GEN3 DATA COMMONS

Introduction to the Gen3 Frontend Framework

Gen3 Community Forum
1 November 2023

THE UNIVERSITY OF CHICAGO
CENTER FOR TRANSLATIONAL DATA SCIENCE

OCC

Australian BioCommons

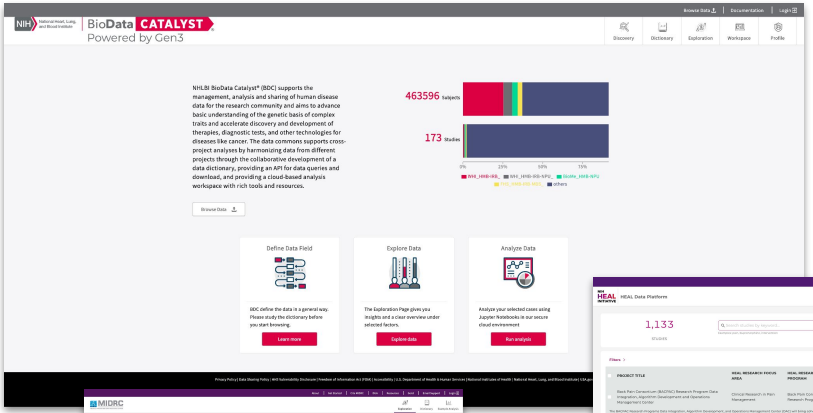
NeSI
New Zealand eScience Infrastructure

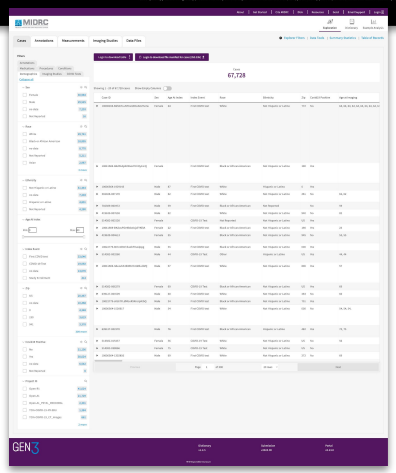
The Agenda

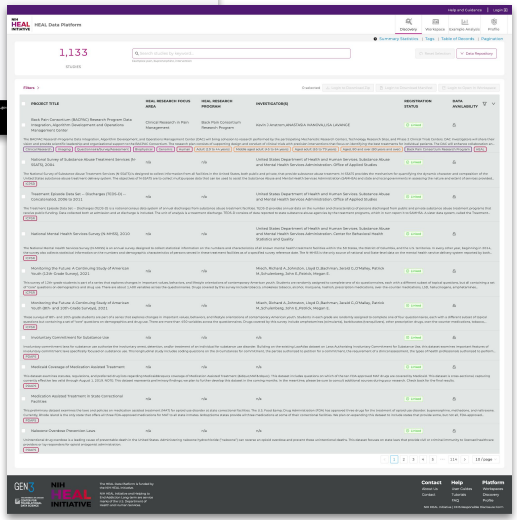
- Introduction
- Presentation
- Q&A
- Topics for future Gen3 Community Events

Gen3 Frontend Framework

Gen3 Data Commons: Current UI Windmill/data-portal







Windmill strengths and weaknesses

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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

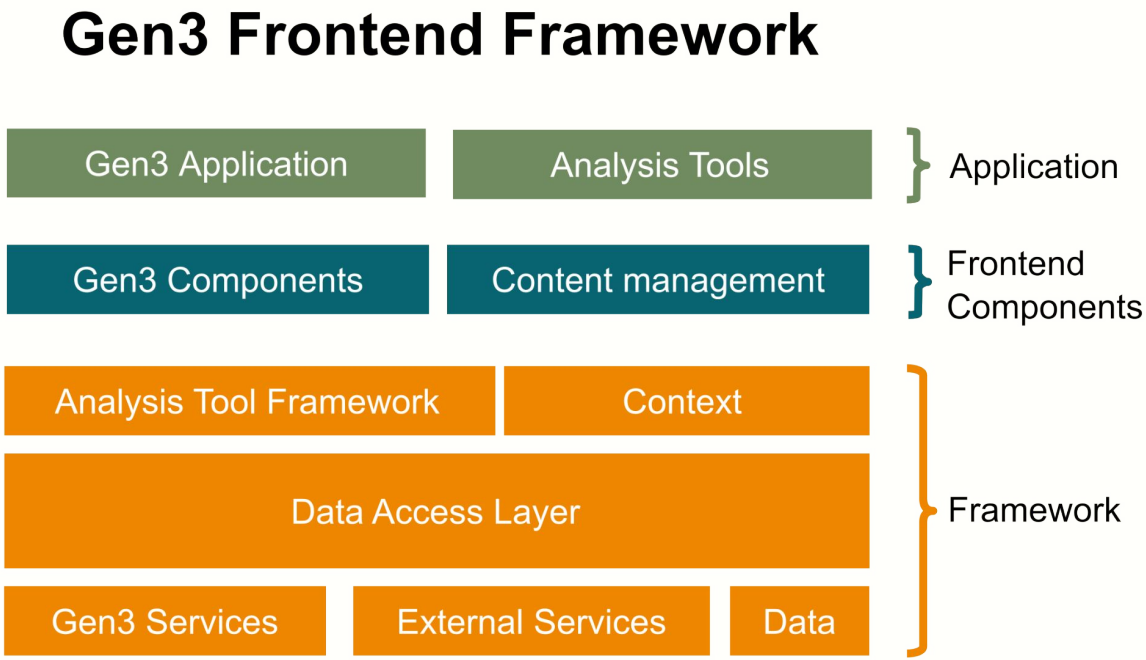
Gen3 Frontend Framework

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

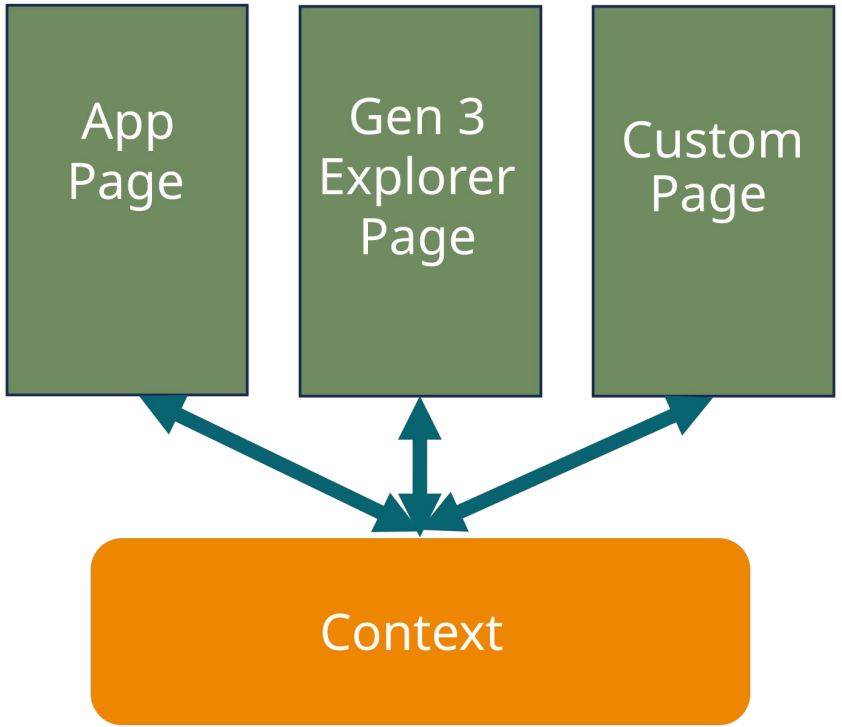
Overview

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



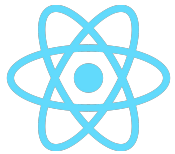
Context

- 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

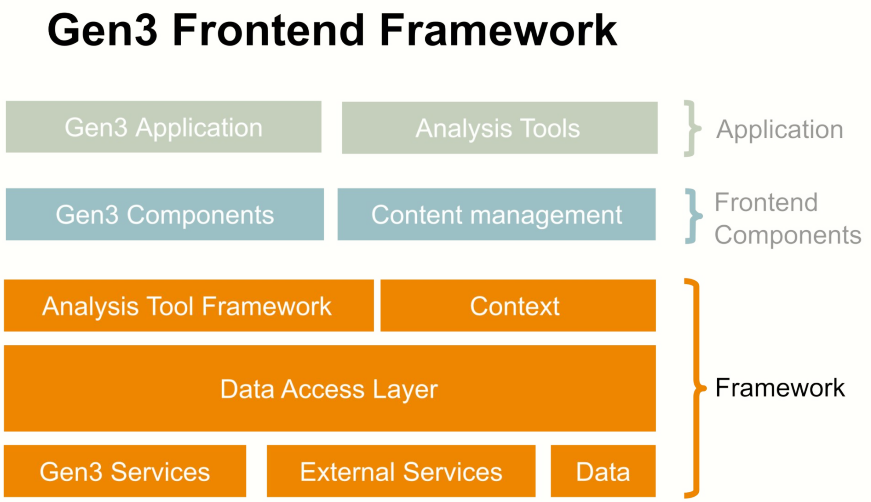


Framework Modules

- 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

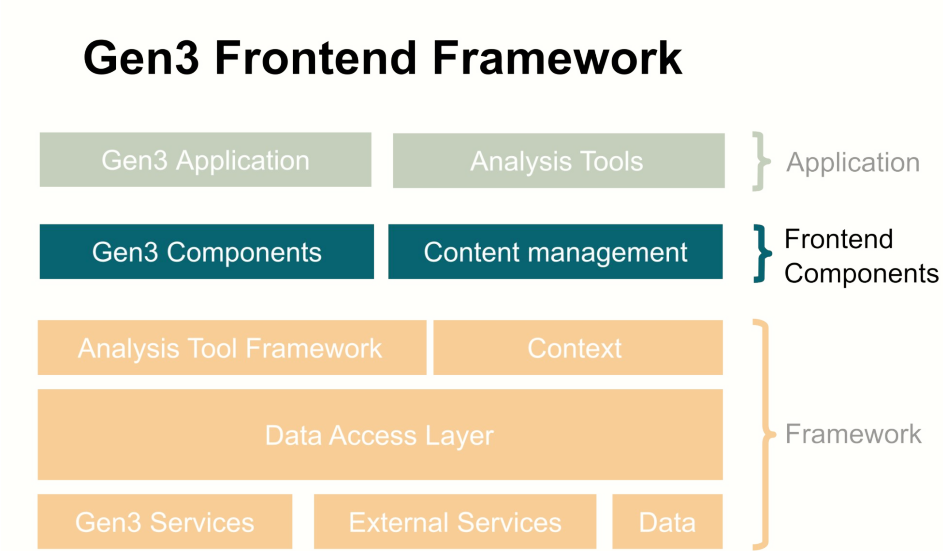


Analysis Tool Framework (ATF)

- 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



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

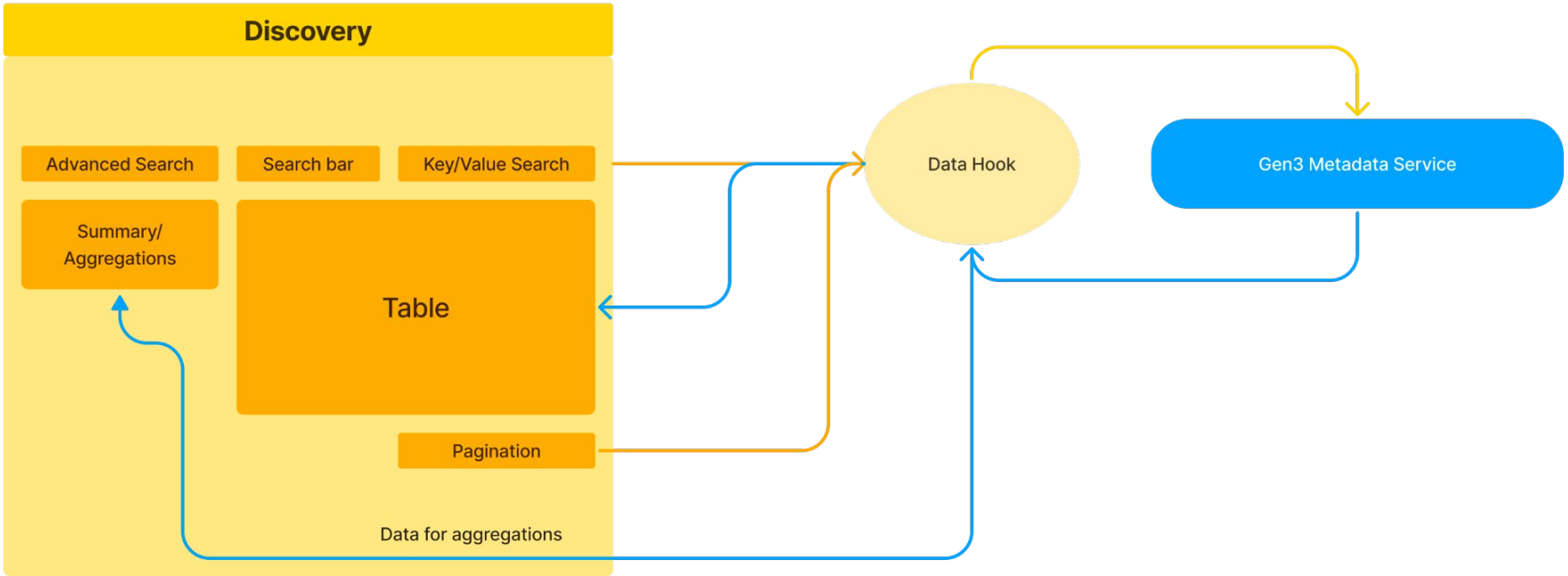
Data-portal:

- 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

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```
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);
};
```

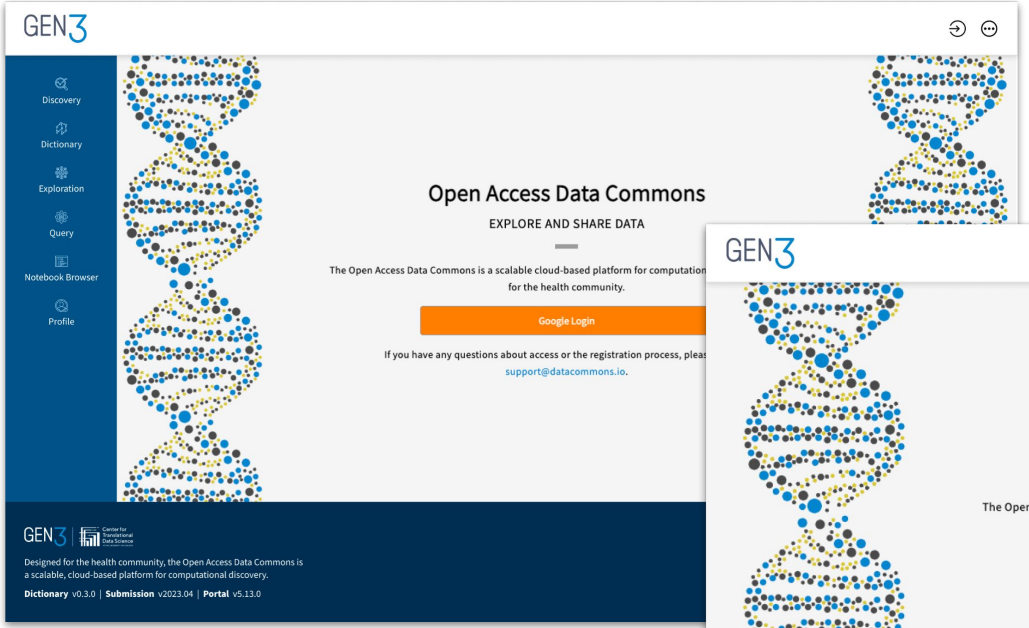
Test Name	Test Results Text
COVID-19 COVID-19 COVID-19 COVID-19	NEGATIVE NEGATIVE NEGATIVE POSITIVE
COVID-19	POSITIVE
COVID-19	POSITIVE
COVID-19	POSITIVE
COVID-19 COVID-19 COVID-19	NEGATIVE NEGATIVE NEGATIVE
COVID-19	NEGATIVE
COVID-19	NEGATIVE
COVID-19	NEGATIVE
COVID-19	NEGATIVE
COVID-19 COVID-19 COVID-19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

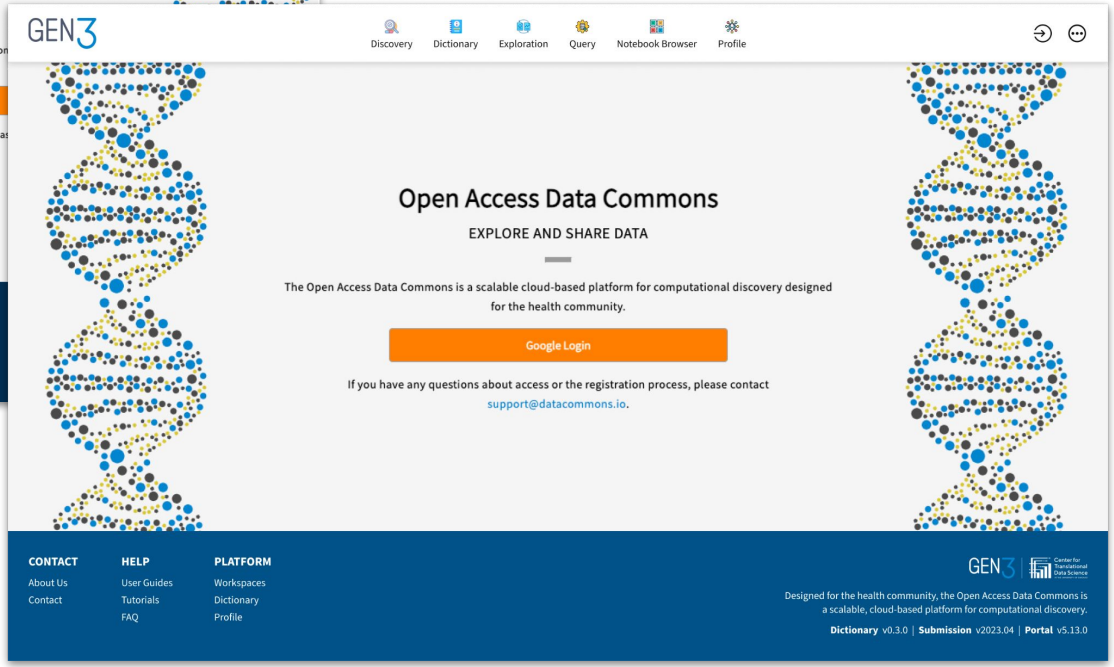
Rows per page 10 1-10 of 12,159

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





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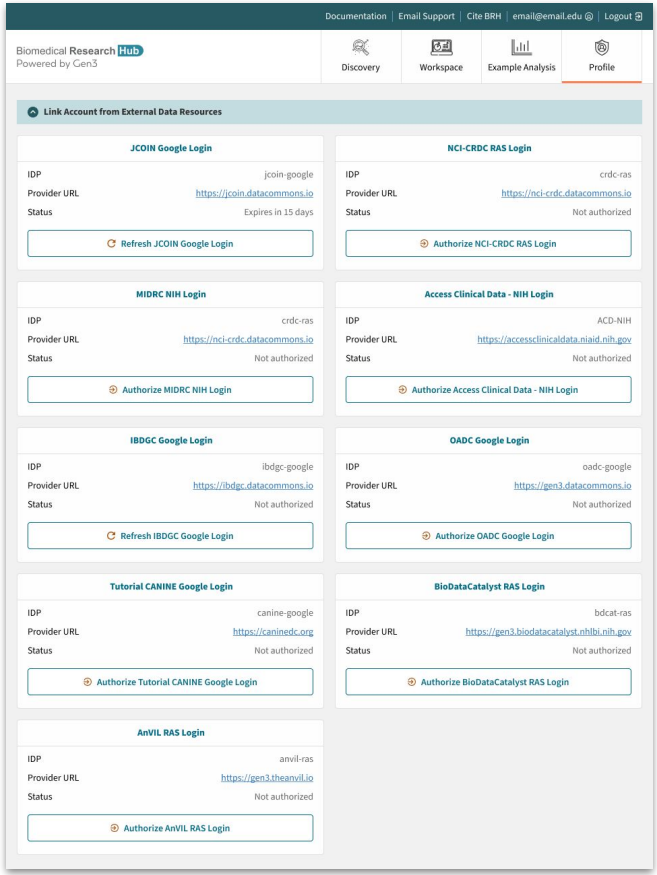

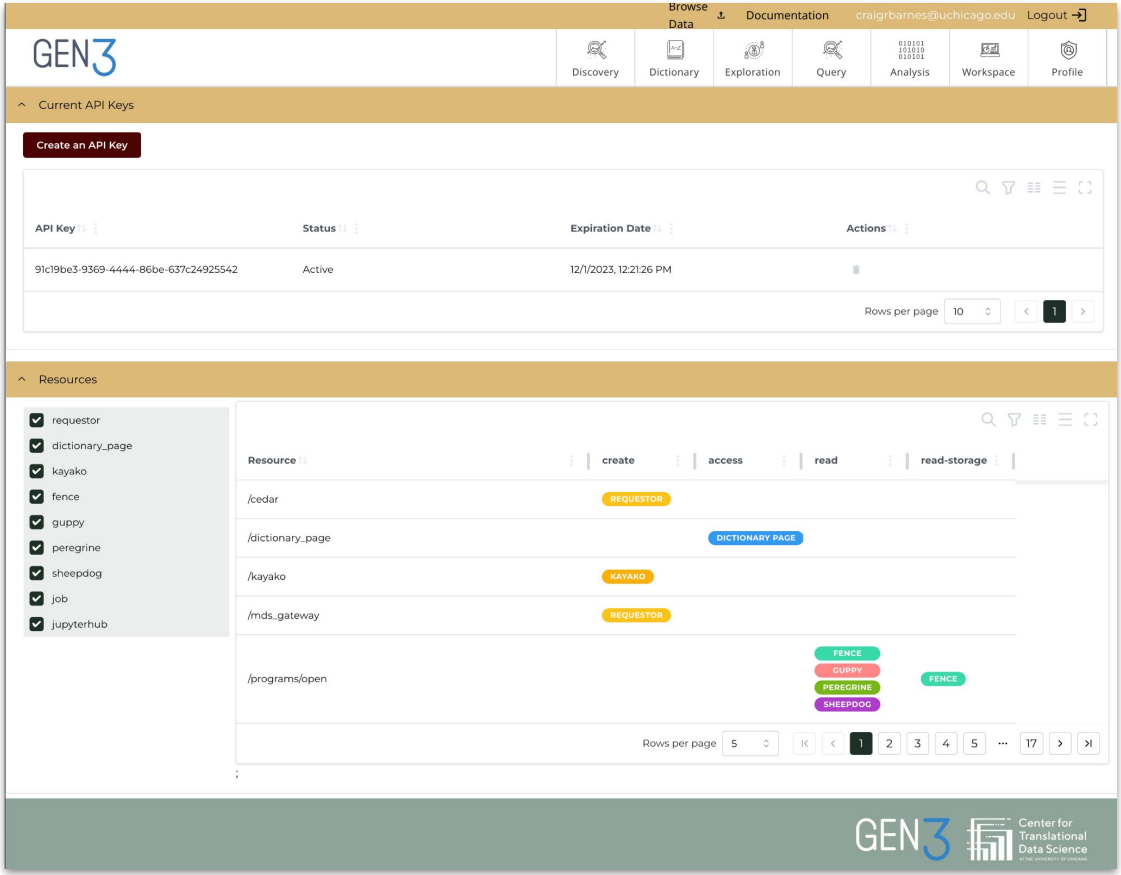

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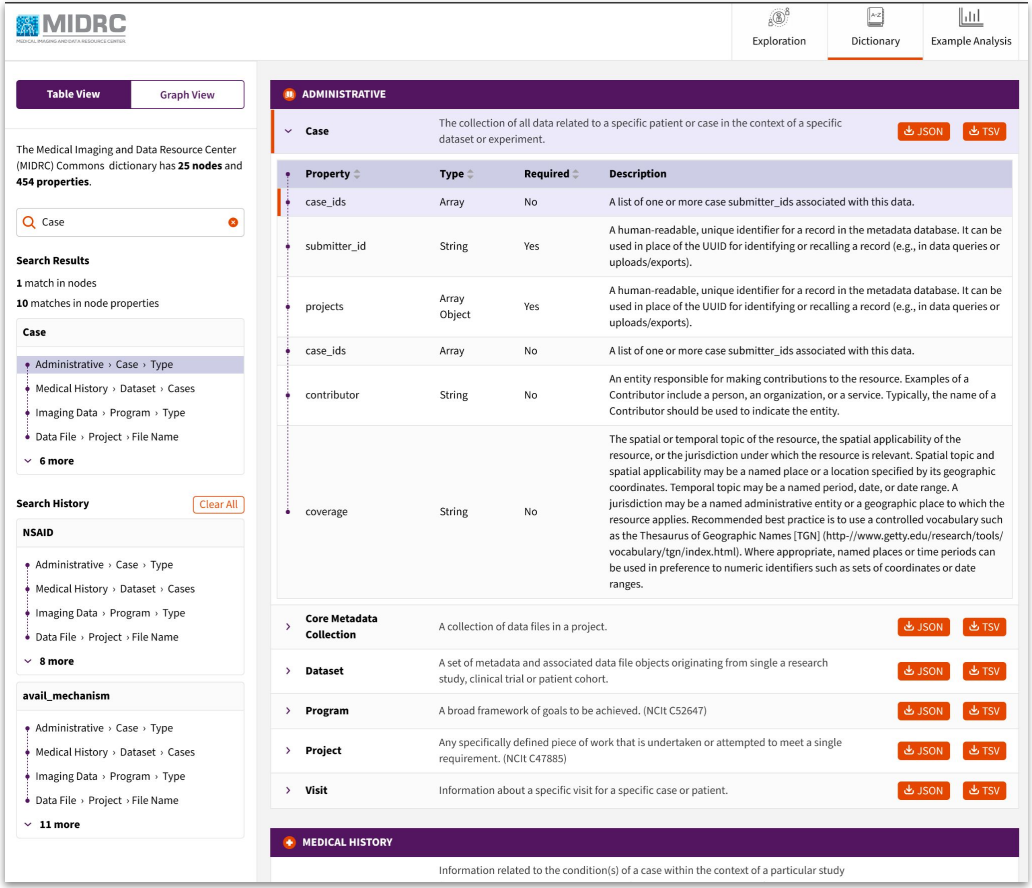

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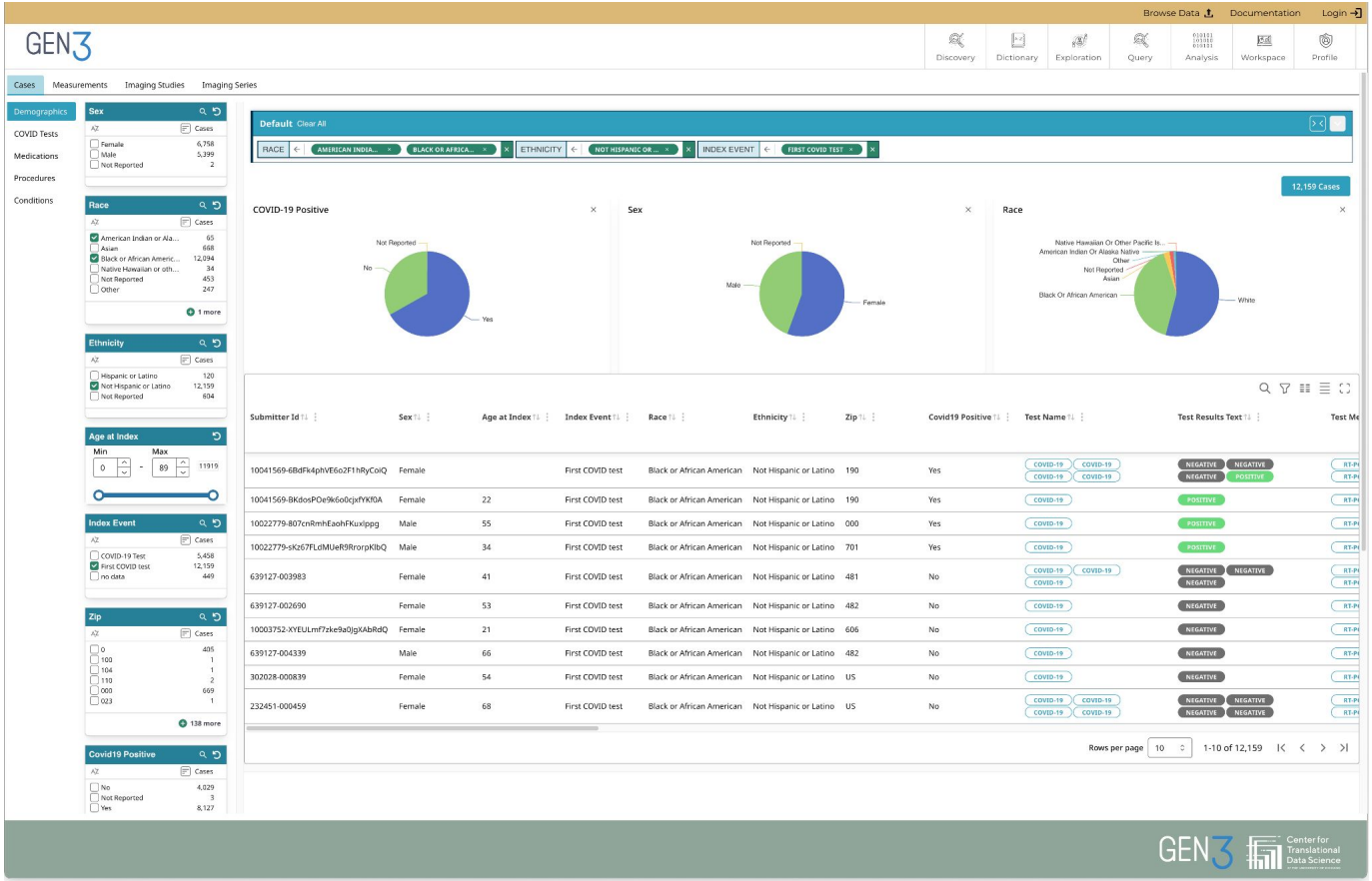
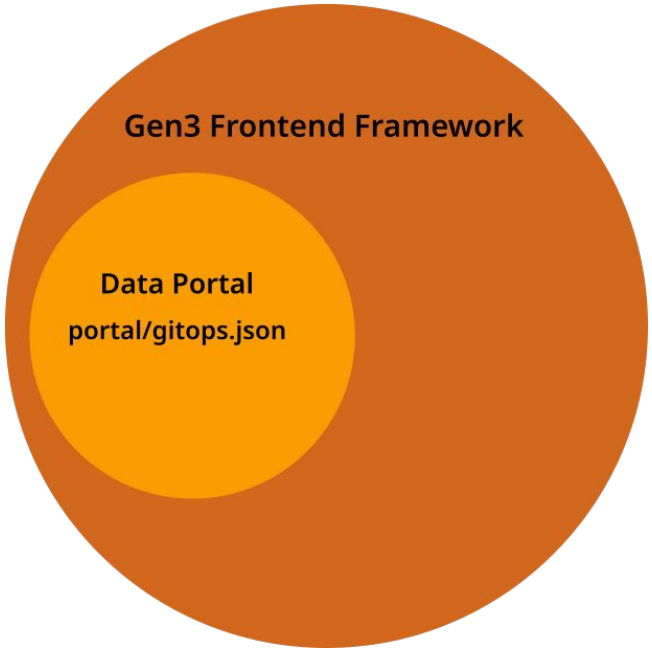


NextJS Application Framework

- 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

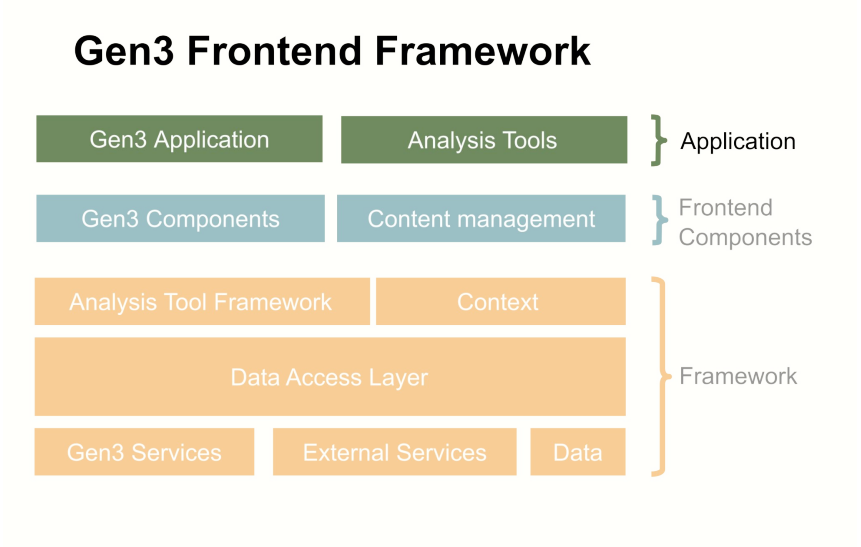
Site Configuration

- 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



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

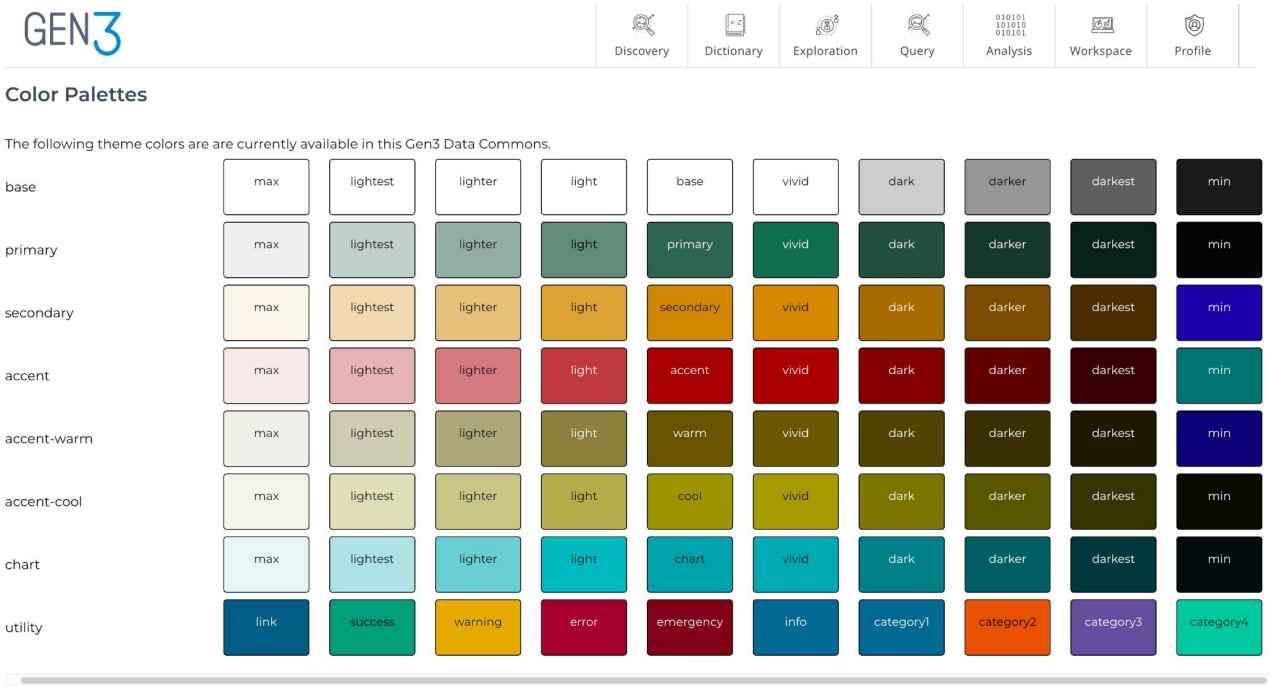
Color tokens based on USWDS:

- 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



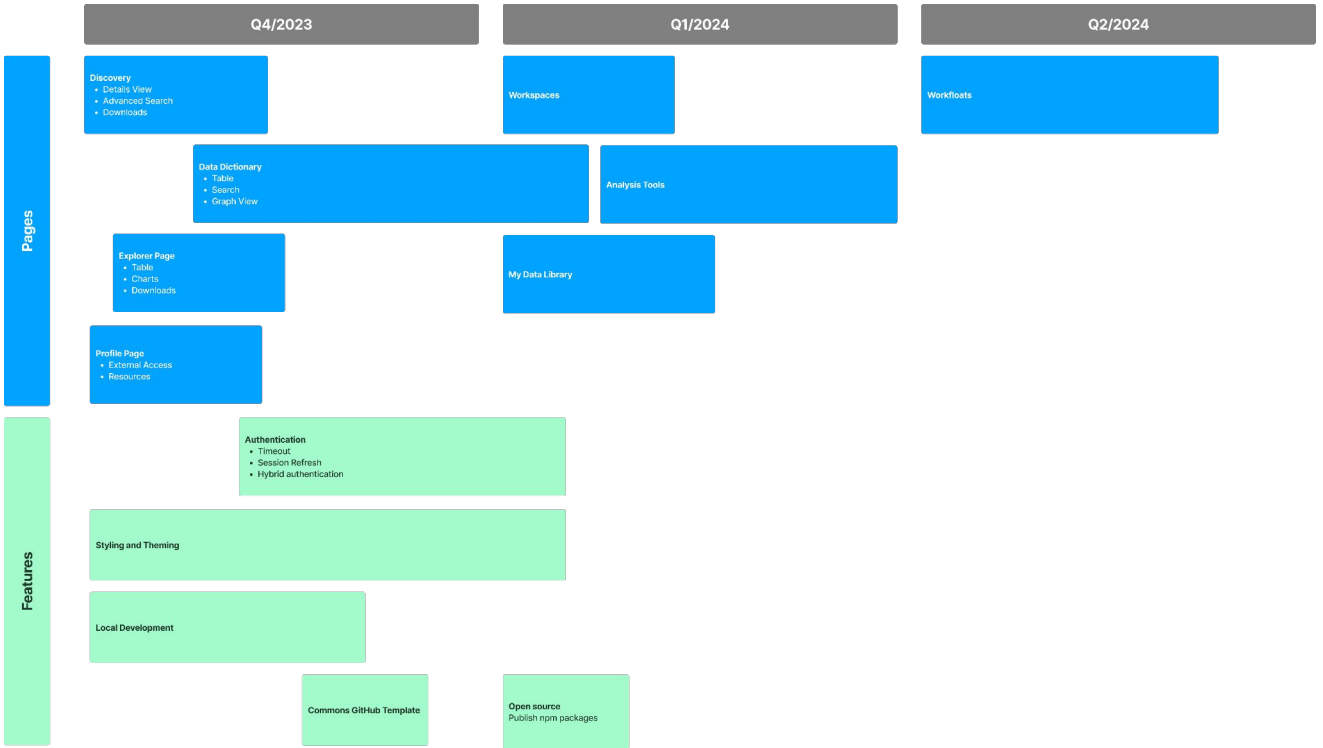
Development Environment

- 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
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- Gen3 Forum Steering Committee
  - Robert Grossman - Center for Translational Data Science, University of Chicago
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  - Plamen Martinov - Open Commons Consortium
  - Michael Fitzsimons - Center for Translational Data Science, University of Chicago

Questions