

Spring Data JPA - Reference Documentation

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NOTE

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Preface

Chapter 1. Project metadata

- Version control - <http://github.com/spring-projects/spring-data-jpa>
- Bugtracker - <https://jira.spring.io/browse/DATAJPA>
- Release repository - <https://repo.spring.io/libs-release>
- Milestone repository - <https://repo.spring.io/libs-milestone>
- Snapshot repository - <https://repo.spring.io/libs-snapshot>

Chapter 2. New & Noteworthy

2.1. What's new in Spring Data JPA 1.10

- Support for [Projections](#) in repository query methods.
- Support for [Query by Example](#).
- The following annotations have been enabled to build own, composed annotations: [@EntityGraph](#), [@Lock](#), [@Modifying](#), [@Query](#), [@QueryHints](#) and [@Procedure](#).
- Support for [Contains](#) keyword on collection expressions.
- AttributeConverters for [ZoneId](#) of JSR-310 and ThreeTenBP.
- Upgrade to Querydsl 4, Hibernate 5, OpenJPA 2.4 and EclipseLink 2.6.1.

Chapter 3. Dependencies

Due to different inception dates of individual Spring Data modules, most of them carry different major and minor version numbers. The easiest way to find compatible ones is by relying on the Spring Data Release Train BOM we ship with the compatible versions defined. In a Maven project you'd declare this dependency in the `<dependencyManagement />` section of your POM:

Example 1. Using the Spring Data release train BOM

```
<dependencyManagement>
  <dependencies>
    <dependency>
      <groupId>org.springframework.data</groupId>
      <artifactId>spring-data-releasetrain</artifactId>
      <version>${release-train}</version>
      <scope>import</scope>
      <type>pom</type>
    </dependency>
  </dependencies>
</dependencyManagement>
```

The current release train version is **Hopper-SR11**. The train names are ascending alphabetically and currently available ones are listed [here](#). The version name follows the following pattern: `${name}-${release}` where release can be one of the following:

- **BUILD-SNAPSHOT** - current snapshots
- **M1**, **M2** etc. - milestones
- **RC1**, **RC2** etc. - release candidates
- **RELEASE** - GA release
- **SR1**, **SR2** etc. - service releases

A working example of using the BOMs can be found in our [Spring Data examples repository](#). If that's in place declare the Spring Data modules you'd like to use without a version in the `<dependencies />` block.

Example 2. Declaring a dependency to a Spring Data module

```
<dependencies>
  <dependency>
    <groupId>org.springframework.data</groupId>
    <artifactId>spring-data-jpa</artifactId>
  </dependency>
</dependencies>
```

3.1. Dependency management with Spring Boot

Spring Boot already selects a very recent version of Spring Data modules for you. In case you want to upgrade to a newer version nonetheless, simply configure the property `spring-data-releasetrain.version` to the `train name and iteration` you'd like to use.

3.2. Spring Framework

The current version of Spring Data modules require Spring Framework in version 4.2.9.RELEASE or better. The modules might also work with an older bugfix version of that minor version. However, using the most recent version within that generation is highly recommended.

Chapter 4. Working with Spring Data Repositories

The goal of Spring Data repository abstraction is to significantly reduce the amount of boilerplate code required to implement data access layers for various persistence stores.

Spring Data repository documentation and your module

IMPORTANT

This chapter explains the core concepts and interfaces of Spring Data repositories. The information in this chapter is pulled from the Spring Data Commons module. It uses the configuration and code samples for the Java Persistence API (JPA) module. Adapt the XML namespace declaration and the types to be extended to the equivalents of the particular module that you are using. [Namespace reference](#) covers XML configuration which is supported across all Spring Data modules supporting the repository API, [Repository query keywords](#) covers the query method keywords supported by the repository abstraction in general. For detailed information on the specific features of your module, consult the chapter on that module of this document.

4.1. Core concepts

The central interface in Spring Data repository abstraction is `Repository` (probably not that much of a surprise). It takes the domain class to manage as well as the id type of the domain class as type arguments. This interface acts primarily as a marker interface to capture the types to work with and to help you to discover interfaces that extend this one. The `CrudRepository` provides sophisticated CRUD functionality for the entity class that is being managed.

Example 3. CrudRepository interface

```
public interface CrudRepository<T, ID extends Serializable>
    extends Repository<T, ID> {

    <S extends T> S save(S entity); ①

    T findOne(ID primaryKey);        ②

    Iterable<T> findAll();           ③

    Long count();                    ④

    void delete(T entity);           ⑤

    boolean exists(ID primaryKey);   ⑥

    // ... more functionality omitted.
}
```

- ① Saves the given entity.
- ② Returns the entity identified by the given id.
- ③ Returns all entities.
- ④ Returns the number of entities.
- ⑤ Deletes the given entity.
- ⑥ Indicates whether an entity with the given id exists.

NOTE

We also provide persistence technology-specific abstractions like e.g. `JpaRepository` or `MongoRepository`. Those interfaces extend `CrudRepository` and expose the capabilities of the underlying persistence technology in addition to the rather generic persistence technology-agnostic interfaces like e.g. `CrudRepository`.

On top of the `CrudRepository` there is a `PagingAndSortingRepository` abstraction that adds additional methods to ease paginated access to entities:

Example 4. PagingAndSortingRepository

```
public interface PagingAndSortingRepository<T, ID extends Serializable>
    extends CrudRepository<T, ID> {

    Iterable<T> findAll(Sort sort);

    Page<T> findAll(Pageable pageable);
}
```

Accessing the second page of `User` by a page size of 20 you could simply do something like this:

```
PagingAndSortingRepository<User, Long> repository = // ... get access to a bean
Page<User> users = repository.findAll(new PageRequest(1, 20));
```

In addition to query methods, query derivation for both count and delete queries, is available.

Example 5. Derived Count Query

```
public interface UserRepository extends CrudRepository<User, Long> {

    Long countByLastname(String lastname);
}
```

Example 6. Derived Delete Query

```
public interface UserRepository extends CrudRepository<User, Long> {

    Long deleteByLastname(String lastname);

    List<User> removeByLastname(String lastname);
}
```

4.2. Query methods

Standard CRUD functionality repositories usually have queries on the underlying datastore. With Spring Data, declaring those queries becomes a four-step process:

1. Declare an interface extending `Repository` or one of its subinterfaces and type it to the domain class and ID type that it will handle.

```
interface PersonRepository extends Repository<Person, Long> { ... }
```

2. Declare query methods on the interface.

```
interface PersonRepository extends Repository<Person, Long> {
    List<Person> findByLastname(String lastname);
}
```

3. Set up Spring to create proxy instances for those interfaces. Either via [JavaConfig](#):

```
import org.springframework.data.jpa.repository.config.EnableJpaRepositories;

@EnableJpaRepositories
class Config {}
```

or via [XML configuration](#):

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:jpa="http://www.springframework.org/schema/data/jpa"
  xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/data/jpa
    http://www.springframework.org/schema/data/jpa/spring-jpa.xsd">

  <jpa:repositories base-package="com.acme.repositories"/>

</beans>
```

The JPA namespace is used in this example. If you are using the repository abstraction for any other store, you need to change this to the appropriate namespace declaration of your store module which should be exchanging `jpa` in favor of, for example, `mongodb`.

Also, note that the JavaConfig variant doesn't configure a package explicitly as the package of the annotated class is used by default. To customize the package to scan use one of the `basePackage` attribute of the data-store specific repository `@Enable`-annotation.

4. Get the repository instance injected and use it.

```
public class SomeClient {

  @Autowired
  private PersonRepository repository;

  public void doSomething() {
    List<Person> persons = repository.findByLastname("Matthews");
  }
}
```

The sections that follow explain each step in detail.

4.3. Defining repository interfaces

As a first step you define a domain class-specific repository interface. The interface must extend `Repository` and be typed to the domain class and an ID type. If you want to expose CRUD methods

for that domain type, extend `CrudRepository` instead of `Repository`.

4.3.1. Fine-tuning repository definition

Typically, your repository interface will extend `Repository`, `CrudRepository` or `PagingAndSortingRepository`. Alternatively, if you do not want to extend Spring Data interfaces, you can also annotate your repository interface with `@RepositoryDefinition`. Extending `CrudRepository` exposes a complete set of methods to manipulate your entities. If you prefer to be selective about the methods being exposed, simply copy the ones you want to expose from `CrudRepository` into your domain repository.

NOTE

This allows you to define your own abstractions on top of the provided Spring Data Repositories functionality.

Example 7. Selectively exposing CRUD methods

```
@NoRepositoryBean
interface MyBaseRepository<T, ID extends Serializable> extends Repository<T, ID> {

    T findOne(ID id);

    T save(T entity);
}

interface UserRepository extends MyBaseRepository<User, Long> {
    User findByEmailAddress(EmailAddress emailAddress);
}
```

In this first step you defined a common base interface for all your domain repositories and exposed `findOne(...)` as well as `save(...)`. These methods will be routed into the base repository implementation of the store of your choice provided by Spring Data ,e.g. in the case if JPA `SimpleJpaRepository`, because they are matching the method signatures in `CrudRepository`. So the `UserRepository` will now be able to save users, and find single ones by id, as well as triggering a query to find `Users` by their email address.

NOTE

Note, that the intermediate repository interface is annotated with `@NoRepositoryBean`. Make sure you add that annotation to all repository interfaces that Spring Data should not create instances for at runtime.

4.3.2. Using Repositories with multiple Spring Data modules

Using a unique Spring Data module in your application makes things simple hence, all repository interfaces in the defined scope are bound to the Spring Data module. Sometimes applications require using more than one Spring Data module. In such case, it's required for a repository definition to distinguish between persistence technologies. Spring Data enters strict repository configuration mode because it detects multiple repository factories on the class path. Strict

configuration requires details on the repository or the domain class to decide about Spring Data module binding for a repository definition:

1. If the repository definition **extends the module-specific repository**, then it's a valid candidate for the particular Spring Data module.
2. If the domain class is **annotated with the module-specific type annotation**, then it's a valid candidate for the particular Spring Data module. Spring Data modules accept either 3rd party annotations (such as JPA's **@Entity**) or provide own annotations such as **@Document** for Spring Data MongoDB/Spring Data Elasticsearch.

Example 8. Repository definitions using Module-specific Interfaces

```
interface MyRepository extends JpaRepository<User, Long> { }

@NoRepositoryBean
interface MyBaseRepository<T, ID extends Serializable> extends JpaRepository<T,
ID> {
    ...
}

interface UserRepository extends MyBaseRepository<User, Long> {
    ...
}
```

MyRepository and **UserRepository** extend **JpaRepository** in their type hierarchy. They are valid candidates for the Spring Data JPA module.

Example 9. Repository definitions using generic Interfaces

```
interface AmbiguousRepository extends Repository<User, Long> {
    ...
}

@NoRepositoryBean
interface MyBaseRepository<T, ID extends Serializable> extends CrudRepository<T,
ID> {
    ...
}

interface AmbiguousUserRepository extends MyBaseRepository<User, Long> {
    ...
}
```

`AmbiguousRepository` and `AmbiguousUserRepository` extend only `Repository` and `CrudRepository` in their type hierarchy. While this is perfectly fine using a unique Spring Data module, multiple modules cannot distinguish to which particular Spring Data these repositories should be bound.

Example 10. Repository definitions using Domain Classes with Annotations

```
interface PersonRepository extends Repository<Person, Long> {
    ...
}

@Entity
public class Person {
    ...
}

interface UserRepository extends Repository<User, Long> {
    ...
}

@Document
public class User {
    ...
}
```

`PersonRepository` references `Person` which is annotated with the JPA annotation `@Entity` so this repository clearly belongs to Spring Data JPA. `UserRepository` uses `User` annotated with Spring Data MongoDB's `@Document` annotation.

```
interface JpaPersonRepository extends Repository<Person, Long> {
    ...
}

interface MongoDBPersonRepository extends Repository<Person, Long> {
    ...
}

@Entity
@Document
public class Person {
    ...
}
```

This example shows a domain class using both JPA and Spring Data MongoDB annotations. It defines two repositories, `JpaPersonRepository` and `MongoDBPersonRepository`. One is intended for JPA and the other for MongoDB usage. Spring Data is no longer able to tell the repositories apart which leads to undefined behavior.

[Repository type details](#) and [identifying domain class annotations](#) are used for strict repository configuration identify repository candidates for a particular Spring Data module. Using multiple persistence technology-specific annotations on the same domain type is possible to reuse domain types across multiple persistence technologies, but then Spring Data is no longer able to determine a unique module to bind the repository.

The last way to distinguish repositories is scoping repository base packages. Base packages define the starting points for scanning for repository interface definitions which implies to have repository definitions located in the appropriate packages. By default, annotation-driven configuration uses the package of the configuration class. The [base package in XML-based configuration](#) is mandatory.

```
@EnableJpaRepositories(basePackages = "com.acme.repositories.jpa")
@EnableMongoRepositories(basePackages = "com.acme.repositories.mongo")
interface Configuration { }
```

4.4. Defining query methods

The repository proxy has two ways to derive a store-specific query from the method name. It can derive the query from the method name directly, or by using a manually defined query. Available options depend on the actual store. However, there's got to be a strategy that decides what actual query is created. Let's have a look at the available options.

4.4.1. Query lookup strategies

The following strategies are available for the repository infrastructure to resolve the query. You can configure the strategy at the namespace through the `query-lookup-strategy` attribute in case of XML configuration or via the `queryLookupStrategy` attribute of the `Enable${store}Repositories` annotation in case of Java config. Some strategies may not be supported for particular datastores.

- **CREATE** attempts to construct a store-specific query from the query method name. The general approach is to remove a given set of well-known prefixes from the method name and parse the rest of the method. Read more about query construction in [Query creation](#).
- **USE_DECLARED_QUERY** tries to find a declared query and will throw an exception in case it can't find one. The query can be defined by an annotation somewhere or declared by other means. Consult the documentation of the specific store to find available options for that store. If the repository infrastructure does not find a declared query for the method at bootstrap time, it fails.
- **CREATE_IF_NOT_FOUND** (default) combines **CREATE** and **USE_DECLARED_QUERY**. It looks up a declared query first, and if no declared query is found, it creates a custom method name-based query. This is the default lookup strategy and thus will be used if you do not configure anything explicitly. It allows quick query definition by method names but also custom-tuning of these queries by introducing declared queries as needed.

4.4.2. Query creation

The query builder mechanism built into Spring Data repository infrastructure is useful for building constraining queries over entities of the repository. The mechanism strips the prefixes `find...By`, `read...By`, `query...By`, `count...By`, and `get...By` from the method and starts parsing the rest of it. The introducing clause can contain further expressions such as a **Distinct** to set a distinct flag on the query to be created. However, the first **By** acts as delimiter to indicate the start of the actual criteria. At a very basic level you can define conditions on entity properties and concatenate them with **And** and **Or**.

```
public interface PersonRepository extends Repository<User, Long> {

    List<Person> findByEmailAddressAndLastname(EmailAddress emailAddress, String
lastname);

    // Enables the distinct flag for the query
    List<Person> findDistinctPeopleByLastnameOrFirstname(String lastname, String
firstname);
    List<Person> findPeopleDistinctByLastnameOrFirstname(String lastname, String
firstname);

    // Enabling ignoring case for an individual property
    List<Person> findByLastnameIgnoreCase(String lastname);
    // Enabling ignoring case for all suitable properties
    List<Person> findByLastnameAndFirstnameAllIgnoreCase(String lastname, String
firstname);

    // Enabling static ORDER BY for a query
    List<Person> findByLastnameOrderByFirstnameAsc(String lastname);
    List<Person> findByLastnameOrderByFirstnameDesc(String lastname);
}
```

The actual result of parsing the method depends on the persistence store for which you create the query. However, there are some general things to notice.

- The expressions are usually property traversals combined with operators that can be concatenated. You can combine property expressions with **AND** and **OR**. You also get support for operators such as **Between**, **LessThan**, **GreaterThan**, **Like** for the property expressions. The supported operators can vary by datastore, so consult the appropriate part of your reference documentation.
- The method parser supports setting an **IgnoreCase** flag for individual properties (for example, **findByLastnameIgnoreCase(...)**) or for all properties of a type that support ignoring case (usually **String** instances, for example, **findByLastnameAndFirstnameAllIgnoreCase(...)**). Whether ignoring cases is supported may vary by store, so consult the relevant sections in the reference documentation for the store-specific query method.
- You can apply static ordering by appending an **OrderBy** clause to the query method that references a property and by providing a sorting direction (**Asc** or **Desc**). To create a query method that supports dynamic sorting, see [Special parameter handling](#).

4.4.3. Property expressions

Property expressions can refer only to a direct property of the managed entity, as shown in the preceding example. At query creation time you already make sure that the parsed property is a property of the managed domain class. However, you can also define constraints by traversing nested properties. Assume a **Person** has an **Address** with a **ZipCode**. In that case a method name of

```
List<Person> findByAddressZipCode(ZipCode zipCode);
```

creates the property traversal `x.address.zipCode`. The resolution algorithm starts with interpreting the entire part (`AddressZipCode`) as the property and checks the domain class for a property with that name (uncapitalized). If the algorithm succeeds it uses that property. If not, the algorithm splits up the source at the camel case parts from the right side into a head and a tail and tries to find the corresponding property, in our example, `AddressZip` and `Code`. If the algorithm finds a property with that head it takes the tail and continue building the tree down from there, splitting the tail up in the way just described. If the first split does not match, the algorithm move the split point to the left (`Address`, `ZipCode`) and continues.

Although this should work for most cases, it is possible for the algorithm to select the wrong property. Suppose the `Person` class has an `addressZip` property as well. The algorithm would match in the first split round already and essentially choose the wrong property and finally fail (as the type of `addressZip` probably has no `code` property).

To resolve this ambiguity you can use `_` inside your method name to manually define traversal points. So our method name would end up like so:

```
List<Person> findByAddress_ZipCode(ZipCode zipCode);
```

As we treat underscore as a reserved character we strongly advise to follow standard Java naming conventions (i.e. **not** using underscores in property names but camel case instead).

4.4.4. Special parameter handling

To handle parameters in your query you simply define method parameters as already seen in the examples above. Besides that the infrastructure will recognize certain specific types like `Pageable` and `Sort` to apply pagination and sorting to your queries dynamically.

Example 14. Using Pageable, Slice and Sort in query methods

```
Page<User> findByLastname(String lastname, Pageable pageable);

Slice<User> findByLastname(String lastname, Pageable pageable);

List<User> findByLastname(String lastname, Sort sort);

List<User> findByLastname(String lastname, Pageable pageable);
```

The first method allows you to pass an `org.springframework.data.domain.Pageable` instance to the query method to dynamically add paging to your statically defined query. A `Page` knows about the total number of elements and pages available. It does so by the infrastructure triggering a count query to calculate the overall number. As this might be expensive depending on the store used, `Slice` can be used as return instead. A `Slice` only knows about whether there's a next `Slice`

available which might be just sufficient when walking through a larger result set.

Sorting options are handled through the `Pageable` instance too. If you only need sorting, simply add an `org.springframework.data.domain.Sort` parameter to your method. As you also can see, simply returning a `List` is possible as well. In this case the additional metadata required to build the actual `Page` instance will not be created (which in turn means that the additional count query that would have been necessary not being issued) but rather simply restricts the query to look up only the given range of entities.

NOTE

To find out how many pages you get for a query entirely you have to trigger an additional count query. By default this query will be derived from the query you actually trigger.

4.4.5. Limiting query results

The results of query methods can be limited via the keywords `first` or `top`, which can be used interchangeably. An optional numeric value can be appended to `top/first` to specify the maximum result size to be returned. If the number is left out, a result size of 1 is assumed.

Example 15. Limiting the result size of a query with `Top` and `First`

```
User findFirstByOrderByLastnameAsc();

User findTopByOrderByAgeDesc();

Page<User> queryFirst10ByLastname(String lastname, Pageable pageable);

Slice<User> findTop3ByLastname(String lastname, Pageable pageable);

List<User> findFirst10ByLastname(String lastname, Sort sort);

List<User> findTop10ByLastname(String lastname, Pageable pageable);
```

The limiting expressions also support the `Distinct` keyword. Also, for the queries limiting the result set to one instance, wrapping the result into an `Optional` is supported.

If pagination or slicing is applied to a limiting query pagination (and the calculation of the number of pages available) then it is applied within the limited result.

NOTE

Note that limiting the results in combination with dynamic sorting via a `Sort` parameter allows to express query methods for the 'K' smallest as well as for the 'K' biggest elements.

4.4.6. Streaming query results

The results of query methods can be processed incrementally by using a Java 8 `Stream<T>` as return type. Instead of simply wrapping the query results in a `Stream` data store specific methods are used

to perform the streaming.

Example 16. Stream the result of a query with Java 8 `Stream<T>`

```
@Query("select u from User u")
Stream<User> findAllByCustomQueryAndStream();

Stream<User> readAllByFirstnameNotNull();

@Query("select u from User u")
Stream<User> streamAllPaged(Pageable pageable);
```

NOTE

A `Stream` potentially wraps underlying data store specific resources and must therefore be closed after usage. You can either manually close the `Stream` using the `close()` method or by using a Java 7 try-with-resources block.

Example 17. Working with a `Stream<T>` result in a try-with-resources block

```
try (Stream<User> stream = repository.findAllByCustomQueryAndStream()) {
    stream.forEach(...);
}
```

NOTE

Not all Spring Data modules currently support `Stream<T>` as a return type.

4.4.7. Async query results

Repository queries can be executed asynchronously using [Spring's asynchronous method execution capability](#). This means the method will return immediately upon invocation and the actual query execution will occur in a task that has been submitted to a Spring `TaskExecutor`.

```
@Async
Future<User> findByFirstname(String firstname); ①

@Async
CompletableFuture<User> findOneByFirstname(String firstname); ②

@Async
ListenableFuture<User> findOneByLastname(String lastname); ③
```

- ① Use `java.util.concurrent.Future` as return type.
- ② Use a Java 8 `java.util.concurrent.CompletableFuture` as return type.
- ③ Use a `org.springframework.util.concurrent.ListenableFuture` as return type.

4.5. Creating repository instances

In this section you create instances and bean definitions for the repository interfaces defined. One way to do so is using the Spring namespace that is shipped with each Spring Data module that supports the repository mechanism although we generally recommend to use the Java-Config style configuration.

4.5.1. XML configuration

Each Spring Data module includes a `repositories` element that allows you to simply define a base package that Spring scans for you.

Example 18. Enabling Spring Data repositories via XML

```
<?xml version="1.0" encoding="UTF-8"?>
<beans:beans xmlns:beans="http://www.springframework.org/schema/beans"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.springframework.org/schema/data/jpa"
  xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/data/jpa
    http://www.springframework.org/schema/data/jpa/spring-jpa.xsd">

  <repositories base-package="com.acme.repositories" />

</beans:beans>
```

In the preceding example, Spring is instructed to scan `com.acme.repositories` and all its sub-packages for interfaces extending `Repository` or one of its sub-interfaces. For each interface found, the infrastructure registers the persistence technology-specific `FactoryBean` to create the appropriate proxies that handle invocations of the query methods. Each bean is registered under a bean name that is derived from the interface name, so an interface of `UserRepository` would be registered under `userRepository`. The `base-package` attribute allows wildcards, so that you can define a pattern of scanned packages.

Using filters

By default the infrastructure picks up every interface extending the persistence technology-specific `Repository` sub-interface located under the configured base package and creates a bean instance for it. However, you might want more fine-grained control over which interfaces bean instances get created for. To do this you use `<include-filter />` and `<exclude-filter />` elements inside `<repositories />`. The semantics are exactly equivalent to the elements in Spring's context namespace. For details, see [Spring reference documentation](#) on these elements.

For example, to exclude certain interfaces from instantiation as repository, you could use the following configuration:


```
<repositories base-package="com.acme.repositories">
  <context:exclude-filter type="regex" expression=".*SomeRepository" />
</repositories>
```

This example excludes all interfaces ending in `SomeRepository` from being instantiated.

4.5.2. JavaConfig

The repository infrastructure can also be triggered using a store-specific `@Enable${store}Repositories` annotation on a JavaConfig class. For an introduction into Java-based configuration of the Spring container, see the reference documentation. [1: [JavaConfig in the Spring reference documentation](#)]

A sample configuration to enable Spring Data repositories looks something like this.

Example 20. Sample annotation based repository configuration

```
@Configuration
@EnableJpaRepositories("com.acme.repositories")
class ApplicationConfiguration {

    @Bean
    public EntityManagerFactory entityManagerFactory() {
        // ...
    }
}
```

NOTE

The sample uses the JPA-specific annotation, which you would change according to the store module you actually use. The same applies to the definition of the `EntityManagerFactory` bean. Consult the sections covering the store-specific configuration.

4.5.3. Standalone usage

You can also use the repository infrastructure outside of a Spring container, e.g. in CDI environments. You still need some Spring libraries in your classpath, but generally you can set up repositories programmatically as well. The Spring Data modules that provide repository support ship a persistence technology-specific `RepositoryFactory` that you can use as follows.

Example 21. Standalone usage of repository factory

```
RepositoryFactorySupport factory = ... // Instantiate factory here
UserRepository repository = factory.getRepository(UserRepository.class);
```

4.6. Custom implementations for Spring Data repositories

Often it is necessary to provide a custom implementation for a few repository methods. Spring Data repositories easily allow you to provide custom repository code and integrate it with generic CRUD abstraction and query method functionality.

4.6.1. Adding custom behavior to single repositories

To enrich a repository with custom functionality you first define an interface and an implementation for the custom functionality. Use the repository interface you provided to extend the custom interface.

Example 22. Interface for custom repository functionality

```
interface UserRepositoryCustom {
    public void someCustomMethod(User user);
}
```

Example 23. Implementation of custom repository functionality

```
class UserRepositoryImpl implements UserRepositoryCustom {

    public void someCustomMethod(User user) {
        // Your custom implementation
    }
}
```

NOTE

The most important bit for the class to be found is the **Impl** postfix of the name on it compared to the core repository interface (see below).

The implementation itself does not depend on Spring Data and can be a regular Spring bean. So you can use standard dependency injection behavior to inject references to other beans like a **JdbcTemplate**, take part in aspects, and so on.

Example 24. Changes to the your basic repository interface

```
interface UserRepository extends CrudRepository<User, Long>, UserRepositoryCustom
{
    // Declare query methods here
}
```

Let your standard repository interface extend the custom one. Doing so combines the CRUD and custom functionality and makes it available to clients.

Configuration

If you use namespace configuration, the repository infrastructure tries to autodetect custom implementations by scanning for classes below the package we found a repository in. These classes need to follow the naming convention of appending the namespace element's attribute `repository-impl-postfix` to the found repository interface name. This postfix defaults to `Impl`.

Example 25. Configuration example

```
<repositories base-package="com.acme.repository" />

<repositories base-package="com.acme.repository" repository-impl-postfix="FooBar"
/>
```

The first configuration example will try to look up a class `com.acme.repository.UserRepositoryImpl` to act as custom repository implementation, whereas the second example will try to lookup `com.acme.repository.UserRepositoryFooBar`.

Manual wiring

The approach just shown works well if your custom implementation uses annotation-based configuration and autowiring only, as it will be treated as any other Spring bean. If your custom implementation bean needs special wiring, you simply declare the bean and name it after the conventions just described. The infrastructure will then refer to the manually defined bean definition by name instead of creating one itself.

Example 26. Manual wiring of custom implementations

```
<repositories base-package="com.acme.repository" />

<beans:bean id="userRepositoryImpl" class="...">
    <!-- further configuration -->
</beans:bean>
```

4.6.2. Adding custom behavior to all repositories

The preceding approach is not feasible when you want to add a single method to all your repository interfaces. To add custom behavior to all repositories, you first add an intermediate interface to declare the shared behavior.

Example 27. An interface declaring custom shared behavior

```
@NoRepositoryBean
public interface MyRepository<T, ID extends Serializable>
    extends PagingAndSortingRepository<T, ID> {

    void sharedCustomMethod(ID id);
}
```

Now your individual repository interfaces will extend this intermediate interface instead of the `Repository` interface to include the functionality declared. Next, create an implementation of the intermediate interface that extends the persistence technology-specific repository base class. This class will then act as a custom base class for the repository proxies.

Example 28. Custom repository base class

```
public class MyRepositoryImpl<T, ID extends Serializable>
    extends SimpleJpaRepository<T, ID> implements MyRepository<T, ID> {

    private final EntityManager entityManager;

    public MyRepositoryImpl(JpaEntityInformation entityInformation,
        EntityManager entityManager) {
        super(entityInformation, entityManager);

        // Keep the EntityManager around to used from the newly introduced methods.
        this.entityManager = entityManager;
    }

    public void sharedCustomMethod(ID id) {
        // implementation goes here
    }
}
```

WARNING

The class needs to have a constructor of the super class which the store-specific repository factory implementation is using. In case the repository base class has multiple constructors, override the one taking an `EntityInformation` plus a store specific infrastructure object (e.g. an `EntityManager` or a template class).

The default behavior of the Spring `<repositories />` namespace is to provide an implementation for all interfaces that fall under the `base-package`. This means that if left in its current state, an implementation instance of `MyRepository` will be created by Spring. This is of course not desired as it is just supposed to act as an intermediary between `Repository` and the actual repository interfaces you want to define for each entity. To exclude an interface that extends `Repository` from being instantiated as a repository instance, you can either annotate it with `@NoRepositoryBean` (as seen above) or move it outside of the configured `base-package`.

The final step is to make the Spring Data infrastructure aware of the customized repository base class. In JavaConfig this is achieved by using the `repositoryBaseClass` attribute of the `@Enable...Repositories` annotation:

Example 29. Configuring a custom repository base class using JavaConfig

```
@Configuration
@EnableJpaRepositories(repositoryBaseClass = MyRepositoryImpl.class)
class ApplicationConfiguration { ... }
```

A corresponding attribute is available in the XML namespace.

Example 30. Configuring a custom repository base class using XML

```
<repositories base-package="com.acme.repository"
  base-class="...MyRepositoryImpl" />
```

4.7. Spring Data extensions

This section documents a set of Spring Data extensions that enable Spring Data usage in a variety of contexts. Currently most of the integration is targeted towards Spring MVC.

4.7.1. Querydsl Extension

`Querydsl` is a framework which enables the construction of statically typed SQL-like queries via its fluent API.

Several Spring Data modules offer integration with Querydsl via `QueryDslPredicateExecutor`.

Example 31. QueryDslPredicateExecutor interface

```
public interface QueryDslPredicateExecutor<T> {  
  
    T findOne(Predicate predicate);           ❶  
  
    Iterable<T> findAll(Predicate predicate); ❷  
  
    long count(Predicate predicate);          ❸  
  
    boolean exists(Predicate predicate);      ❹  
  
    // ... more functionality omitted.  
}
```

- ❶ Finds and returns a single entity matching the **Predicate**.
- ❷ Finds and returns all entities matching the **Predicate**.
- ❸ Returns the number of entities matching the **Predicate**.
- ❹ Returns if an entity that matches the **Predicate** exists.

To make use of Querydsl support simply extend **QueryDslPredicateExecutor** on your repository interface.

Example 32. Querydsl integration on repositories

```
interface UserRepository extends CrudRepository<User, Long>,  
    QueryDslPredicateExecutor<User> {  
  
}
```

The above enables to write typesafe queries using Querydsl **Predicate** s.

```
Predicate predicate = user.firstname.equalsIgnoreCase("dave")  
    .and(user.lastname.startsWithIgnoreCase("mathews"));  
  
userRepository.findAll(predicate);
```

4.7.2. Web support

NOTE

This section contains the documentation for the Spring Data web support as it is implemented as of Spring Data Commons in the 1.6 range. As it the newly introduced support changes quite a lot of things we kept the documentation of the former behavior in [Legacy web support](#).