

## Grails Database Migration Plugin

# Database Migration Plugin - Reference Documentation

**Authors:** Burt Beckwith

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## Table of Contents

- 1** Introduction to the Database Migration Plugin
  - 1.1** History
- 2** Getting Started
  - 2.1** Migration from Autobase
- 3** Configuration
- 4** General Usage
- 5** Groovy Changes
- 6** Groovy Preconditions
- 7** GORM Support
- 8** DbDoc Controller

# 1 Introduction to the Database Migration Plugin

The Database Migration plugin helps you manage database changes while developing Grails applications. The plugin uses the [Liquibase](#) library.

Using this plugin (and Liquibase in general) adds some structure and process to managing database changes. It will help avoid inconsistencies, communication issues, and other problems with ad-hoc approaches.

Database migrations are represented in text form, either using a Groovy DSL or native Liquibase XML, in one or more changelog files. This approach makes it natural to maintain the changelog files in source control and also works well with branches. Changelog files can include other changelog files, so often developers create hierarchical files organized with various schemes. One popular approach is to have a root changelog named `changelog.groovy` (or `changelog.xml`) and to include a changelog per feature/branch that includes multiple smaller changelogs. Once the feature is finished and merged into the main development tree/trunk the changelog files can either stay as they are or be merged into one large file. Use whatever approach makes sense for your applications, but keep in mind that there are many options available for changelog management.

Individual changes have an ID that should be globally unique, although they also include the username of the user making the change, making the combination of ID and username unique (although technically the ID, username, and changelog location are the "unique key").

As you make changes in your code (typically domain classes) that require changes in the database, you add a new change set to the changelog. Commit the code changes along with the changelog additions, and the other developers on your team will get both when they update from source control. Once they apply the new changes their code and development database will be in sync with your changes. Likewise when you deploy to a QA, a staging server, or production, you'll run the un-run changes that correspond to the code updates to being that environment's database in sync. Liquibase keeps track of previously executed changes so there's no need to think about what has and hasn't been run yet.

## Scripts

Your primary interaction with the plugin will be using the provided scripts. For the most part these correspond to the many Liquibase commands that are typically executed directly from the commandline or with its Ant targets, but there are also a few Grails-specific scripts that take advantage of the information available from the GORM mappings.

All of the scripts start with `dbm-` to ensure that they're unique and don't clash with scripts from Grails or other plugins.

## 1.1 History

### History

- April 17, 2013
  - 1.3.3 release
  - [JIRA Issues](#)
- January 4, 2013

- 1.3.2 release
- [JIRA Issues](#)
- January 4, 2013
  - 1.3.1 release
  - [JIRA Issues](#)
- January 3, 2013
  - 1.3 release
  - [JIRA Issues](#)
- December 6, 2012
  - 1.2.2 release
- December 1, 2012
  - 1.2.1 release
  - [JIRA Issues](#)
- October 28, 2012
  - 1.2 release
  - [JIRA Issues](#)
- May 11, 2012
  - 1.1 release
  - [JIRA Issues](#)
- August 17, 2011
  - 1.0 release
  - [JIRA Issues](#)
- April 19, 2011
  - 0.2.1 release
- February 13, 2011
  - 0.2 release
    - One breaking change: the default migrations folder changed from grails-app/conf/migrations to grails-app/migrations
- May 22, 2010
  - initial 0.1 release

## 2 Getting Started

The first step is to add a dependency for the plugin in `BuildConfig.groovy`:

```
plugins {  
    ...  
    runtime ':database-migration:1.1'  
}
```

or install with `install-plugin`:

```
grails install-plugin database-migration
```

### Typical initial workflow

Next you'll need to create an initial changelog. You can use Liquibase XML or the plugin's Groovy DSL for individual files. You can even mix and match; Groovy files can include other Groovy files and Liquibase XML files (but XML files can't include Groovy files).

Depending on the state of your database and code, you have two options; either create a changelog from the database or create it from your domain classes. The decision tends to be based on whether you prefer to design the database and adjust the domain classes to work with it, or to design your domain classes and use Hibernate to create the corresponding database structure.

To create a changelog from the database, use the [dbm-generate-changelog](#) script:

```
grails dbm-generate-changelog changelog.groovy
```

or

```
grails dbm-generate-changelog changelog.xml
```

depending on whether you prefer the Groovy DSL or XML. The filename is relative to the changelog base folder, which defaults to `grails-app/migrations`.



If you use the XML format (or use a non-default Groovy filename), be sure to change the name of the file in `Config.groovy` so `dbm-update` and other scripts find the file:

```
grails.plugin.databasemigration.changelogFileName =  
'changelog.xml'
```

Since the database is already correct, run the [dbm-changelog-sync](#) script to record that the changes have already been applied:

```
grails dbm-changelog-sync
```

Running this script is primarily a no-op except that it records the execution(s) in the Liquibase DATABASECHANGELOG table.

To create a changelog from your domain classes, use the [dbm-generate-gorm-changelog](#) script:

```
grails dbm-generate-gorm-changelog changelog.groovy
```

or

```
grails dbm-generate-gorm-changelog changelog.xml
```

If you haven't created the database yet, run the [dbm-update](#) script to create the corresponding tables:

```
grails dbm-update
```

or the [dbm-changelog-sync](#) script if the database is already in sync with your code:

```
grails dbm-changelog-sync
```



If you use the searchable plugin you need to configure it to run after the database migrations have run. Either in `Searchable.groovy` or in `Config.groovy` (if that's where you configure Searchable):

```
// disable the plugin's operations here. we'll re-enable
them in the Bootstrap to avoid conflicts with
database-migration
mirrorChanges = false
bulkIndexOnStartup = false
```

In `Bootstrap.groovy`:

```
class Bootstrap {
  def searchableService

  def init = { servletContext ->
    // do any data loading you would normally do

    // Manually start the mirroring process to ensure that it
    comes after the automated migrations.
    println "Performing bulk index"
    searchableService.reindex()
    println "Starting mirror service"
    searchableService.startMirroring()
  }
}
```

## Source control

Now you can commit the changelog and the corresponding application code to source control. Other developers can then update and synchronize their databases, and start doing migrations themselves.

## 2.1 Migration from Autobase

Autobase is another plugin for managing database migrations. It uses Groovy migration scripts that have a similar syntax to this plugin's ones, but there are some differences that mean you will have to do a little bit of work to migrate your existing scripts. The following notes are applicable to Autobase 0.11 and earlier.

### Location of migration scripts

Autobase defaulted to putting its migration scripts into a `./migrations` directory, whereas the Database Migration plugin uses `./grails-app/migrations` as the default. So, you can either move your scripts or add this setting to your `grails-app/conf/Config.groovy` file:

```
grails.plugin.databasemigration.changelogLocation = "migrations"
```

### New syntax for all scripts

Autobase allowed you to write changelog files that just included the change sets one after the other. This isn't supported by the Database Migration plugin, so *all* changelogs must put their change set definitions inside a block like so:

```
databaseChangeLog = {
    changeSet(...) { ... }
    changeSet(...) { ... }
    ...
}
```

In addition, if your main Autobase changelog specifies a logical file path (see next section), you will have to use the syntax:

```
databaseChangeLog = {
    logicalFilePath "app-autobase"
    ...
}
```

in all the changelog files. If you don't do this, the plugin won't recognise that existing migrations have already been applied to a database and all of them will be reapplied.

These changes also apply to the main changelog, but there are some other differences to cover for that.

## Parent changelog differences

The syntax for the main (or parent) Autobase changelog file looks like:

```
databaseChangeLog(logicalFilePath: "appName-autobase") {
    include "../migrations/batch/SomeBigChanges.groovy"
    include "../migrations/changelog-1.0.1.groovy"
    include "../migrations/changelog-1.0.5.groovy"
}
```

The new format is noticeably different:

```
databaseChangeLog = {
    logicalFilePath "site-autobase"

    include file: "batch/SomeBigChanges.groovy"
    include file: "changelog-1.0.1.groovy"
    include file: "changelog-1.0.5.groovy"
}
```

In particular, note that:

- The `databaseChangeLog` line is different
- The logical file path must be defined inside the block
- `include` takes a named `file` argument
- The file paths passed to `include` are relative to the configured migrations directory



Fortunately, these changes are highly localised and pretty trivial to implement.

## **modifyColumn refactoring no longer available**

The `modifyColumn` refactoring has been removed in the version of Liquibase that comes with the Database Migration plugin. Instead you should use the new `modifyDataType` refactoring like so:

```
...
changeSet(id:'IncreaseCommentBodySize', author:'someone') {
    modifyDataType tableName: 'comment', columnName: 'body', newDataType:
    'TEXT'
}
```

The parameters are the same as for `modifyColumn`, but the syntax is somewhat different.

## 3 Configuration

There are a few configuration options for the plugin:

| Property   | Default               | Meaning   |
|--|-----------------------|---|
| grails.plugin.databasemigration.changelogLocation          | grails-app/migrations | the folder containing the main changelog file (which can include one or more other files)   |
| grails.plugin.databasemigration.changelogFileName          | changelog.groovy      | the name of the main changelog file   |
| grails.plugin.databasemigration.changelogProperties        | none                  | a map of properties to use for property substitution in Groovy DSL changelogs   |
| grails.plugin.databasemigration.contexts                   | none                  | A comma-delimited list of <a href="#">context</a> names. If specified, only changesets tagged with one of the context names will be run |
| grails.plugin.databasemigration.dbDocLocation              | target/dbdoc          | the directory where the output from the <a href="#">dbm-db-doc</a> script is written  |
| grails.plugin.databasemigration.dbDocController.enabled    | true in dev mode      | whether the /dbdoc/ url is accessible at runtime  |
| grails.plugin.databasemigration.dropOnStart                | false                 | if true then drops all tables before auto-running migrations (if updateOnStart is true)   |
| grails.plugin.databasemigration.updateOnStart              | false                 | if true then changesets from the specified list of names will be run at startup   |
| grails.plugin.databasemigration.updateOnStartFileNames     | none                  | one or more file names (relative to changelogLocation) to run at startup if updateOnStart is true                                       |
| grails.plugin.databasemigration.updateOnStartDefaultSchema | none                  | the default schema to use when running auto-migrate on start  |
| grails.plugin.databasemigration.updateOnStartContexts      | none                  | A comma-delimited list of <a href="#">context</a> names. If specified, only changesets tagged with one of the context names will be run |

|  |                         |   |
|--|-------------------------|---|
| grails.plugin.databasemigration.<br>autoMigrateScripts             | 'RunApp'                | the scripts when running auto-migrate. Useful to run auto-migrate during test phase with: 'RunApp', 'TestApp' |
| grails.plugin.databasemigration.<br>ignoredObjects                 | none                    | one or more database object names to ignore while performing a dbm-gorm-diff or dbm-generate-gorm-changelog   |
| grails.plugin.databasemigration.<br>databaseChangeLogTableName     | 'databasechangelog'     | the Liquibase changelog record table name   |
| grails.plugin.databasemigration.<br>databaseChangeLogLockTableName | 'databasechangeloglock' | the Liquibase lock table name   |



All of the above configs can be used for a multiple datasources in Grails 2.0.x.

## Multiple DataSource Example:

If a reports dataSource is configured in DataSource.groovy

```
dataSource_reports {
    url = ...
    driverClassName = ...
    ...
}
```

The configuration for this data source would be:

```
grails.plugin.databasemigration.reports.updateOntart = true
grails.plugin.databasemigration.reports.changelogFileName =
changelog-reports.groovy
```

## 4 General Usage

After creating the initial changelog, the typical workflow will be along the lines of:

- make domain class changes that affect the schema
- add changes to the changelog for them
- backup your database in case something goes wrong
- run `grails dbm-update` to update your development environment (or wherever you're applying the changes)
- check the updated domain class(es) and changelog(s) into source control



When running migration scripts on non-development databases, it's important that you backup the database before running the migration in case anything goes wrong. You could also make a copy of the database and run the script against that, and if there's a problem the real database will be unaffected.

To create the changelog additions, you can either manually create the changes or with the [dbm-gorm-diff](#) script (you can also use the [dbm-diff](#) script but it's far less convenient and requires a 2nd temporary database).

You have a few options with `dbm-gorm-diff`:

- `dbm-gorm-diff` will dump to the console if no filename is specified, so you can copy/paste from there
- if you include the `--add` parameter when running the script with a filename it will register an include for the filename in the main changelog for you

Regardless of which approach you use, be sure to inspect generated changes and adjust as necessary.

### Autorun on start

Since Liquibase maintains a record of changes that have been applied, you can avoid manually updating the database by taking advantage of the plugin's auto-run feature. By default this is disabled, but you can enable it by adding

```
grails.plugin.databasemigration.updateOnStart = true
```

to `Config.groovy`. In addition you must specify the file(s) containing changes; specify the name(s) using the `updateOnStartFileNames` property, e.g.:

```
grails.plugin.databasemigration.updateOnStartFileNames = ['changelog.groovy']
```

Since changelogs can contain changelogs you'll most often just specify the root changelog, `changelog.groovy` by convention. Any changes that haven't been executed (in the specified file(s) or files included by them) will be run in the order specified.

You may optionally limit the plugin's auto-run feature to run only specific contexts. If this configuration parameter is empty or omitted, all contexts will be run.

```
grails.plugin.databasemigration.updateOnStartContexts = ['context1,context2']
```

You can be notified when migration are run (for example to do some work before and/or after the migrations execute) by registering a "callback" class as a Spring bean. The class can have any name and package and doesn't have to implement any interface since its methods will be called using Groovy duck-typing.

The bean name is "migrationCallbacks" and there are currently three callback methods supported (all are optional):

- `beforeStartMigration` will be called (if it exists) for each datasource before any migrations have run; the method will be passed a single argument, the Liquibase Database for that datasource
- `onStartMigration` will be called (if it exists) for each migration script; the method will be passed three arguments, the Liquibase Database, the Liquibase instance, and the changelog file name
- `afterMigrations` will be called (if it exists) for each datasource after all migrations have run; the method will be passed a single argument, the Liquibase Database for that datasource

An example class will look like this:

```
package com.mycompany.myapp

import liquibase.Liquibase
import liquibase.database.Database

class MigrationCallbacks {
    void beforeStartMigration(Database Database) {
        ...
    }

    void onStartMigration(Database database, Liquibase liquibase, String
        changelogName) {
        ...
    }

    void afterMigrations(Database Database) {
        ...
    }
}
```

Register it in `resources.groovy`:

```
import com.mycompany.myapp.MigrationCallbacks  
  
beans = {  
    migrationCallbacks(MigrationCallbacks)  
}
```

## 5 Groovy Changes

In addition to the built-in Liquibase changes (see [the documentation](#) for what's available) you can also make database changes using Groovy code (as long as you're using the Groovy DSL file format). These changes use the `grailsChange` tag name and are contained in a `changeSet` tag like standard built-in tags.

There are four supported inner tags and two callable methods (to override the default confirmation message and checksum value).

### General format

This is the general format of a Groovy-based change; all inner tags and methods are optional:

```
databaseChangeLog = {
  changeSet(author: '...', id: '...') {
    grailsChange {
      init {
        // arbitrary initialization code; note that no
        // database or connection is available
      }
      validate {
        // can call warn(String message) to log a warning
        // or error(String message) to stop processing
      }
      change {
        // arbitrary code; make changes directly and/or return a
        // SqlStatement using the sqlStatement(SqlStatement sqlStatement)
        // method or multiple with sqlStatements(List sqlStatements)
      }
      confirm 'change confirmation message'
    }
    rollback {
      // arbitrary code; make rollback changes directly and/or
      // return a SqlStatement using the sqlStatement(SqlStatement
      sqlStatement)
      // method or multiple with sqlStatements(List sqlStatements)
    }
    confirm 'rollback confirmation message'
  }
  confirm 'confirmation message'
  checksum 'override value for checksum'
}
```

### Available variables

These variables are available throughout the change closure:

- `changeSet`
  - the current Liquibase `ChangeSet` instance
- `resourceAccessor`
  - the current Liquibase `ResourceAccessor` instance
- `ctx`
  - the Spring `ApplicationContext`
- `application`
  - the `GrailsApplication`

The `change` and `rollback` closures also have the following available:

- `database`
  - the current Liquibase `Database` instance
- `databaseConnection`
  - the current Liquibase `DatabaseConnection` instance, which is a wrapper around the `JDBC Connection` (but doesn't implement the `Connection` interface)
- `connection`
  - the real `JDBC Connection` instance (a shortcut for `database.connection.wrappedConnection`)
- `sql`
  - a `groovy.sql.Sql` instance which uses the current `connection` and can be used for arbitrary queries and updates

## **init**

This is where any optional initialization should happen. You can't access the database from this closure.

## **validate**

If there are any necessary validation checks before executing changes or rollbacks they should be done here. You can log warnings by calling `warn(String message)` and stop processing by calling `error(String message)`. It may make more sense to use one or more `preConditions` instead of directly validating here.

## **change**

All migration changes are done in the `change` closure. You can make changes directly (using the `sql` instance or the `connection`) and/or return one or more `SqlStatements`. You can call `sqlStatement(SqlStatement statement)` multiple times to register instances to be run. You can also call the `sqlStatements(statements)` method with an array or list of instances to be run.



## **rollback**

All rollback changes are done in the `rollback` closure. You can make changes directly (using the `sql` instance or the `connection`) and/or return one or more `SqlStatements`. You can call `sqlStatement(SqlStatement statement)` multiple times to register instances to be run. You can also call the `sqlStatements(statements)` method with an array or list of instances to be run.

## **confirm**

The `confirm(String message)` method is used to specify the confirmation message to be shown. The default is "Executed GrailsChange" and it can be overridden in the `change` or `rollback` closures to allow phase-specific messages or outside of both closures to use the same message for the update and rollback phase.

## **checksum**

The checksum for the change will be generated automatically, but if you want to override the value that gets hashed you can specify it with the `checksum(String value)` method.

## 6 Groovy Preconditions

In addition to the built-in Liquibase preconditions (see [the documentation](#) for what's available) you can also specify preconditions using Groovy code (as long as you're using the Groovy DSL file format). These changes use the `grailsPrecondition` tag name and are contained in the `databaseChangeLog` tag or in a `changeSet` tag like standard built-in tags.

### General format

This is general format of a Groovy-based precondition:

```
databaseChangeLog = {
  changeSet(author: '...', id: '...') {
    preConditions {
      grailsPrecondition {
        check {
          // use an assertion
          assert x == x

          // use an assertion with an error message
          assert y == y : 'value cannot be 237'

          // call the fail method
          if (x != x) {
            fail 'x != x'
          }

          // throw an exception (the fail method is preferred)
          if (y != y) {
            throw new RuntimeException('y != y')
          }
        }
      }
    }
  }
}
```

As you can see there are a few ways to indicate that a precondition wasn't met:

- use a simple assertion
- use an assertion with a message
- call the `fail(String message)` method (throws a `PreconditionFailedException`)
- throw an exception (shouldn't be necessary - use `assert` or `fail()` instead)

### Available variables

- `database`
  - the current Liquibase Database instance
- `databaseConnection`
  - the current Liquibase DatabaseConnection instance, which is a wrapper around the JDBC Connection (but doesn't implement the Connection interface)
- `connection`
  - the real JDBC Connection instance (a shortcut for `database.connection.wrappedConnection`)
- `sql`
  - a `groovy.sql.Sql` instance which uses the current connection and can be used for arbitrary queries and updates
- `resourceAccessor`
  - the current Liquibase ResourceAccessor instance
- `ctx`
  - the Spring ApplicationContext
- `application`
  - the GrailsApplication
- `changeSet`
  - the current Liquibase ChangeSet instance
- `changeLog`
  - the current Liquibase DatabaseChangeLog instance

## Utility methods

- `createDatabaseSnapshotGenerator()`
  - retrieves the DatabaseSnapshotGenerator for the current Database
- `createDatabaseSnapshot(String schemaName = null)`
  - creates a DatabaseSnapshot for the current Database (and schema if specified)

## 7 GORM Support

The plugin's support for GORM is one feature that differentiates it from using Liquibase directly. Typically when using Liquibase you make changes to a database yourself, and then create changesets manually, or use a diff script to compare your updated database to one that hasn't been updated yet. This is a decent amount of work and is rather error-prone. It's easy to forget some changes that aren't required but help performance, for example creating an index on a foreign key when using MySQL.

### create-drop, create, and update

On the other end of the spectrum, Hibernate's `create-drop` mode (or `create`) will create a database that matches your domain model, but it's destructive since all previous data is lost when it runs. This works well in the very early stages of development but gets frustrating quickly. Unfortunately Hibernate's `update` mode seems like a good compromise since it only makes changes to your existing schema, but it's very limited in what it will do. It's very pessimistic and won't make any changes that could lose data. So it will add new tables and columns, but won't drop anything. If you remove a not-null domain class property you'll find you can't insert anymore since the column is still there. And it will create not-null columns as nullable since otherwise existing data would be invalid. It won't even widen a column e.g. from `VARCHAR(100)` to `VARCHAR(200)`.

### dbm-gorm-diff

The plugin provides a script that will compare your GORM current domain model with a database that you specify, and the result is a Liquibase changeset - `dbm-gorm-diff`. This is the same changeset you would get if you exported your domain model to a scratch database and diffed it with the other database, but it's more convenient.

So a good workflow would be:

- make whatever domain class changes you need (add new ones, delete unneeded ones, add/change/remove properties, etc.)
- once your tests pass and you're ready to commit your changes to source control, run the script to generate the changeset that will bring your database back in line with your code
- add the changeset to an existing changelog file, or use the `include` tag to include the whole file
- run the changeset on your functional test database
- assuming your functional tests pass, check everything in as one commit
- the other members of your team will get both the code and database changes when they next update, and will know to run the update script to sync their database with the latest code
- once you're ready to deploy to QA for testing (or staging or production), you can run all of the un-run changes since the last deployment

### dbm-generate-gorm-changelog

The [dbm-generate-gorm-changelog](#) script is useful for when you want to switch from `create-drop` mode to doing proper migrations. It's not very useful if you already have a database that's in sync with your code, since you can just use the [dbm-generate-changelog](#) script that creates a changelog from your database.

## 8 DbDoc Controller

You can use the [dbm-db-doc](#) script to generate static HTML files to view changelog information, but another option is to use the `DbDocController` at runtime. By default this controller is mapped to `/appname/dbdoc/` but this can be customized with `UrlMappings` like any controller.

You probably don't want to expose this information to all of your application's users so by default the controller is only enabled in the development environment. But you can enable or disable it for any environment in `Config.groovy` with the `dbDocController.enabled` config option. For example to enable for all environments (be sure to guard the URL with a security plugin in prod):

```
grails.plugin.databasemigration.dbDocController.enabled = true
```

or to enable in the production environment:

```
environments {
  production {
    grails.plugin.databasemigration.dbDocController.enabled = true
  }
  ...
}
```