

# Table of Contents

Workspace Recipes .....	1
Using Workspaces .....	1
Creating an in Memory Workspace .....	3
Add Layer's Features in Chunks .....	3
Using a Directory Workspace .....	4
Investigating Workspaces .....	6
Creating Workspaces .....	7
Database Workspace .....	17

## Workspace Recipes

The Workspace classes are in the [geoscript.workspace](#) package.

A Workspace is a collection of Layers. You can create, add, remove, and get Layers. There are many different kinds of Workspaces in GeoScript including Memory, PostGIS, Directory (for Shapefiles), GeoPackage, and many more.

## Using Workspaces

### *Create a Workspace*

```
Workspace workspace = new Workspace()
```

### *Create a Layer*

```
Schema schema = new Schema("cities", [  
    new Field("geom", "Point", "EPSG:4326"),  
    new Field("id", "Integer"),  
    new Field("name", "String")  
)  
Layer layer = workspace.create(schema)  
println layer
```

```
cities
```

### *Check whether a Workspace has a Layer by name*

```
boolean hasCities = workspace.has("cities")  
println hasCities
```

true

### *Get a Layer from a Workspace*

```
Layer citiesLayer = workspace.get('cities')
println citiesLayer
```

cities

### *Add a Layer to a Workspace*

```
Schema statesSchema = new Schema("states", [
    new Field("geom", "Polygon", "EPSG:4326"),
    new Field("id", "Integer"),
    new Field("name", "String")
])
Layer statesLayer = new Layer("states", statesSchema)
workspace.add(statesLayer)
println workspace.has("states")
```

true

### *Get the names of all Layers in a Workspace*

```
List<String> names = workspace.names
names.each { String name ->
    println name
}
```

```
FlatGeobuf
PostGIS
Geobuf
Shapefile
PostGIS (JNDI)
GeoPackage
SQLite
Properties
MBTiles with vector tiles
MySQL
MySQL (JNDI)
Directory of spatial files (shapefiles)
H2 (JNDI)
Web Feature Server (NG)
H2
```

*Remove a Layer from a Workspace*

```
workspace.remove("cities")
println workspace.has('cities')
```

```
false
```

*Close the Workspace when you are done*

```
workspace.close()
```

## Creating an in Memory Workspace

*The empty Workspace constructor creates an in Memory Workspace. You can create a Layer by passing a name and a list of Fields. You can then remove the Layer by passing a reference to the Layer.*

```
Workspace workspace = new Workspace()

Layer layer = workspace.create("cities", [
    new Field("geom", "Point", "EPSG:4326"),
    new Field("id", "Integer"),
    new Field("name", "String")
])
println layer

workspace.remove(layer)
println workspace.has(layer.name)
```

```
cities
false
```

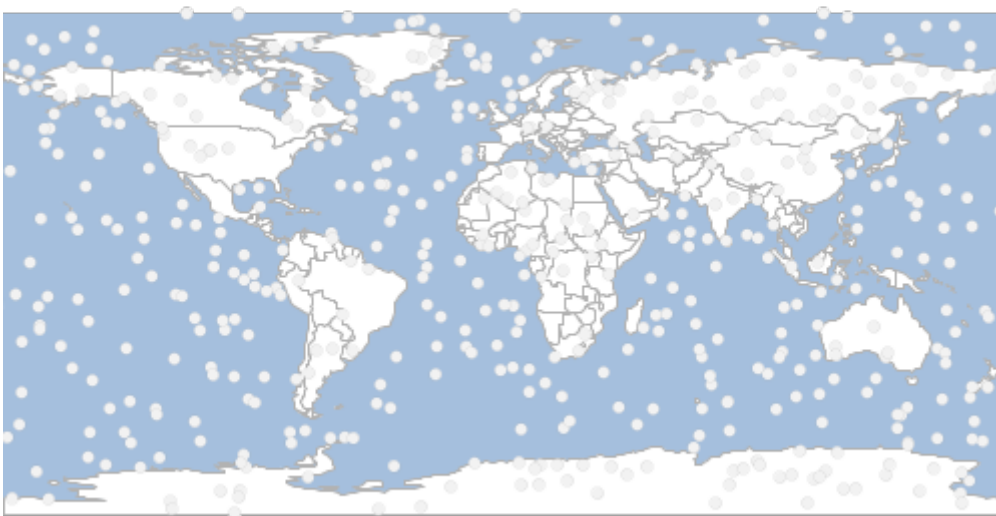
## Add Layer's Features in Chunks

When adding a large Layer to a Workspace, you can add Features in chunks.

```
Workspace workspace = new Memory()
Layer layer = workspace.create("points", [
    new Field("geom", "Point", "EPSG:4326"),
    new Field("id", "Integer")
])
Bounds bounds = new Bounds(-180,-90, 180,90, "EPSG:4326")
Geometry.createRandomPoints(bounds.geometry, 500).geometries.eachWithIndex { Geometry
geom, int i ->
    layer.add([geom: geom, id: i])
}
println "Original Layer has ${layer.count} features."

Layer copyOfLayer = workspace.add(layer, "random points", 100)
println "Copied Layer has ${copyOfLayer.count} features."
```

Original Layer has 500 features.  
Copied Layer has 500 features.



## Using a Directory Workspace

A Directory Workspace is a directory of Shapefiles.

*Create a Directory Workspace*

```
Directory directory = new Directory("src/main/resources/data")
println directory.toString()
```

```
Directory[/home/runner/work/geoscript-groovy-cookbook/geoscript-groovy-cookbook/src/main/resources/data]
```

*View the Workspace's format*

```
String format = directory.format
println format
```

```
Directory
```

*View the Workspace's File*

```
File file = directory.file
println file
```

```
/home/runner/work/geoscript-groovy-cookbook/geoscript-groovy-cookbook/src/main/resources/data
```

*View the Workspace's list of Layer names*

```
List names = directory.names
names.each { String name ->
    println name
}
```

```
states
```

*Get a Layer by name*

```
Layer layer = directory.get("states")
int count = layer.count
println "Layer ${layer.name} has ${count} Features."
```

```
Layer states has 49 Features.
```

*Close the Directory when done.*

```
directory.close()
```

# Investigating Workspaces

*Get available Workspace names*

```
List<String> names = Workspace.getWorkspaceNames()
names.each { String name ->
    println name
}
```

```
FlatGeobuf
PostGIS
Geobuf
Shapefile
PostGIS (JNDI)
GeoPackage
SQLite
Properties
MBTiles with vector tiles
MySQL
MySQL (JNDI)
Directory of spatial files (shapefiles)
H2 (JNDI)
Web Feature Server (NG)
H2
```

*Get parameters for a Workspace*

```
List<Map> parameters = Workspace.getWorkspaceParameters("GeoPackage")
parameters.each { Map param ->
    println "Parameter = ${param.key} Type = ${param.type} Required?
    ${param.required}"
}
```

```
Parameter = dbtype Type = java.lang.String Required? true
Parameter = database Type = java.io.File Required? true
Parameter = passwd Type = java.lang.String Required? false
Parameter = namespace Type = java.lang.String Required? false
Parameter = Expose primary keys Type = java.lang.Boolean Required? false
Parameter = fetch size Type = java.lang.Integer Required? false
Parameter = Batch insert size Type = java.lang.Integer Required? false
Parameter = Primary key metadata table Type = java.lang.String Required? false
Parameter = Session startup SQL Type = java.lang.String Required? false
Parameter = Session close-up SQL Type = java.lang.String Required? false
Parameter = Callback factory Type = java.lang.String Required? false
Parameter = read_only Type = java.lang.Boolean Required? false
Parameter = memory map size Type = java.lang.Integer Required? false
```

# Creating Workspaces

## Creating a Workspace from a connection string

You can create a Workspace from a connection string that contains paramters in key=value format with optional single quotes.

*Create a Shapefile Workspace*

```
String connectionString = "url='states.shp' 'create spatial index'=true"
Workspace workspace = Workspace.getWorkspace(connectionString)
```

*Create a GeoPackage Workspace*

```
connectionString = "dbtype=geopkg database=layers.gpkg"
workspace = Workspace.getWorkspace(connectionString)
```

*Create a H2 Workspace*

```
connectionString = "dbtype=h2 database=layers.db"
workspace = Workspace.getWorkspace(connectionString)
```

*You can use the withWorkspace method to automatically handle closing the Workspace.*

```
Workspace.withWorkspace("dbtype=geopkg database=src/main/resources/data.gpkg") {
  Workspace workspace ->
    println workspace.format
    println "-----"
    workspace.names.each { String name ->
      println "${name} (${workspace.get(name).count})"
    }
}
```

```
GeoPackage
-----
countries (177)
graticules (27)
ocean (2)
places (243)
rivers (13)
states (51)
```

## Creating a Workspace from a connection map

You can create a Workspace from a connection map that contains paramters.

### Create a H2 Workspace

```
Map params = [dbtype: 'h2', database: 'test.db']
Workspace workspace = Workspace.getWorkspace(params)
```

### Create a PostGIS Workspace

```
params = [
    dbtype : 'postgis',
    database: 'postgres',
    host    : 'localhost',
    port    : 5432,
    user    : 'postgres',
    passwd  : 'postgres'
]
workspace = Workspace.getWorkspace(params)
```

### Create a GeoBuf Workspace

```
params = [file: 'layers.pbf', precision: 6, dimension: 2]
workspace = Workspace.getWorkspace(params)
```

You can use the `withWorkspace` method to automatically handle closing the `Workspace`.

```
Workspace.withWorkspace([dbtype: 'geopkg', database: 'src/main/resources/data.gpkg'])
{ Workspace workspace ->
    println workspace.format
    println "-----"
    workspace.names.each { String name ->
        println "${name} (${workspace.get(name).count})"
    }
}
```

```
GeoPackage
-----
countries (177)
graticules (27)
ocean (2)
places (243)
rivers (13)
states (51)
```

## Creating Directory Workspaces



### Create a Directory Workspace from a directory name

```
Workspace workspace = new Directory("src/main/resources/shapefiles")
println workspace.format
println "-----"
workspace.names.each { String name ->
    println "${name} (${workspace.get(name).count})"
}
```

```
Directory
-----
ocean (2)
countries (177)
graticules (27)
```

### Create a Directory Workspace from a File directory

```
Workspace workspace = new Directory(new File("src/main/resources/shapefiles"))
println workspace.format
println "-----"
workspace.names.each { String name ->
    println "${name} (${workspace.get(name).count})"
}
```

```
Directory
-----
ocean (2)
countries (177)
graticules (27)
```

### Create a Directory Workspace from a URL

```
Directory directory = Directory.fromURL(
    new URL
    ("http://www.naturalearthdata.com/http://www.naturalearthdata.com/download/110m/cultural/ne_110m_admin_0_countries.zip"),
    new File("naturalearth")
)
println directory.format
println "-----"
directory.names.each { String name ->
    println "${name} (${directory.get(name).count})"
}
```

Directory

-----

ne\_110m\_admin\_0\_countries (177)

## Creating GeoPackage Workspaces

*Create a GeoPackage Workspace from a file name*

```
Workspace workspace = new GeoPackage("src/main/resources/data.gpkg")
println workspace.format
println "-----"
workspace.names.each { String name ->
    println "${name} (${workspace.get(name).count})"
}
```

GeoPackage

-----

countries (177)

graticules (27)

ocean (2)

places (243)

rivers (13)

states (51)

*Create a GeoPackage Workspace from a File*

```
Workspace workspace = new GeoPackage(new File("src/main/resources/data.gpkg"))
println workspace.format
println "-----"
workspace.names.each { String name ->
    println "${name} (${workspace.get(name).count})"
}
```

GeoPackage

-----

countries (177)

graticules (27)

ocean (2)

places (243)

rivers (13)

states (51)

## Creating H2 Workspaces

### Create a H2 Workspace from a File

```
Workspace workspace = new H2(new File("src/main/resources/h2/data.db"))
println workspace.format
println "--"
workspace.names.each { String name ->
    println "${name} (${workspace.get(name).count})"
}
```

```
H2
--
LAYER_STYLES (0)
countries (177)
ocean (2)
places (326)
states (52)
```

### Create a H2 Workspace with basic parameters

```
H2 h2 = new H2(
    "database",    ①
    "localhost",   ②
    "5421",        ③
    "geo",         ④
    "user",        ⑤
    "password"     ⑥
)
```

- ① Database name
- ② Host name
- ③ Port
- ④ User name
- ⑤ Password

### Create a H2 Workspace with named parameters. Only the database name is required.

```
H2 h2 = new H2("database",
    "host": "localhost",
    "port": "5412",
    "schema": "geo",
    "user": "user",
    "password": "secret"
)
```

## Creating Geobuf Workspaces

*Create a Geobuf Workspace from a File*

```
Workspace workspace = new Geobuf(new File("src/main/resources/geobuf"))
println workspace.format
println "-----"
workspace.names.each { String name ->
    println "${name} (${workspace.get(name).count})"
}
```

```
Geobuf
-----
ocean (2)
places (326)
countries (177)
```

## Creating Flatgeobuf Workspaces

*Create a Flatgeobuf Workspace from a File*

```
Workspace workspace = new FlatGeobuf(new File("src/main/resources/flatgeobuf"))
println workspace.format
println "-----"
workspace.names.each { String name ->
    println "${name} (${workspace.get(name).count})"
}
```

```
FlatGeobuf
-----
ocean (2)
places (326)
countries (177)
```

## Creating Property Workspaces

*Create a Property Workspace from a File*

```
Workspace workspace = new Property(new File("src/main/resources/property"))
println workspace.format
println "-----"
workspace.names.each { String name ->
    println "${name} (${workspace.get(name).count})"
}
```

Property

-----

circles (10)

places (10)

## Creating SQLite Workspaces

*Create a SQLite Workspace from a File*

```
Workspace workspace = new Sqlite(new File("src/main/resources/data.sqlite"))
println workspace.format
println "-----"
workspace.names.each { String name ->
    println "${name} (${workspace.get(name).count})"
}
```

Sqlite

-----

countries (177)

ocean (2)

places (326)

rivers (460)

states (52)

## Creating PostGIS Workspaces

*Create a PostGIS Workspace with basic parameters*

```
PostGIS postgis = new PostGIS(
    "database",    ①
    "localhost",   ②
    "5432",        ③
    "public",      ④
    "user",        ⑤
    "password"     ⑥
)
```

① Database name

② Host name

③ Port

④ Schema

⑤ User name

⑥ Password

Create a PostGIS Workspace with advanced parameters

```
PostGIS postgis = new PostGIS(  
    "database",           ①  
    "localhost",         ②  
    "5432",              ③  
    "public",            ④  
    "user",              ⑤  
    "password",          ⑥  
    true,                ⑦  
    true,                ⑧  
    "OWNER geo TABLESPACE points" ⑨  
)
```

- ① Database name
- ② Host name
- ③ Port
- ④ Schema
- ⑤ User name
- ⑥ Password
- ⑦ Estimated Extent
- ⑧ Create Database
- ⑨ Create Database Params

Create a PostGIS Workspace with named parameters. Only the database name is required.

```
PostGIS postgis = new PostGIS("database",  
    "host": "localhost",  
    "port": "5432",  
    "schema": "public",  
    "user": "user",  
    "password": "secret",  
    "estimatedExtent": false,  
    "createDatabase": false,  
    "createDatabaseParams": "OWNER geo TABLESPACE points"  
)
```

Delete a PostGIS database.

```
PostGIS.deleteDatabase(  
    "database", ①  
    "localhost", ②  
    "5432",     ③  
    "user",     ④  
    "password"  ⑤  
)
```

- ① Database name
- ② Host name
- ③ Port
- ④ User name
- ⑤ Password

*Delete a PostGIS database with named parameters. Only the database name is required.*

```
PostGIS.deleteDatabase("database",  
    "host": "localhost",  
    "port": "5432",  
    "user": "user",  
    "password": "secret"  
)
```

## Creating MySQL Workspaces

*Create a MySQL Workspace with basic parameters*

```
MySQL mysql = new MySQL(  
    "database",    ①  
    "localhost",  ②  
    "3306",        ③  
    "user",        ④  
    "password"     ⑤  
)
```

- ① Database name
- ② Host name
- ③ Port
- ④ User name
- ⑤ Password

*Create a MySQL Workspace with named parameters. Only the database name is required.*

```
MySQL mysql = new MySQL("database",  
    "host": "localhost",  
    "port": "3306",  
    "user": "user",  
    "password": "secret"  
)
```

## Creating SpatiaLite Workspaces

The SpatiaLite Workspace requires GDAL and OGR to be installed with Java support.

*Create a SpatialLite Workspace with a File name*

```
SpatialLite spatialite = new SpatialLite("db.sqlite")
```

*Create a SpatialLite Workspace with a File*

```
File directory = new File("databases")  
File file = new File("db.sqlite")  
SpatialLite spatialite = new SpatialLite(file)
```

## Creating WFS Workspaces

*Create a WFS Workspace with a URL*

```
WFS wfs = new WFS  
("http://localhost:8080/geoserver/ows?service=wfs&version=1.1.0&request=GetCapabilities")
```

## Creating OGR Workspaces

The OGR Workspace requires GDAL and OGR to be installed with Java support.

On Ubuntu, you can install GDAL and OGR with the following commands:

```
sudo apt-get install gdal-bin  
sudo apt-get install libgdal-java
```

*Determine if OGR is available.*

```
boolean isAvailable = OGR.isAvailable()
```

*Get OGR Drivers.*

```
Set<String> drivers = OGR.drivers
```

*Get a Shapefile Workspace from OGR.*

```
File file = new File("states.shp")  
OGR ogr = new OGR("ESRI Shapefile", file.absolutePath)
```

*Get a SQLite Workspace from OGR*

```
File file = new File("states.sqlite")  
OGR ogr = new OGR("SQLite", file.absolutePath)
```



```
File file = new File("states.json")
OGR ogr = new OGR("GeoJSON", file.absolutePath)
```

## Database Workspace

### SQL

Run SQL queries directly against Database Workspace (PostGIS, MySQL, H2)

```
Database workspace = new H2(new File("src/main/resources/h2/data.db"))
Sql sql = workspace.sql
```

Count the number of results

```
int numberOfPlaces = sql.firstRow("SELECT COUNT(*) as count FROM \"places\"").get(
    "count") as int
println "# of Places = ${numberOfPlaces}"
```

```
# of Places = 326
```

Calculate statistics

```
GroovyRowResult result = sql.firstRow("SELECT MIN(ELEVATION) as min_elev,
    MAX(ELEVATION) as max_elev, AVG(ELEVATION) as avg_elev FROM \"places\"")
println "Minimum Elevation = ${result.get('min_elev')}"
println "Maximum Elevation = ${result.get('max_elev')}"
println "Average Elevation = ${result.get('avg_elev')}"
```

```
Minimum Elevation = 0.0
Maximum Elevation = 2320.0
Average Elevation = 30.085889570552148
```

Select rows

```
List<String> names = []
sql.eachRow "SELECT TOP 10 \"NAME\" FROM \"places\" ORDER BY \"NAME\" DESC ", {
    names.add(it["NAME"])
}
names.each { String name ->
    println name
}
```

Zürich  
Zibo  
Zhengzhou  
Zagreb  
Yerevan  
Yaounde  
Yamoussoukro  
Xian  
Wuhan  
Windhoek

*Execute spatial sql*

```
Workspace memory = new Memory()
Layer layer = memory.create("places_polys", [new Field("buffer", "Polygon"), new
Field("name", "String")])
sql.eachRow "SELECT ST_Buffer(\"the_geom\", 10) as buffer, \"NAME\" as name FROM
\"places\"", {row ->
    Geometry poly = Geometry.fromWKB(row.buffer as byte[])
    layer.add([buffer: poly, name: row.NAME])
}
```



**View**

### Create a new Layer from a SQL View

```
Database workspace = new H2(new File("src/main/resources/h2/data.db"))
Layer layer = workspace.createView(
    "megacities",                                     ①
    "SELECT * FROM \"places\" WHERE \"MEGACITY\" = '%mega%'", ②
    new Field("the_geom", "Point", "EPSG:4326"),        ③
    params: [['mega', '1']]                             ④
)
boolean hasLayer1 = workspace.has("megacities")
println "Does layer exist? ${hasLayer1}"
```

- ① The layer name
- ② The SQL Statement
- ③ The Geometry Field
- ④ Query Parameters

Does layer exist? true



### Remove the new Layer created from a SQL View

```
workspace.deleteView("megacities")
boolean hasLayer2 = workspace.has("megacities")
println "Does layer exist? ${hasLayer2}"
```

Does layer exist? false

## Index

### Create an Index

```
Database workspace = new H2(new File("src/main/resources/h2/data.db"))
workspace.createIndex("places", "name_idx", "NAME", true)
workspace.createIndex("places", "megacity_idx", "MEGACITY", false)
workspace.createIndex("places", "a3_idx", ["SOV_A3", "ADM0_A3"], false)
```

### Get an Index

```
List<Map> indexes = workspace.getIndexes("places")
indexes.each { Map index ->
    println "Index name = ${index.name}, unique = ${index.unique}, attributes =
    ${index.attributes}"
}
```

```
Index name = PRIMARY_KEY_C, unique = true, attributes = [fid]
Index name = name_idx, unique = true, attributes = [NAME]
Index name = a3_idx, unique = false, attributes = [SOV_A3, ADM0_A3]
Index name = megacity_idx, unique = false, attributes = [MEGACITY]
```

### Remove an Index

```
workspace.deleteIndex("places", "name_idx")
workspace.deleteIndex("places", "megacity_idx")
workspace.deleteIndex("places", "a3_idx")
```