OBJECT COMPUTING
HOME TO GRAILS & MICRONAUT

Build a Better API with GORM & GraphQL

Zachary Klein, Senior Software Engineer
STL JUG
October 10 2019

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19 AVERAGE YEARS
Engineering Experience

14 AVERAGE YEARS
OCI Tenure

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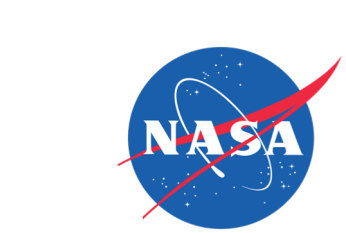

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REPEAT CLIENTS

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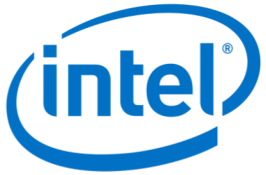

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Grails

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https://grails.org

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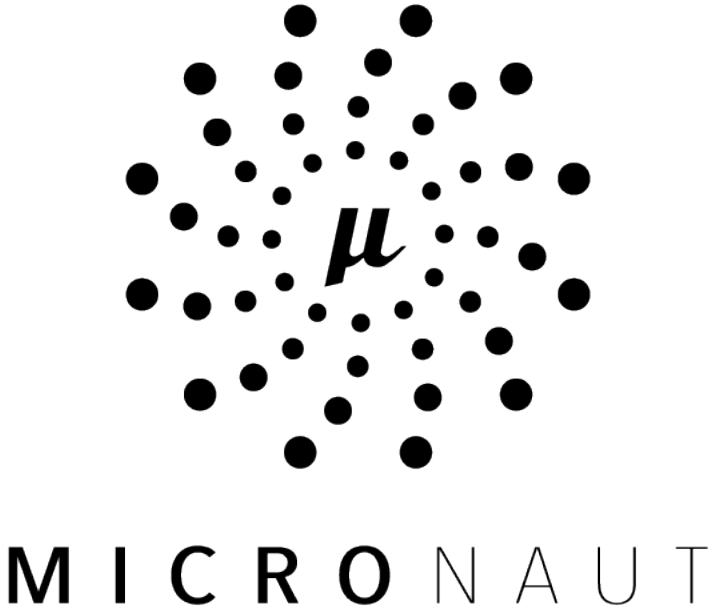
Micronaut



https://micronaut.io

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About Me

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Zachary Klein is a Senior Software Engineer at OCI. He has been practicing web development since 2010 and frontend development since 2015. He's a contributor to both the Grails and Micronaut frameworks, a conference speaker and an instructor in OCI's training practice.

Zachary's home base is in St Louis, MO, along with his wife, Beth, and their three children.

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Agenda

1. What is GraphQL?
    1. Overview
    2. Considerations & Limitations
2. Introducing GORM for GraphQL
    1. Overview
    2. Customization
    3. Testing

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The Problem

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REST is too **rigid** 😟

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The Solution

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GraphQL 😄

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What is GraphQL?

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NOT a Graphing Database! 🤔

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What is GraphQL?

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- Specification
- Schema Definition
- Introspective
- Application Layer Middleware
- Strongly-Typed

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Advantages of GraphQL

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Efficiency, **Efficiency**, *Efficiency* 🚀

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Advantages of GraphQL 👍

- Multiple operations simultaneously
- Only the data requested is returned
- Self documenting
- Client features to control response based on variables and data types
- One “endpoint” can support many use cases

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Disadvantages of GraphQL 👎

- Truly Dynamic Data Not Easy
- Recursive Data Structures
- Inflexible Security
- Time Intensive To Setup
- (Yet) Another Point Of Failure
- Client-side complexity

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Disadvantages of GraphQL 👎

- Truly Dynamic Data Not Easy
- Recursive Data Structures
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Demo GraphQL

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GitHub API v4 is implemented with GraphQL:

https://developer.github.com/v4/

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Challenges implementing GraphQL

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- Generating a Schema
- Efficient queries
- Implementing HTTP layer (for web apps)

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Generating a Schema

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1. Define your domain model

```
class Book {

    String title

    Date dateCreated
    Date lastUpdated

    static hasMany = [pages: Page]

    static constraints = {
    }
}
```

```
class Page {

    Integer number
    String text

    static belongsTo = [book: Book]

    static constraints = {
    }
}
```

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Generating a Schema

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2. Define arguments for input

…for each argument type

```
newInputObject()
    .name( name: 'BookCreate')
    .field(newInputObjectField()
        .name( name: "title")
        .type(nonNull(Scalars.GraphQLString)))
    .field(newInputObjectField()
        .name( name: "pages")
        .type(list(newInputObject()
            .name( name: "PageCreateNested")
            .field(newInputObjectField()
                .name( name: "id")
                .type(Scalars.GraphQLLong))
            .field(newInputObjectField()
                .name( name: "number")
                .type(Scalars.GraphQLInt))
            .field(newInputObjectField()
                .name( name: "text")
                .type(Scalars.GraphQLString)).build())))
```

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Generating a Schema

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3. Define each query/mutation

…handle versioning,

validation…

4. And so on…

```
newInputObject()
    .name( name: 'BookUpdate')
    .field(newInputObjectField()
        .name( name: "version")
        .type(Scalars.GraphQLLong))
    .field(newInputObjectField()
        .name( name: "title")
        .type(Scalars.GraphQLString))
    .field(newInputObjectField()
        .name( name: "pages")
        .type(list(newInputObject()
            .name( name: "PageUpdateNested")
            .field(newInputObjectField()
                .name( name: "id")
                .type(Scalars.GraphQLLong))
            .field(newInputObjectField()
                .name( name: "number")
                .type(Scalars.GraphQLInt))
            .field(newInputObjectField()
                .name( name: "text")
                .type(Scalars.GraphQLString)).build())))
```

New Field

Null Allowed

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Implementing HTTP layer

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Implement GraphQL best practices for:

- Content Types
- Request Methods
- Parameter Names
- Endpoint URI
- Response Format

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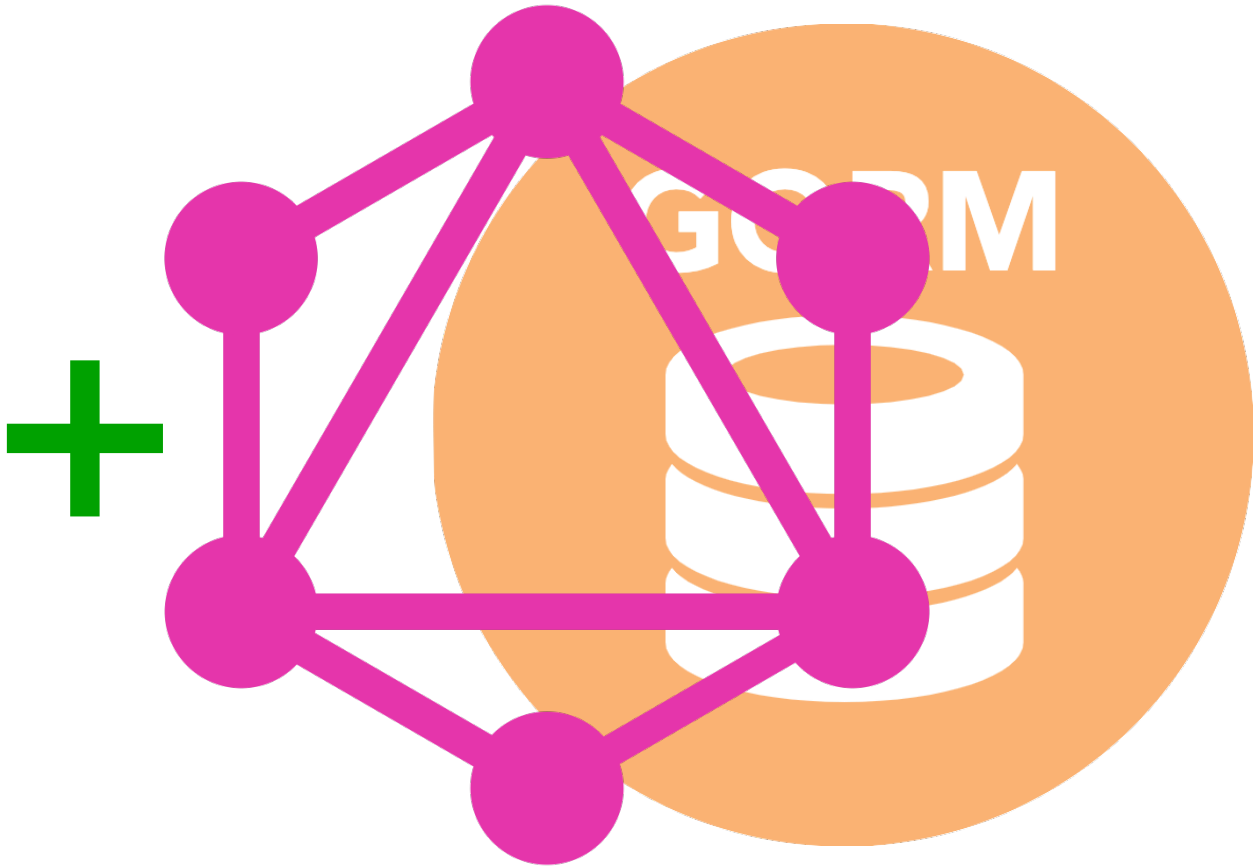
It’s a lot of work! 😴

GORM

- **Groovy-based** data access &
  persistence framework
- Originally an ORM fram
  Hibernate
- Supports MongoDB, I
- Supports RxJava for
  applications
- Supports multiple data
- Usable in **Grails**, **Spring**
  Java applications generally


GORM

What is GORM for GraphQL?

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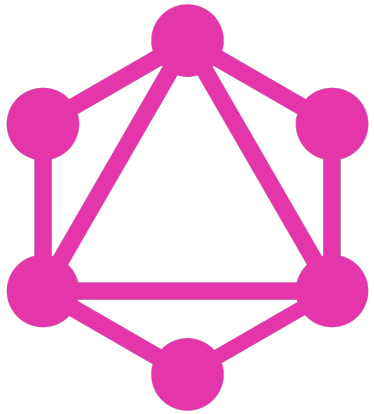
- GraphQL Schema-generation **library**
  - Also generates standard CRUD operations
- Grails (3 & 4) **plugin** with additional features
  - HTTP communication, GraphiQL browser, testing utilities, etc



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GORM for GraphQL Features

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Core Library:

- Schema generation
- Query & Mutation generation
- Efficient Query building

Grails Plugin

- HTTP Communication
- Spring Integration
- GraphiQL Browser
- Data Binding
- Testing Support

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Getting Started

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1. Add `static graphql` property
2. GORM/GraphQL will generate 6 operations for each exposed domain class:
   - Create
   - Update
   - Delete
   - List
   - Show
   - Count

```
class Book {

    String title

    Date dateCreated
    Date lastUpdated

    static hasMany = [pages: Page]

    static constraints = {
    }

    static graphql = true
}
```

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Demo GORM for GraphQL

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Example Application:

https://github.com/grails-samples/graphql-demo

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Customizing the Schema

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- How do I customize the existing operations?
- How do I add my own operations?
- How do I add custom properties?
- How do I deprecate properties?
- How do I add a description for my properties?
- How do I supply my own queries?
- How do I change how validation errors are returned?
- How do I change the response for a delete?
- How do I …

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GraphQL Customization Concepts

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- **Data Fetcher**: Responsible for retrieving all data
- **Interceptor**: Customize behavior of operations and fields within the schema
- **Data Binders**: Binds incoming arguments to persistence entities
- **Scalars**: Type conversion between custom types and the schema

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Customization Opportunities

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There are several areas where customizations can occur.

Persistent Entity Mapping

- Define Metadata (Description, etc)
- Add New Properties
- Create New Operations
- Override Data Fetchers For Properties
- Exclude Properties

Bean Post Processor (Plugin Only)

- Add Custom Scalar Types
- Register Data Fetchers For Domains
- Register Data Binders For Domains
- Register Interceptors

Bean Overrides (Plugin Only)

- Delete Response Handler
- Validation Errors Response Handler
- Many Others…

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Customizing the Schema

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Replace:

```
static graphql = true
```

With:

```
static graphql = GraphQLMapping.build {


}
```

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Customizations - Return Types

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Return type of custom properties/operations/arguments/fields can be either:

1. `Class (Author)`: Instance of class
2. `List<Class> ([Author])`: Collection of instances
3. `PaginatedType`: Paginated collection
4. `String ("CustomType")`: Custom return type

```
add(name, type) {} // Adding a custom property
query(name, type) {} // Defining a new query operation
mutation(name, type) {} // Defining a new mutation operation
```

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Customizations - Custom Types

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- Custom types are a collection of fields.
- Custom types require a data fetcher to be provided in order to return the desired data to GraphQL.
- The defined fields follow the same rules for return types and can be a custom type themselves.

```
class Author {

    LocalDate birthDay

    Map getAge() {
        LocalDate now = LocalDate.now()

        [days: ChronoUnit.DAYS.between(birthDay, now),
         months: ChronoUnit.MONTHS.between(birthDay, now),
         years: ChronoUnit.YEARS.between(birthDay, now)]
    }

    static graphql = GraphQLMapping.build {
        add( 'age', typeName: 'Age') {
            input input: false
            type {
                field('days', Long)
                field('months', Long)
                field('years', Long)
            }
        }
    }
}
```

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Customizations - Metadata

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Metadata can be defined either via the mapping DSL or the @GraphQL annotation

Examples

Adding a description to a property (Mapping DSL):

```
property( name: "name", description: "The name of the Author")
```

And with the annotation:

```
@GraphQL("The name of the author")
String name
```

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Customizations - Custom Operations

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- Operations of of two types: **query** and **mutation**
- Both type require a **data fetcher**

```
query( name: 'usersByRole', [User]) {
    argument('role', Long)
    dataFetcher(new UsersByRoleDataFetcher())
}
```

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Customizations - Custom Operations

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```
@CompileStatic
class UsersByRoleDataFetcher extends EntityDataFetcher<List<User>> {

    UsersByRoleDataFetcher() {
        super(User.gormPersistentEntity)
    }

    @GrailsCompileStatic
    @Override
    protected List executeQuery(DataFetchingEnvironment environment, Map queryArgs) {
        Role role = Role.load((Serializable) environment.getArgument( name: 'role'))
        def users = UserRole.where { role == role }.property( property: 'user')
        User.where {
            id in users
        }.list(queryArgs)
    }
}
```

Provided By Library

Type being queried

Join Properties

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Data Fetchers - Context

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- Data Fetchers are not part of the Spring application context
- Not request-aware
- Data Fetchers have a **context** which can be manipulated via an exposed bean
- Default context is a **Map** with a single key, “locale” (locale of the current HTTP request)

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Data Fetchers - Context

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```
class MyGraphQLContextBuilder extends DefaultGraphQLContextBuilder {

    @Autowired
    SpringSecurityService springSecurityService

    @Override
    Map buildContext(GrailsWebRequest request) {
        Map context = super.buildContext(request)
        context.springSecurityService = springSecurityService
        context
    }
}
```

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Customization - Interceptors

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- GraphQL uses a single endpoint
- Security rules cannot by applied based on URL
- Interceptors provide an opportunity to perform authorization checking
- Best practice: return null for data/operations that are not allowed
- 2 basic types of interceptors:
  - Interceptor executed prior to data fetcher execution
  - Interceptor executed prior to schema generation (low-level)

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Customization - Interceptors

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```
class AuthorUpdateInterceptor extends BaseGraphQLFetcherInterceptor {

    @Override
    boolean onMutation(DataFetchingEnvironment environment, GraphQLDataFetcherType type) {
        if (type == GraphQLDataFetcherType.UPDATE) {
            Author author = Author.get((Long) environment.getArgument( name: "id"))
            Map context = (Map) environment.context
            SpringSecurityService springSecurityService = (SpringSecurityService) context.springSecurityService
            springSecurityService.currentUser == author.user
        } else {
            true
        }
    }
}
```

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Interceptor Registration

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1. Define a bean post processor class and access the `GraphQLInterceptorManager`.
2. Register your custom interceptor and any domain classes that should trigger it

```
class MyGraphQLCustomizer extends GraphQLPostProcessor {

    @Override
    void doWith(GraphQLInterceptorManager interceptorManager) {
        interceptorManager.registerInterceptor(Author, new AuthorUpdateInterceptor())
    }
}
```

3. Register this class as a bean in resources.groovy.

```
beans = {
    myGraphQLCustomizer(MyGraphQLCustomizer)
}
```

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Customizations - Data Binding

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```
@CompileStatic
class UserDataBinder extends GrailsGraphQLDataBinder {

    @Override
    void bind(Object object, Map data) {
        Integer first = (Integer)data.remove( key: 'firstNumber')
        Integer second = (Integer)data.remove( key: 'secondNumber')
        if (first != null && second != null) {
            data.put('addedNumbers', first + second)
        }
        super.bind(object, data)
    }
}
```

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Data Binder Registration

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1. Define a bean post processor class and access the `GraphQLInterceptorManager`.
2. Register your custom interceptor and any domain classes that should trigger it

```
class MyGraphQLCustomizer extends GraphQLPostProcessor {

    @Override
    void doWith(GraphQLDataBinderManager dataBinderManager) {
        dataBinderManager.registerDataBinder(User, new UserDataBinder())
    }
}
```

3. Register the class as a bean in resources.groovy.

```
beans = {
    myGraphQLCustomizer(MyGraphQLCustomizer)
}
```

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Testing Utilities

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The Grails Plugin provides two testing helpers:

1. Functional test trait
2. Unit-testing support for schema generation

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Functional Test Trait

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```
@Integration
class PetIntegrationSpec extends Specification implements GraphQLSpec {

    void "test calling graphql"() {
        when:
        def resp = graphQL.graphql( requestBody: """
            mutation {
                petCreate(pet: {
                    name: "Butch",
                    type: DOG
                }) {
                    id
                }
            }
        """)

        def result = resp.json

        then:
        result.data.petCreate.id == 1
    }
}
```

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Schema Testing

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```
class SchemaSpec extends Specification implements GraphQLSchemaSpec {

    @Shared @AutoCleanup HibernateDatastore hibernateDatastore
    @Shared GraphQLSchema schema
    @Shared GraphQLObjectType queryType
    @Shared GraphQLObjectType mutationType

    void setupSpec() {
        hibernateDatastore = new HibernateDatastore(
                DatastoreUtils.createPropertyResolver(
                        Collections.singletonMap(Settings.SETTING_DB_CREATE, 'create-drop')),
                GeneralPackage.getPackage(), HibernatePackage.getPackage())
        schema = new Schema(hibernateDatastore.mappingContext).generate()
        queryType = schema.queryType
        mutationType = schema.mutationType
    }
```

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Resources

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- Documentation: https://grails.github.io/gorm-graphql/snapshot/guide/index.html
- Grails Guide: https://guides.grails.org/gorm-graphql-with-react-and-apollo/guide/index.html
- GraphQL website: https://www.graphql.org
- Grails Sample code: https://github.com/grails-samples/graphql-demo
- Micronaut sample code: https://github.com/jameskleeh/micronaut-gorm-graphql-example

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Grails Application Forge: http://start.grails.org

GRAILS APPLICATION FORGE

Project Type:
Application

Name your application:
myapp

Version:
3.3.5

Profile:
web

Pick your Features:
- [x] asset-pipeline
- [x] events
- [x] geb
- [ ] geb2
- [x] gsp
- [ ] hibernate4
- [x] hibernate5
- [ ] json-views
- [ ] less-asset-pipeline
- [ ] markup-views
- [ ] mongodb
- [ ] neo4j
- [ ] rx-mongodb

Generate

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Grails Guides: http://guides.grails.org

GUIDES

LATEST GUIDES

TWITTER OAUTH WITH GRAILS 3 AND SPRING SECURITY REST
Apr 30, 2018 - Advanced Grails
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Apr 02, 2018 - Grails + Devops
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BUILDING A VUE.JS APP WITH GRAILS
Mar 26, 2018 - Grails + Vue.js
Read More

SEARCH

GRAILS TRAINING

Course	Date(s)	Instructor(s)	Hour(s)
Micronaut Deep Dive at GR8Conf US	Jul 23 - Jul 24	Brown	12
Introduction to Grails Security	May 17 - May 18	del Amo Caballero	6
GROOVY 2.5 UPDATE	May 18	King	1

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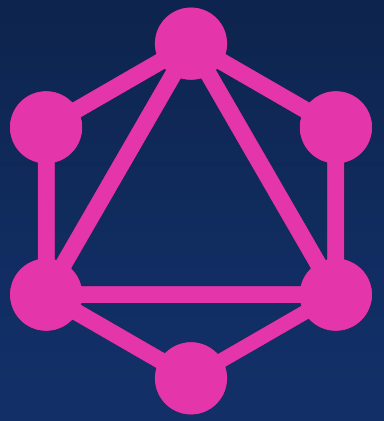
Thank you!



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Q&A

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