

10041569-68df4phIVE6o2f1hRyCoQ Female First COVID test Black or African American Not Hispanic or Latino 190 Yes COVID-19 COVID-19 NEGATIVE NEGATIVE RTPN

10041569-BKd0sP0e9k6o0cjxYKf0A Female 22 First COVID test Black or African American Not Hispanic or Latino 190 Yes COVID-19 COVID-19 POSITIVE RTPN

10022779-807crNmhEad0hKurVppg Male 55 First COVID test Black or African American Not Hispanic or Latino 000 Yes COVID-19 POSITIVE RTPN

10022779-sk67FLdMuieR0RrorpKbQ Male 34 First COVID test Black or African American Not Hispanic or Latino 701 Yes COVID-19 POSITIVE RTPN

639127-003983 Female 41 First COVID test Black or African American Not Hispanic or Latino 481 No COVID-19 COVID-19 NEGATIVE NEGATIVE RTPN

639127-002690 Female 53 First COVID test Black or African American Not Hispanic or Latino 482 No COVID-19 NEGATIVE RTPN

10003752-XYEULmF7ke9a0jgXAbfRdQ Female 21 First COVID test Black or African American Not Hispanic or Latino 606 No COVID-19 NEGATIVE RTPN

639127-004339 Male 66 First COVID test Black or African American Not Hispanic or Latino 482 No COVID-19 NEGATIVE RTPN

302028-000839 Female 54 First COVID test Black or African American Not Hispanic or Latino US No COVID-19 NEGATIVE RTPN

232451-000459 Female 68 First COVID test Black or African American Not Hispanic or Latino US No COVID-19 COVID-19 NEGATIVE NEGATIVE RTPN

Rows per page: 10 | 1-10 of 12,159 | < > >>

Discovery Dictionary Exploration Query Analysis Workspace Profile

Center for Translational Data Science

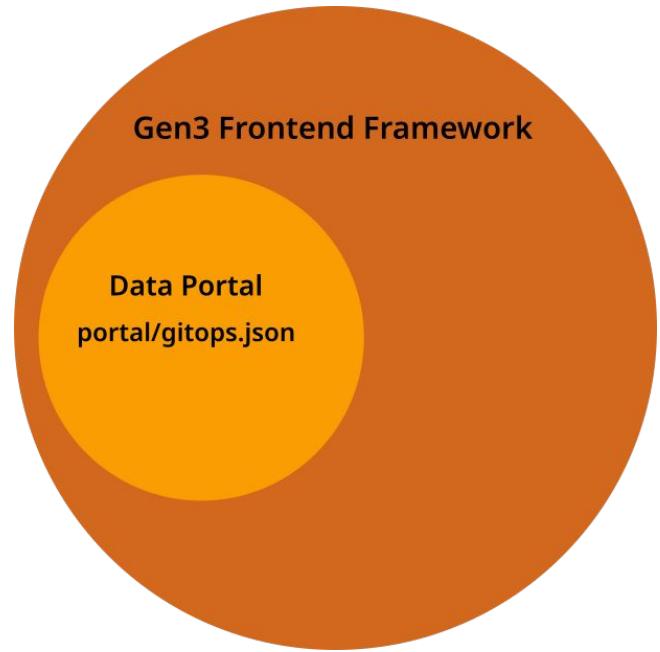
# NextJS Application Framework



- 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

# Site Configuration

- 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

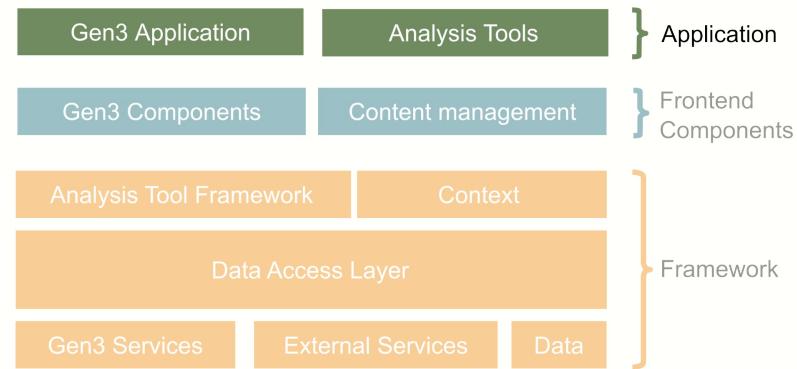


# Data-commons Web Application Framework



- 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



# Custom Content and Analysis Tools



- 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.

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

# Development Environment

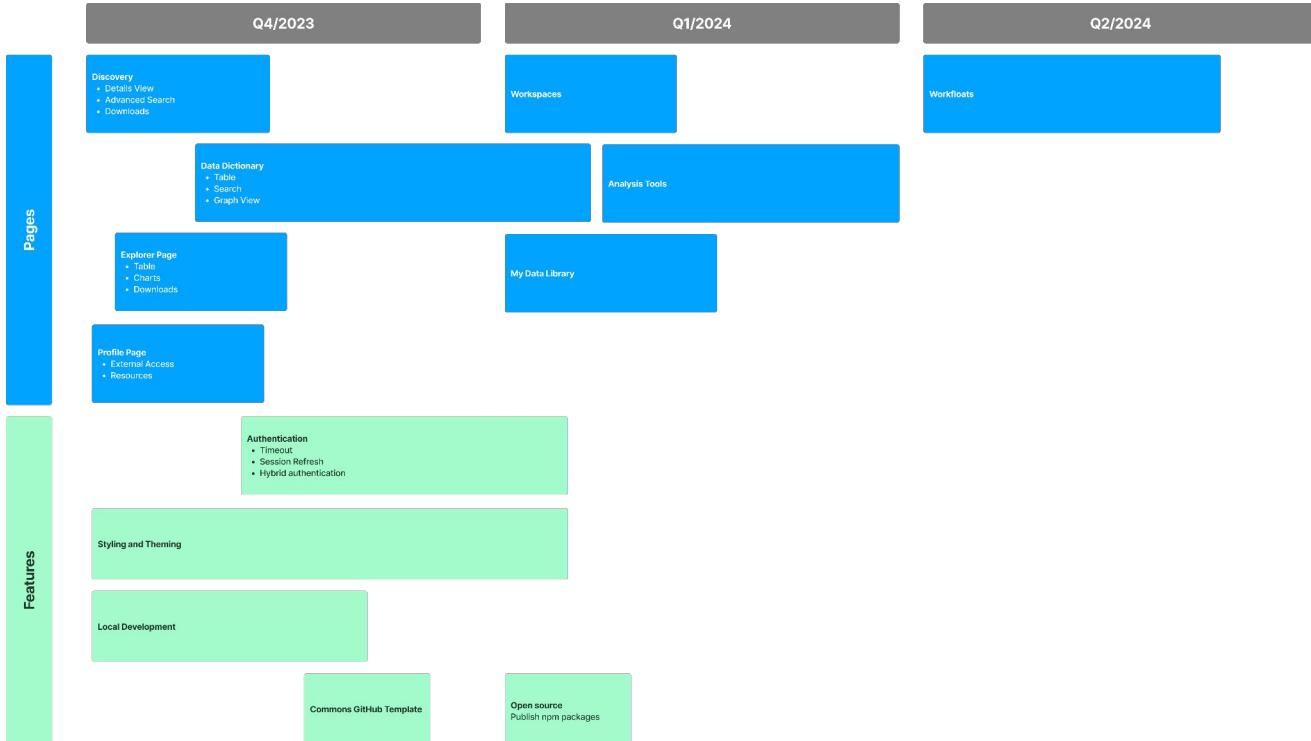


- Local development using Gen3 Helm charts for Gen3 Services
- Commons site runs as a NextJS development server
- Support development features:
  - hot reloading,
  - debugging w/breakpoints
- Plan to support debug commons
- Provide sample helm configurations and tools to run local development environment

# Status and Roadmap

## Current:

- Discovery Page
- Query Page
- Login
- Profile
- Basic theming
- Configuration



# Conclusion

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

# Acknowledgements

- **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