

Oracle® Spatial Studio

Guide



Release 21.3

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The Oracle logo, consisting of a solid red square with the word "ORACLE" in white, uppercase, sans-serif font centered within it.

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Oracle Spatial Studio Guide, Release 21.3

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Primary Author: Lavanya Jayapalan

Contributors: Chuck Murray, Mamata Basapur, Daniel Cuadra, Honglei Zhu, Roberto Mercado Mariscal, Carol Palmer, L.J. Qian, David Lapp, Siva Ravada, Denise Myrick

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Preface

Audience

This document is intended for users of the Spatial Studio tool who have one or more of the following responsibilities:

- Administering Spatial Studio. Such users install the tool, and create and manage database users of the tool.
- Using Spatial Studio. Such users are typically data analysts or application developers, or both.



Tip:

If you choose to print the PDF version of this book, and if you do not want to include the licensing details in the printout, print **only pages 1 (title page) through the last page of the last chapter**. (Most of the content of the book consists of license details in Appendix A.)

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Related Resources

For more information, see these Oracle resources:

- Oracle Technical Resources (formerly called Oracle Technology Network) page: <https://www.oracle.com/database/technologies/spatialandgraph.html> (and look for Spatial Studio)
- *Oracle Spatial Developer's Guide*

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

Changes in this Release for this Guide

New Features for Oracle Spatial Studio Release 21.3

- Added support for choropleth maps using predefined color codes which are stored in a dataset column.
See [Applying Predefined Colors to a Map Layer](#) for more information.
- Added support for visualizing a non-spatial dataset by joining it to an existing spatial dataset.
See [Preparing a Non-Spatial Dataset for Analysis](#) for more information.
- Added support for configuring a custom basemap using a OGC WMS service.
See [Adding a Custom Basemap](#) and [Changing Map Backgrounds](#) for more information.
- Added support to pin a location on the map.
See [Adding a Pin on a Map](#) for more information.
- Added support for setting the selection tolerance for geometry features on a map layer.
See [Setting Selection Tolerance on a Map Layer](#) for more information.
- Added support for creating Spatial metadata and index for geometry columns in a dataset.
See [Datasets with Issues](#) for more information.
- Improved design for **Create Dataset** dialog on the Datasets page.
See [Figure 3-5](#) to view the updated user interface.
- Added a mechanism to warn and prevent users from running multiple different Spatial Studio installations that access the same metadata schema.
See [Managing Metadata Schema when Running Multiple Instances of Spatial Studio](#) for more information.
- Added support for visualizing views containing latitude and longitude columns.
See [Enabling Spatial on a View-Based Dataset](#) for more information.

Database Support

Oracle Spatial Studio Release 21.3 is the last release to support Oracle Database 12.2 and 18c releases.

1

Introduction to Oracle Spatial Studio

Oracle Spatial Studio is a graphical tool for working with spatial data in Oracle Spatial and Graph format.

1.1 About Oracle Spatial Studio

Oracle Spatial Studio, also referred to as Spatial Studio, is a free tool that lets you connect with, visualize, explore, and analyze geospatial data stored in and managed by Oracle Spatial.

Spatial Studio is a multiuser Java EE application that can be used as a standalone tool (Quick Start) or deployed to WebLogic Server.

Before you can use Spatial Studio, you must download the kit from Oracle Technical Resources (formerly called Oracle Technology Network), install the software, and perform certain administrative actions like creating database users that are authorized to use the tool, and managing those users.



Note:

Spatial Studio is **not** the Spatial map visualization component (formerly called "MapView"), which is not an end-user "tool" but rather a separate and distinct component.

The map visualization component is documented in [Spatial Map Visualization Guide](#).

1.2 Spatial Studio Terminology

This section introduces the key concepts and domain objects of Oracle Spatial Studio.

- **Connection:** Connections are user-created; they provide details so that the Spatial Studio can load user data from an external data source, typically a specific database schema.
- **Dataset:** A dataset is the basic organizational unit of a user's data.
- **Project:** A project is where data visualization and analysis occur. It represents a "workspace" that can be saved and reopened.
- **Published Project:** A published project is a snapshot of the visualizations and analyses that a user has created in a project. It provides an easy way of sharing what users have created within their organization.
- **Analysis:** An analysis is typically one or more (spatial) operations performed on one or more datasets. The operation types and their parameters for an analysis are all stored as part of a *project*. The result of any analysis can be visualized, just like any other dataset.

- **Metadata schema (repository):** The metadata schema for Spatial Studio is an Oracle Database that contains the repository where all Spatial Studio metadata is centrally managed.
- **User:** Spatial Studio's end users, which are typically business analysts and administrative users. These users are NOT database schema owners; rather they are application users, whose information is typically stored in an LDAP-like directory and whose authentication is carried out by WebLogic Server.
- **Public Dataset:** A public dataset is one with a GeoJSON endpoint that can be accessed without having to log onto the Spatial Studio first. A public dataset is always visible to all the Spatial Studio users and can be used in their projects.
- **Public Published Project (PPP):** A public published project is a published project where all the datasets involved are public datasets, and the published project itself is also made public. You can embed the visualizations of a public published project in other web applications, or can be viewed standalone in a web browser, without having to log onto Spatial Studio server first.

1.3 Spatial Studio Metadata and Connection Management

This section provides conceptual information about the metadata schema and the connections object in Spatial Studio.

Spatial Studio stores all of its own metadata (such as the definitions of all the datasets and connections created by different users) in a single Oracle Database schema known as the metadata schema, or repository.

This metadata schema is one that Spatial Studio must be able to connect to during initial start up, because all of its essential metadata and states are stored there. This metadata schema can be an Oracle Database devoted solely to Spatial Studio use, or it can be any schema potentially used for other purposes as well, as long as the schema is provisioned for use by Spatial Studio, with the minimum necessary privileges.

The main types of connections are created by Spatial Studio's end users so that they can gain access to a set of data tables stored in potentially several different database schemas, and explore them together in a single project. For each such user-created connection, only its connection details are stored in Spatial Studio's metadata schema, while no actual (raw) data is ever copied or extracted into the metadata schema.

If a schema user name and password are specified when a connection is created in Spatial Studio, this information is securely encrypted before being stored in the metadata schema tables. When a user opens a project that depends on datasets originated from such a connection, then the password is decrypted at that time and a new JDBC connection pool is established. This connection pool is then used by Spatial Studio to run queries against the target table(s) from that connection whenever needed.

By default a connection is **private**, meaning that only the user that created the connection can access it (either in a project or anywhere else). For example, if User A creates a connection, then User B will not be able to see or use that connection or any data from the connection. The only exception is if User B is an admin user, in which case all connections and datasets are fully accessible by User B.

1.4 Spatial Studio Best Practices

This section describes the best practice recommendations when working with Spatial Studio.

Standardize Longitude/Latitude Data on SRID 4326

In Oracle Database, spatial data includes a SRID (spatial reference identifier), which uniquely identifies the coordinate system associated with the data. If you want to perform any spatial analysis operations involving multiple data sets, it is recommended that the data sets have the same SRID.

Many SRIDs can be used for longitude/latitude data, but probably the most widely used is 4326. Oracle recommends that you use SRID 4326 for longitude/latitude geometries unless there is information to indicate otherwise. Also, if you have Oracle tables with longitude/latitude geometries and if the SRID is not consistent across the tables, you are advised to standardize on SRID 4326.

(For detailed information about SRIDs and coordinate system support in Oracle Spatial, see the Coordinate Systems (Spatial Reference Systems) chapter in the Spatial manual.)

The following example transforms geometries that do not use SRID 4326 so that they use SRID 4326. You would need to do these actions for each existing table that does not use SRID 4326. The example assumes a geometry table named `TABLE_1` with a geometry column named `GEOM`. It also drops the existing spatial index named `table_1_idx`, and later re-creates it.

```
-- Drop the existing spatial index.
DROP INDEX table_1_idx FORCE;

-- Update the spatial metadata.
INSERT INTO user_sdo_geom_metadata
VALUES (
  'TABLE_1', -- table name
  'GEOM',    -- geometry column name
  SDO_DIM_ARRAY(
    SDO_DIM_ELEMENT('Longitude', -180, 180, 0.05), -- 0.05 meter tolerance
    SDO_DIM_ELEMENT('Latitude', -90, 90, 0.05) -- 0.05 meter tolerance
  ),
  4326 -- SRID for 'Longitude / Latitude (WGS 84)' coordinate system
);

-- Update (transform) geometry data to use SRID 4326.
update table_1 set geom = sdo_cs.transform(geom, 4326);

-- Re-create the spatial index.
CREATE INDEX table_1_idx
ON table_1(geom)
INDEXTYPE IS MDSYS.SPATIAL_INDEX_V2;
```

 **Note:**

In the CREATE INDEX statement, SPATIAL_INDEX_V2 is recommended if the Oracle Database is Release 18 or later. If it is earlier than Release 18, specify just SPATIAL_INDEX.

2

Administering Oracle Spatial Studio

Administering Oracle Spatial Studio involves certain actions that must be performed before non-administrative users can work with spatial data. If you are an administrative user of Spatial Studio, you must:

- Download the Oracle Spatial Studio application from Oracle Technical Resources (formerly called Oracle Technology Network) and install it.
- Set up a database schema to be the Spatial Studio schema, that is, to hold metadata for Spatial Studio.
The Spatial Studio schema can be either an existing database schema in which Spatial Studio metadata will be added, or a newly created schema that will be used only for Spatial Studio.
- Configure the newly installed Spatial Studio application.
When the installation and configuration actions are completed, users can connect to the database, start Spatial Studio, and use its features.

Note:

The Spatial Studio application can be downloaded in either of the following formats:

- Quick Start: A ready-to-run standalone application packaged in a zip file containing what you need to launch the Spatial Studio web application on your desktop. (You will still need to have JDK 8 64-bit, update 181 or later installed on your desktop, because no Java kit is bundled with this kit.) Quick Start is well suited for personal and development use.
- A WLS-optimized EAR (Enterprise Application aRchive) file. This `.ear` file can be deployed to an existing WebLogic Server domain administered by an organization's WLS or middleware administrator.
This is the recommended installation and deployment method if you intend for multiple end users to access the same Spatial Studio web application.

A given person or database user can be *both* an administrative user and a non-administrative user, *or* can be *only* an administrative user or a non-administrative user.

2.1 Prerequisites and Recommendations for Spatial Studio

This section describes the prerequisites and recommendations that apply for using Spatial Studio.

Oracle Spatial must be installed on the database to which any users will connect to perform actions with Spatial Studio. (It is not sufficient to have only Oracle Locator installed.)

The following additional requirements and recommendations apply:

- Java versions: Java 8 (64-bit, update 181 or later); or JDK 11 (64-bit).

- Oracle Database 12.2 or later. This applies both to the Spatial Studio metadata schema and to all database connections that will be used by Spatial Studio users.

 **Note:**

- Oracle Spatial Studio Releases are backward compatible with supported Oracle Database versions.
- Oracle Spatial Studio Release 21.3 is the last release to support Oracle Database 12.2 and 18c releases.

- Oracle WebLogic Server 12.2.1.3 or later.
- All the privileges listed in section [Setting Up the Spatial Studio Metadata Schema](#) are required for each database user that works with Spatial Studio.
- Quota on the default tablespace for each database user that works with Spatial Studio. ALTER USER statement format: ALTER USER [username] QUOTA [quota value] ON [default tablespace name];
For example, for a user named test_user with default tablespace users:

```
ALTER USER test_user QUOTA unlimited ON users;
```

- The default tablespace for the Spatial Studio repository schema should not use compression.

2.2 Downloading and Installing Spatial Studio

Spatial Studio must be downloaded and installed before anyone can use it to perform interesting work on spatial data.

Go to <https://www.oracle.com/database/technologies/spatial-studio/get-started.html> to see more information for downloading and installing Spatial Studio.

2.2.1 Installing and Configuring the Spatial Studio Quick Start

Quick Start is an easy method for getting started, and is well suited for personal and development use.

The Quick Start is packaged in a single zip that contains everything you need to start using Spatial Studio, except for Java 8 (64-bit, update 181 or later) and your own database schemas.

The following are general steps for getting started:

1. Download the Quick Start zip archive `OracleSpatialStudio_qs.zip`.
2. Unzip (extract) it, which results in a directory named `Oracle_Spatial_Studio`.
3. Ensure that the `JAVA_HOME` environment variable exists on your system, and points to a full JDK installation of Java SE Development Kit 8u181 (64-bit) or later. JDK 11 can also be used.
4. Ensure that the ports 8080 and 4040 are not being used by any other (web) applications. (You can direct Spatial Studio to use different ports, but 8080 and

4040 are the default.) Port 8080 is to used with the `http://` protocol, while port 4040 is for the `https://` protocol.

Note that by default, Spatial Studio only allows access using `https`.

5. From a command window (Windows) or terminal (Linux or Mac), go to (`cd`) the `Oracle_Spatial_Studio` directory. This directory contains several `.bat` or `.sh` files.
6. Use `start.sh` or `start.bat` to start the application. (On Linux or Mac you may need to ensure that the `.sh` files are executable by first running the command: `chmod u+x *.sh`) Leave the terminal or command window open.
7. In your browser, go to the URL: `https://localhost:4040/spatialstudio`
The default admin user login credentials are `admin/welcome1`. It is strongly recommended that you immediately change the password.

The admin user's and the two built-in regular users' passwords are all stored in encrypted form. For how to change the (encrypted) password of a Spatial Studio user, see the README file for the Quick Start. This README file also contains information about starting and restarting the Quick Start.

 **Note:**

The following considerations apply to using the Quick Start:

- The default port is 4040, but you can change it by editing the file `conf/server.json` in `Oracle_Spatial_Studio`. You will need to restart the application after you make any change. (The same applies if you change the HTTP port value from the default 8080.)
- The Quick Start provides several predefined web user login accounts named `admin`, `manager`, `author`, `consumer`, and `limited`. These users and their login passwords are defined in the configuration file `conf/jetty-realm.properties`. You should **change the passwords immediately** after you unzip the downloaded Quick Start kit.
Because the Quick Start is intended for personal use, the passwords for the end user accounts **are not encrypted**. However, all other passwords, such as those used to log into the Spatial Studio metadata schema or for any user-created connections to database schemas, **are strongly encrypted** everywhere.
- To stop the application, the preferred approach is to start a second terminal or command window, then go to the same `Oracle_Spatial_Studio` folder and run the `stop.bat` or `stop.sh` script.

2.2.2 Installing Spatial Studio to a WebLogic Server Domain

Spatial Studio can be deployed to a WebLogic Server domain, the recommended approach if multiple end users will access the same Spatial Studio application.

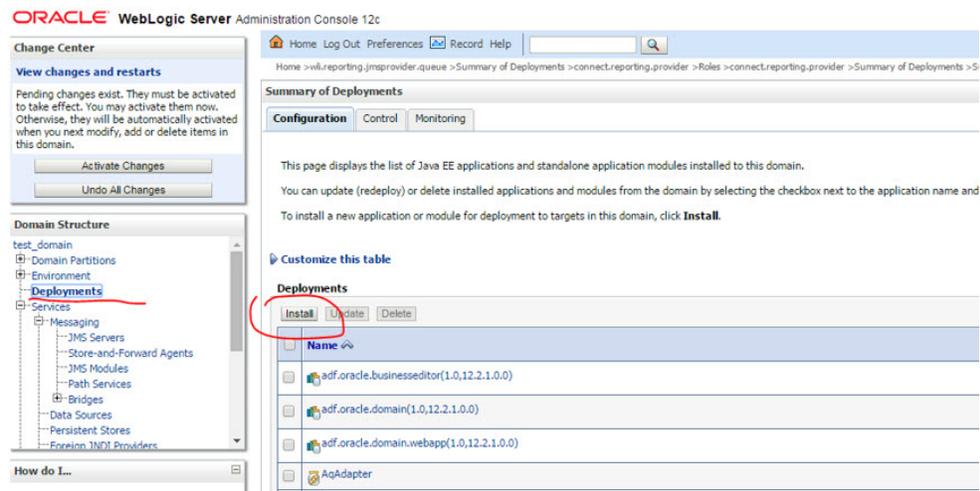
 **Note:**

A WebLogic Server license is required in order to host Spatial Studio in WebLogic Server for multiple end users.

The general approach for deploying Spatial Studio to WebLogic Server is no different from deploying any other Java EE EAR application. The easiest way to do so is by using the WebLogic Server's Admin console with the following steps. Note that in all or most steps you can accept the default values provided by the WLS Installation Application Wizard.

1. Download the Studio EAR archive from Oracle Technical Resources or eDelivery, and save it to your local system.
2. Log into the target WLS domain's Admin console.
3. Click the **Deployments** link on the left side.
4. Click **Install** button under the Deployments section, as shown in the following figure (note that the exact contents may be different for your instance of WLS).

Figure 2-1 WLS Admin Console for Deploying Spatial Studio



5. On the next page, , select the Spatial Studio EAR file downloaded previously, and install it as an application (not as a library).
6. Click through the remaining steps, including selecting the proper target server. You should accept the default options in all cases unless you know exactly what you are doing. Finally, click **Save** to complete the deployment.
7. If your WLS runs in production mode, you may need to activate the changes to ensure the deployment is activated.
8. Make sure the newly deployed Spatial Studio application is marked Active; otherwise, you may need to explicitly start it from the WLS administrative console.
9. Access the Studio application using your managed server's URL with the / spatialstudio context root. For example: `http://mycompany.com:7002/spatialstudio`

2.2.2.1 Preventing a Spatial Studio Admin User from General WLS Administration

If you want to prevent a Spatial Studio administrative user from performing other general WebLogic Server administrative operations, follow the instructions in this topic.

The Spatial Studio application by default allows all WebLogic managed admin users (those who are in WebLogic's **Administrators** group) to log into the Spatial Studio application and assume Admin role inside the Spatial Studio application as well.

However, in some scenarios, your organization may *not* want to provide the WebLogic Server admin account information to the user(s) that will be administering only the Spatial Studio application. In such cases, the WLS system administrator can create a new WLS group with the id value of "**SGTech_SystemAdmin**" in the default WLS security realm. Then, either create a new user or assign an existing non-WLS-admin user to this group. From then on, this user will assume the admin role of the Spatial Studio whenever logged in, but will not be able to administrate the WLS server in general.

Note that all WLS managed users will be able to log into Spatial Studio by default, but they will be limited to accessing only their own Spatial Studio objects such as connections, datasets, and projects. Administrative users of Spatial Studio will have full access to every Spatial Studio object created by everyone.

2.2.3 Installing Spatial Studio from Oracle Cloud Marketplace

You can provision Spatial Studio to Oracle Cloud from Oracle Cloud Marketplace.

The following resources help you to deploy Spatial Studio from Cloud Marketplace:

- [Deploy Spatial Studio from Cloud Marketplace](#)
- [LiveLabs Workshop - Install Oracle Spatial Studio from Cloud Marketplace](#)

2.3 Setting Up the Spatial Studio Metadata Schema

You must set up a database schema to be the Spatial Studio schema, which will hold metadata used by the Spatial Studio application.

The Spatial Studio schema can be either an existing database schema in which Spatial Studio metadata will be added, or a newly created schema that will be used only for Spatial Studio. The recommended practice is to create a new database user that will be used only for Spatial Studio. The database user for the Spatial Studio schema must have the following privileges:

- CONNECT
- CREATE PROCEDURE
- CREATE SEQUENCE
- CREATE SESSION
- CREATE SYNONYM
- CREATE TABLE
- CREATE TRIGGER
- CREATE TYPE
- CREATE VIEW

 **Note:**

The `CREATE TRIGGER` privilege is required only if you intend to store and display GeoRaster data in the schema.

For example, when connected as a user with DBA privileges:

```
SQL> create user SPATIAL_STUDIO identified by <password>;
SQL> grant connect, create procedure, create sequence, create session,
create synonym, create table, create trigger, create type, create view
to SPATIAL_STUDIO;
```

When the Spatial Studio application starts running for the first time, it will generate a configuration file in a folder named **.sgtech** under the current user's operating system home folder. The configuration file is named `sgtech_config.json`. This is where Spatial Studio application will be obtaining and storing the connection details in its metadata schema.

After the connection to the metadata schema is established, the Spatial Studio application will automatically check if the required tables and other database objects are already present, and if their versions are up to date with the latest Spatial Studio application software. If these tables are not found, or if the tables require migration, the Spatial Studio application will run the necessary SQL scripts to create or migrate them, all without any intervention from the user.

The Spatial Studio schema will contain the following tables and views:

- `SGTECH_OBJECT`: stores all the domain objects for Spatial Studio.
- `SGTECH_SYS_TYPE`: defines all the known types of domain objects of Spatial Studio.
- `SGTECH_SYS_JSON_SCHEMA`: stores JSON data schema.
- `SGTECH_TASK_QUEUE`: stores long-running jobs of Spatial Studio.
- `SGTECH_TASK_BROKER`: stores job brokers for Spatial Studio.

 **Note:**

Do **not** add, delete, or edit any of the Spatial Studio tables or views or the data within them. They are automatically maintained by Spatial Studio, and should not be modified by users unless directed by Oracle Support.

Managing Metadata Schema when Running Multiple Instances of Spatial Studio

Spatial Studio prevents you from running multiple application instances each having its own `sgtech_config.json` file from using the same metadata schema. In case you want to run another instance, it is recommended that you copy the `sgtech_config.json` configuration file linked to the initial instance to the system where you want to start the new instance.

Otherwise, any attempt to connect to the same metadata schema from an instance running on a different system is prevented by Spatial Studio with the following warning:

```
The selected repository is already registered to another instance of Spatial Studio. Check the system logs for more details.
```

2.4 Connection Requirements for Database Users of Spatial Studio

This section describes the connection requirements for database users to work on Spatial Studio.

Each individual user must connect as a database user who is authorized to run Spatial Studio. A Spatial Studio administrator can enable access for the database users.

You can create new database users specifically for Spatial Studio access, or you can modify existing database users to enable Spatial Studio access, or you can do a combination of these approaches.

All database users must have a minimum set of privileges. In addition, each database user that works with Spatial Studio must have quota on its default tablespace. The privilege and quota requirements are explained in [Prerequisites and Recommendations for Spatial Studio](#).

2.5 Changing the Configuration Using the `sgtech_config.json` File

This section describes the configuration of important properties in `sgtech_config.json` file.

By default, Spatial Studio will create (if it does not already exist) and use a JSON file named `sgtech_config.json` for most of its essential configuration information.

This file is typically found in the operating system user's home directory, in a subfolder named `.sgtech`. This is true whether you deployed the Studio EAR to a WebLogic domain or are just using the Quick Start.

The following topics describe some important properties in the configuration file that a system administrator should be aware of.

2.5.1 Allow HTTPS-ONLY Access

One of the top level properties in the `sgtech_config.json` config file is **`https_only`**. When this value is set to **`true`** (the default), Oracle Spatial Studio will actively monitor all incoming requests and only allow requests that were made using SSL. Normal `http://` requests will be denied.

Thus, if you tried to access the Spatial Studio application using an `http://` URL such as `http://localhost:8080/spatialstudio`, and if the value of `https_only` is set to `true`, then you will not be able to log in. In fact, you will not even see the login page itself, because none of the page resources will be accessible by your browser. Similarly, all RESTful requests will be blocked unless accessed using HTTPS.

If your environment (such as WebLogic Server) supports only `http` access, then you can change the value of `https_only` to `false`, and make sure to restart the Spatial Studio application or the JavaEE container where Spatial Studio is deployed.

2.5.2 Connecting to the Spatial Studio Metadata Schema

Spatial Studio must have access to a set of metadata tables, such as `SGTECH_OBJECT`. These tables are collectively considered the repository of the Spatial Studio application. The database schema that hosts these tables is considered the metadata schema or repository schema of Spatial Studio.

Spatial Studio must be able to establish a connection to this metadata schema as the first step during startup, when the connection details are found in the `sgtech_config.json` file in the `metadata_schema` section.

In an emergency situation, you can also manually edit this section to change or correct the connection details. However, be careful whenever editing this file, because any syntax error can cause Spatial Studio to stop working or fail to restart.

When you manually enter the repository schema connection details in the `sgtech_config.json` file (in the `metadata_schema` section), you must first specify whether `CONTAINER` or `SPATIAL_STUDIO` is managing the physical JDBC connections:

```
"metadata_schema" : {
  "connection_manager": "CONTAINER"
}
```

Or

```
"metadata_schema" : {
  "connection_manager": "SPATIAL_STUDIO"
}
```

When `connection_manager` is set to `CONTAINER`, it means the JDBC connections to the Spatial Studio's repository schema are managed through a Java EE data source already created in Jetty (for Quick Start) or WebLogic Server. For example, if there is a data source named `jdbc/studioMetadata` in the WLS domain, and if you want Studio to connect to the target schema using this data source, the relevant section in `sgtech_config.json` should look like this:

```
"metadata_schema" {
  "connection_manager" : "CONTAINER",
  "container_managed":{
    "jndi_datasource_name" : "jdbc/studioMetadata"
  }
}
```

 **Note:**

As of Spatial Studio Release 19.2, you cannot enter the container-managed connection details in the Spatial Studio application, so manually editing `sgtech_config.json` file is the only supported approach.

However, if you want Spatial Studio to manage the physical connections to its metadata schema, set `connection_manager` to `SPATIAL_STUDIO`, and supply the full set of JDBC connection details, which vary depending on whether the schema resides in an Oracle Autonomous database (which requires a database Wallet for establishing connections), or a regular database on-premises. You can check the inline comments inside the `sgtech_config.json` file for more details, but it is best if you simply log onto Spatial Studio as an admin user and then interactively supply the connection details for the repository schema. Such details will then be automatically saved in `sgtech_config.json` after Spatial Studio verifies the connection.

2.5.3 Caching Metadata Objects

During run time as users create connections, datasets, and projects, Spatial Studio is creating, modifying, and storing a large amount of metadata (sometimes called Spatial Studio's "domain objects"), such as the definition of a dataset and all of its columns, or the definition of a project including the full layout of all of its visualizations.

All the metadata objects are permanently stored in the metadata table `SGTECH_OBJECT`, but if the database must be accessed frequently (such as every time you open a project or view the properties of a dataset), performance may suffer. If this occurs, the solution is to **cache** frequently accessed copies of such metadata objects in memory.

The `cache` section of the `sgtech_config.json` file lets you specify whether to enable such an in-memory cache of metadata objects. If the cache is enabled, then you can further specify how many such objects can be cached and for how long. A general rule is that `max_size` (the maximum number of metadata objects to be cached) should be no less than 1000, but probably should not exceed 10000 unless you have a very large amount of memory allocated to Spatial Studio.

2.5.4 If the Spatial Studio Repository Schema Password Has Been Changed

If the Spatial Studio Repository Schema Password has been changed, you must update the `sgtech_config.json` configuration file, as follows:

1. Make a backup copy of the file. For example, copy `~/ .sgtech/sgtech_config.json` to `~/ .sgtech/sgtech_config.json_backup`.
2. On the Spatial Studio compute node, edit the file `~/ .sgtech/sgtech_config.json`.
3. In the `metadata_schema` section, update `database_password` to the desired value.
4. Save the file and then restart the Spatial Studio deployment. To restart if you are using the Quick Start kit, see the `README` file for the Quick Start; to restart if this is a WebLogic Server deployment, use the WebLogic Server console.
5. Open the Studio Spatial Studio application. You should be able to log in.

You will still have all the artifacts you had created, including other (non-repository) connections, which you can edit as needed.

3

Using Oracle Spatial Studio

Using Oracle Spatial Studio, you can create one or more projects, each of which can define one or more spatial datasets on which you can perform various spatial operations.

It is important you understand the following terminologies when working on Spatial Studio:

- A **project** contains Spatial Studio objects, such as datasets, that are logically related to some intended usage. For example, a project might be named New England Sales Territories, or Sales Territories and Customers, or Ohio Airports and Counties. When creating a project, you should know the purposes for which you want to identify and analyze spatial data in a geographic area.
- A **dataset** is a collection of spatial features of a specific usage type and geometry type. For example, datasets might include Airports represented by polygon geometries, or Roadways represented by LRS line string geometries, or Accidents represented by point geometries.
- A **connection** specifies information for connecting to an Oracle Database schema where spatial data of interest resides: user name, password, system, port, database name, and so on. (It is similar to a SQL Developer connection.)

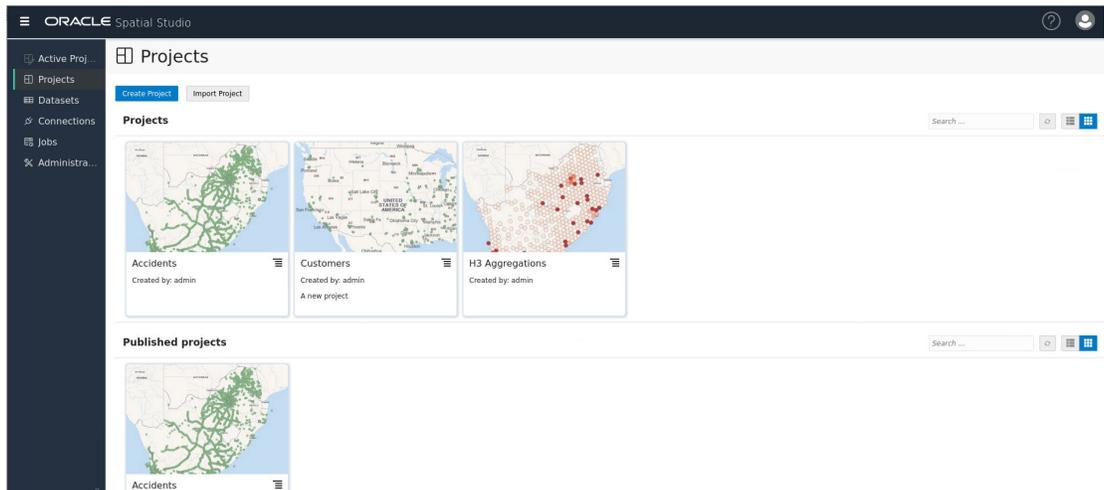


Note:

See also [Spatial Studio Terminology](#) for more information.

The main landing page for Spatial Studio for a new user is as shown:

Figure 3-1 Spatial Studio Main Page



The overall layout of the Spatial Studio user interface comprises of:

- **Header:** The header at the top of the page contains the following buttons:
 - : to display or hide the side navigation menu
 - : to help you get started on Spatial Studio by providing an overview of the tool and links to other tutorial resources
 - : displays the user profile details
- **Side Navigation Menu:** A navigation panel on the left displays the menu items. You can expand or collapse the navigation drawer.
- **User Workspace:** The page specific details for the selected menu option is displayed on the right.

The navigation menu consists of the following menu options:

- **Active Project:** Directs you to the Active Project page where your recent working project is displayed.
- **Projects:** Directs you to the Projects page where all your existing projects and published projects are listed.
- **Datasets:** Directs you to the Datasets page where all the datasets available to you are listed.
- **Connections:** Directs you to the Connections page where all the existing connections (data sources) available to you are listed.
- **Jobs:** Directs you to the Jobs page where the various background jobs started by Spatial Studio to process various requests are listed.
- **Administration:** Directs you to the Administration page where you can monitor the status and activity of Spatial Studio. It contains tabs for Settings, Maintenance, and Monitoring.

3.1 Getting Started Using Spatial Studio

Spatial Studio includes a page with information and links to help you get started using the tool.

To display this page, click the small question mark icon (?) in the top right area of most pages (above the Create button). The Get Started with Spatial Studio page includes:

- **Watch Overview:** Watching this video is perhaps the best way to grasp the user interface and see how to perform available actions.
- **Prepare Data:** Enable your business data for mapping and spatial analysis.
- **Visualize and Analyze:** Explore geographic patterns and relationships in your business data.
- **Learn More:** Visit our video library to learn more about Oracle Spatial Cloud.

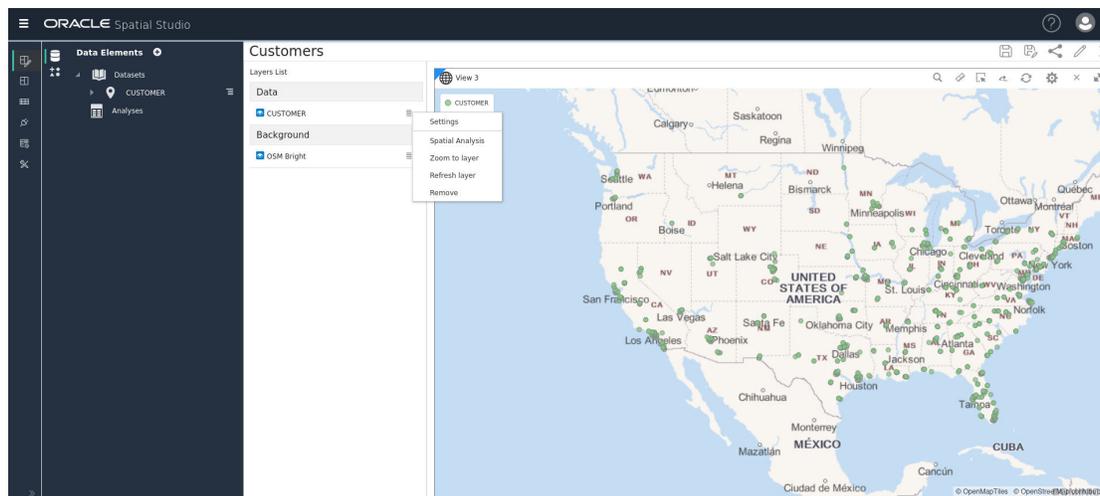
3.2 Spatial Studio Active Project Page

The Active Project page displays your current working project.

You can switch to your working project at any time from the other pages when working in Spatial Studio.

The following figure shows a layout of the Active Project page:

Figure 3-2 Active Project Page



You can perform the following actions on the Active Project page:

- Creating a table or map visualization.
- Adding or removing datasets from your project.
- Adding or removing data from a visualization layer.
- Adjusting the style setting or the zoom resolution for your visualization layer. You can click the menu selector next to the dataset name in the **Data** tab to display the following available options:
 - **Settings**: Shows display options for Style, Interaction, and Legend.
 - **Spatial Analysis**: Lets you perform many spatial operations (All, or filtered by type: Filter, Combine, Transform, Measure), such as Add a buffer of a specified distance, Return shapes having spatial relationship to another, and Calculate area.
 - **Zoom to Layer**: Zooms the display (out or in) to fit the entire layer.
 - **Refresh Layer**: Refreshes the layer to reflect all user actions.
 - **Remove**: Removes the layer from the project.

The following icons are displayed on the top-right area of the Active Project page:

Figure 3-3 Active Project Page Icons



They are as follows:

- **Save** : Saves your updates to the project

- **Save As** : Creates a new copy of the project
- **Share** : Publishes the project
- **Project Settings**: Allows you to edit the project details (such as, Name, Created By and Description)
- **Close**: Close the project

3.3 Spatial Studio Projects Page

The Projects page lists all the projects that have been created, both unpublished and published.

Figure 3-1 shows the layout of the Projects page.

You can perform the following actions on the Projects page:

- You can select a project to work or for viewing the details.
- You can create a new project by clicking **Create Project**.
- You can import a project by clicking **Import** and selecting a project zip file in the **Import Project** dialog.
- You can open, export or delete a project by clicking the hamburger icon for any of the listed projects.
- You can alter the display settings to have the projects listed as cards or in a tabular format.
- You can search for both unpublished and published projects.



Note:

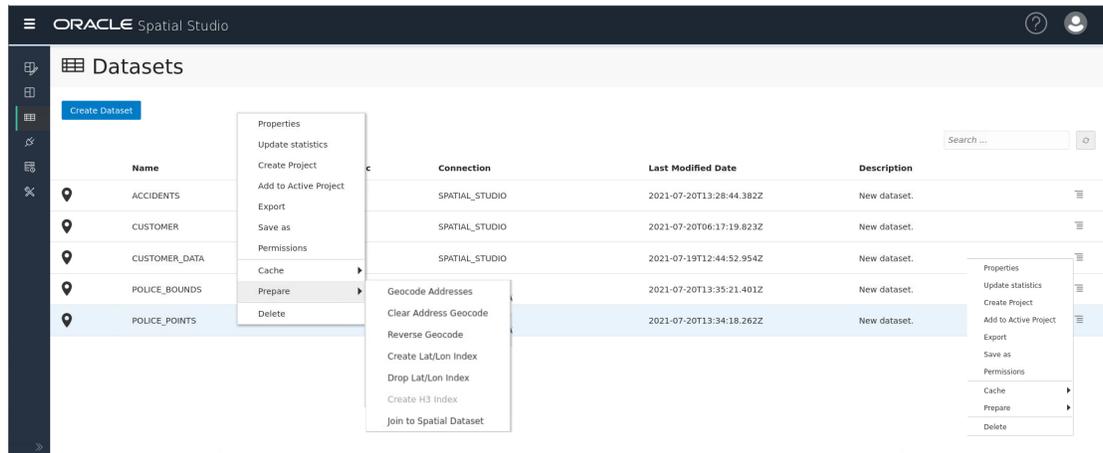
For the first two actions, the project will be opened in the **Active Project** page.

3.4 Spatial Studio Datasets Page

The Datasets page lets you view and edit existing datasets, and create new ones.

The following figure shows the Datasets page:

Figure 3-4 Datasets Page



You can perform the following actions on the Datasets page:

- You can create a new dataset, by clicking **Create Dataset**.
You can create a dataset from the following sources:
 - Oracle Database table or view using a database connection
 - By uploading dataset files with different formats to the database, such as :
 - * Spreadsheet file
 - * Shapefile
 - * GeoJSON file
 - * CSV file
 - * KML file
 - By importing 3D Tiles Tileset

By clicking  against any displayed dataset or by right-clicking a dataset row, you can perform the following actions :

- **Properties:** View or modify properties of the dataset
- **Update Statistics:** Update the dataset statistics
- **Create Project:** Create a new project using the dataset
- **Add to Active Project:** Add the dataset to the project in the Active Project page
- **Export:** Export the dataset (in GeoJSON or CSV file format)
- **Save as:** Make a new copy of the dataset
- **Permissions:** Configure dataset sharing and permissions
- **Cache:** Control map tiles pre-caching activities
- **Prepare:** Prepare a dataset for any of the following options:
 - **Geocode Addresses:** Add geocoded information such as geographic coordinates to the dataset
 - **Clear Address Geocode:** Remove geocoded information from the dataset

- **Reverse Geocode:** Add address information from a set of geographic coordinates to the dataset
- **Create Lat/Lon Index:** Create latitude/longitude index
- **Drop Lat/Lon Index:** Remove latitude/longitude index
- **Create H3 Index:** Prepare an H3 aggregation dataset
- **Join to Spatial Dataset:** Prepare a non-spatial dataset for map visualization by joining to a spatial dataset
- **Delete:** Delete the dataset

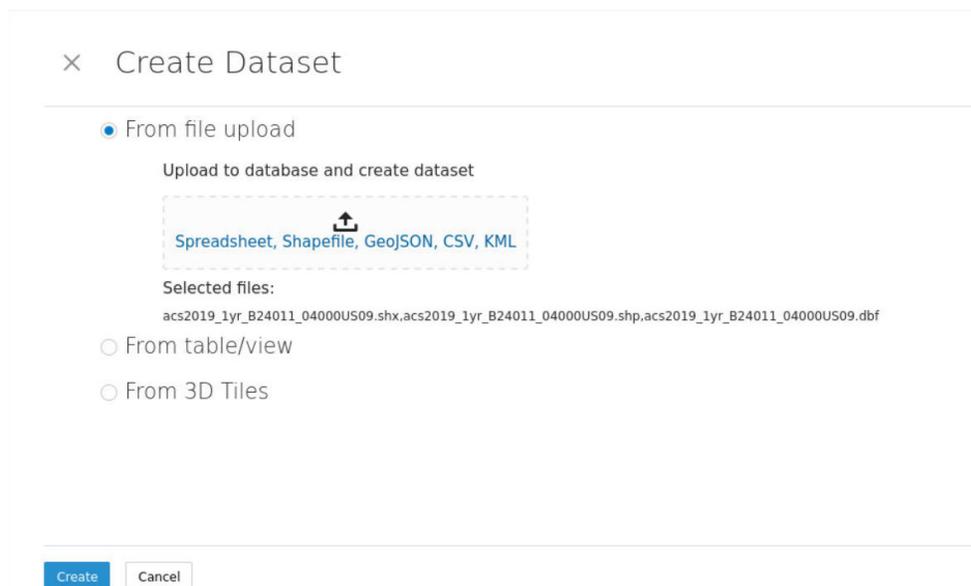
3.4.1 Creating a Dataset

The following steps enable you to add a new dataset.

1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.

The **Create Dataset** window opens:

Figure 3-5 Creating a Dataset



3. Click on one of the data source options and perform the steps appropriate to your selection as shown in the following:

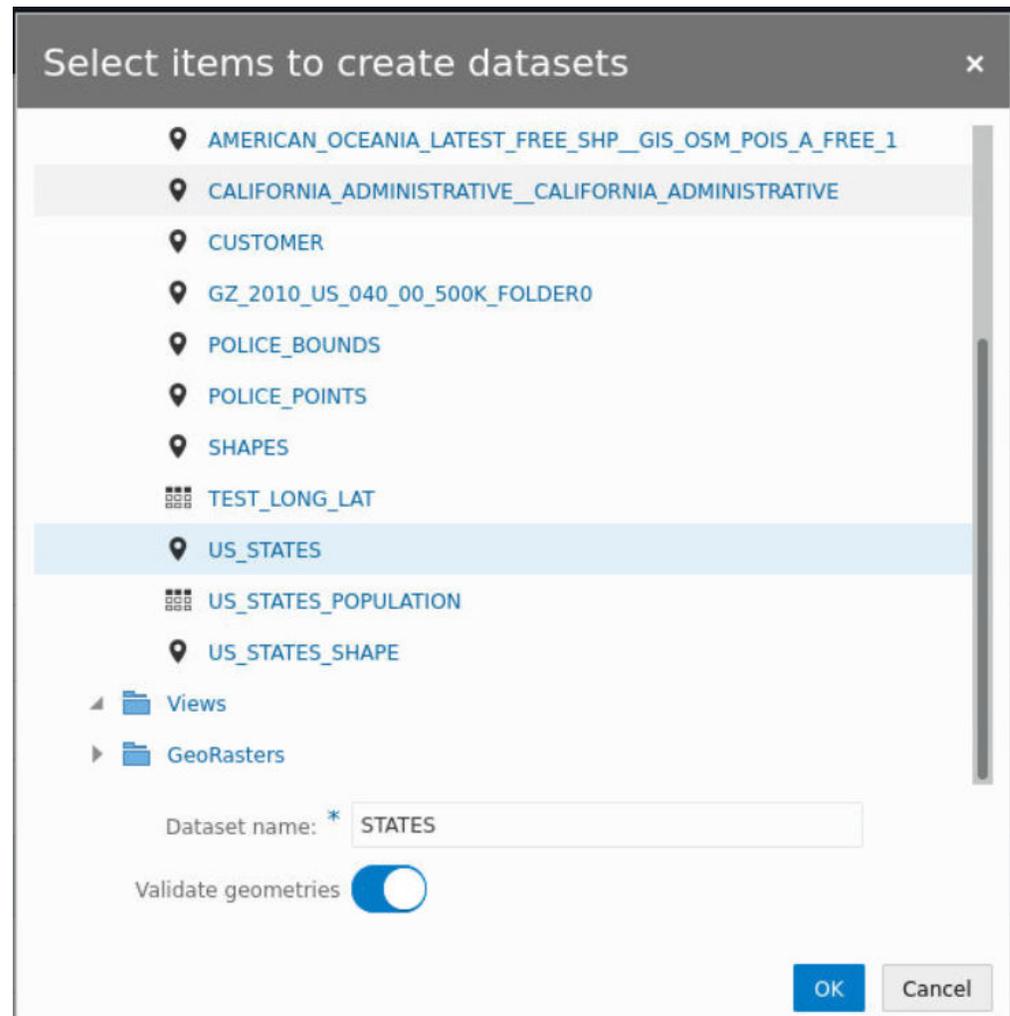
From file upload:

- a. Upload one of the supported file types.
- b. Click **Create**.

From table/view:

- a. Select a connection from the **Select Connection** drop-down.
- b. Click **Create**.
The **Select items to create datasets** window opens listing all the tables, views and GeoRaster data present in the database.

Figure 3-6 Select the Data Source



- c. Select an item from the list and click **OK**.

From 3D Tiles

- a. Select a **Tileset location**.

You can choose one of the following options:

- **Tileset located on server:** Enter **Name** and **Directory** to load a tileset from a server.
- **Upload tileset:** Upload a new tileset zip file. The supported formats are:
 - **.b3dm:** Batched
 - **.pnts:** Point Cloud
- Click **Create**.

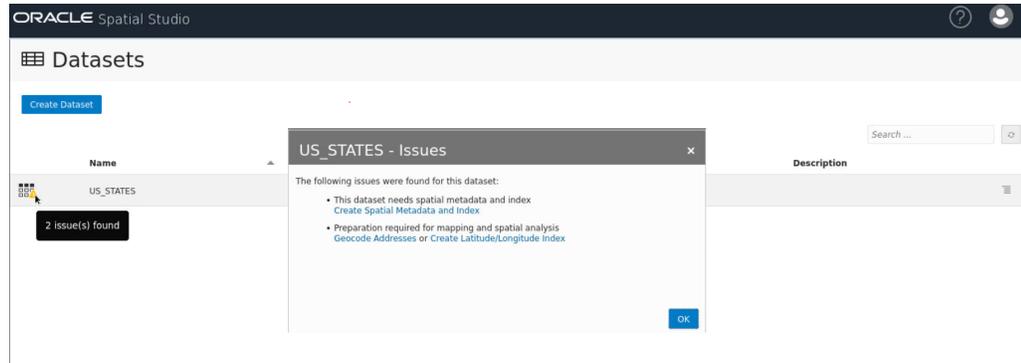
The new dataset is added and listed on the Datasets page.

3.4.2 Datasets with Issues

All datasets must meet certain data requirements in order to be used for analysis. Otherwise, Spatial Studio highlights these datasets with a warning on the Datasets page.

You may click on the warning icon to view the issues. You can then click on the resolution link under the issue to prepare the dataset as required for analysis, as shown:

Figure 3-7 Warnings on a Dataset



The following table lists a few common issues that are highlighted on a dataset.

Table 3-1 Selected List of Dataset Issues

Issue	Cause	Spatial Studio Resolution
No key column was found	Primary key is missing on the dataset.	Click Go to Dataset Columns to create a dataset key.
This dataset needs spatial metadata and index	The geometry column in the dataset does not have the spatial metadata or a spatial index or both.	Click Create Spatial Metadata and Index to create the spatial metadata and index for the geometry column.
Preparation Required for mapping and spatial analysis	It can be due to one of the following reasons: <ul style="list-style-type: none"> The dataset contains address information but the geographic coordinates are missing. Latitude and Longitude index are missing for latitude/longitude data in the dataset. 	Depending on the cause, you may need to perform one of the following: <ul style="list-style-type: none"> Click Geocode Addresses Click Create Latitude/Longitude Index

3.4.2.1 Enabling Spatial on a View-Based Dataset

Spatial Studio allows you to create spatial index on a dataset created from a view containing latitude and longitude columns, thereby enabling you to visualize and analyse views.

The following steps enable you to create latitude/longitude index on a view-based dataset.

The instructions assume:

- You have created a dataset from a view having latitude and longitude columns. See [Creating a Dataset](#) for more information on creating a dataset from a view.

- This view-based dataset is listed on the Datasets page with a warning icon since the dataset is not spatially enabled for visualization.
1. Navigate to the **Datasets** page.
 2. Click on the warning icon to view the issues on the view-based dataset.
 3. Click **Create Latitude/Longitude Index**.

The **Latitude and Longitude Columns** window opens as shown:

Figure 3-8 Creating a Latitude/Longitude Index on a View-Based Dataset

STATES_VIEW: Latitude & Longitude Columns

Creating spatial index for the following pair of latitude/longitude columns.

* Latitude Column LATITUDE

* Longitude Column LONGITUDE

Reuse lat/lon index on the base table

* Ensure the base table has a lat/lon index on the selected columns

OK Cancel

4. Select the **Latitude Column**.
5. Select the **Longitude Column**.
6. Select the **Reuse lat/lon index on the base table** checkbox.

As displayed in the preceding figure, ensure that the base table on which the view is created has a spatial index on the latitude and longitude columns.

7. Click **OK**.

A background task of type **Create lon-lat** index gets executed. A successful completion of this task on the **Jobs** page indicates that the dataset is spatially enabled for visualization.

You can now use this view-based dataset for visualization on the **Active Project** page.

3.4.3 Reverse Geocoding a Dataset

Reverse geocoding is the process of deriving the address information from a set of latitude and longitude coordinates.

You can reverse geocode a dataset in Spatial Studio to add address information to the dataset's table using the following steps.



Note:

Reverse Geocoding is supported only in point or latitude and longitude datasets.

The instructions assume that a dataset containing the coordinates details is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the **dataset name** on which you want to apply reverse geocoding.
3. Select **Reverse Geocode** from the **Prepare** context menu.
4. Optionally select and modify the required **Location attributes** as shown in [Figure 3-9](#).

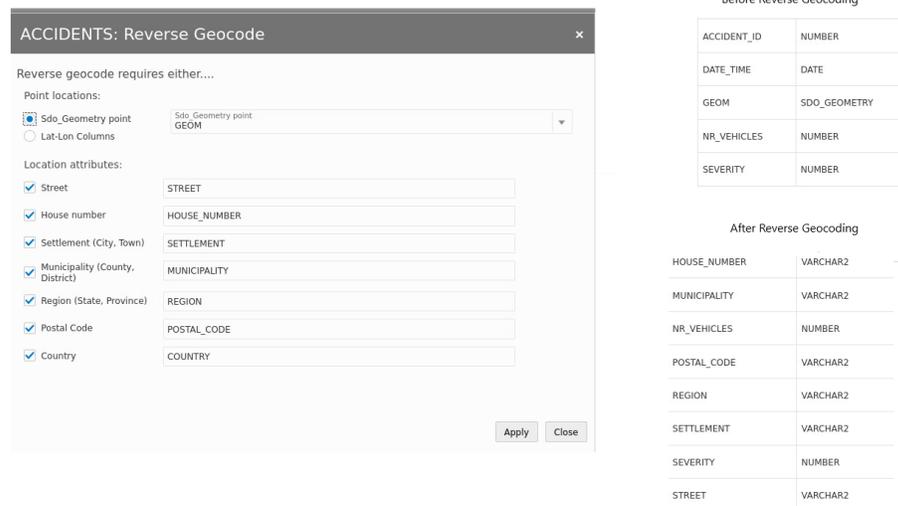
The Input text fields for Location attributes are the column names to be created in the underlying database table for the target dataset.

5. Click **Apply**.

You can monitor the **Reverse geocode dataset** background task on the **Jobs** page. A successful completion of the job indicates that reverse geocoding is applied for the data in the dataset.

By viewing the dataset properties, you can verify that reverse geocoding has been applied to your dataset as shown in the following figure:

Figure 3-9 Reverse Geocoding



3.4.4 Preparing a Non-Spatial Dataset for Analysis

Spatial Studio allows you to prepare a non-spatial dataset for mapping and analysis by joining to a spatial dataset.

Also, note the following highlights about joining two datasets:

- You can only join a non-spatial dataset to a spatial dataset and not conversely.
- It is essential that the non-spatial data in one dataset is linked to the spatial data in the other dataset through a common primary key column.
- You can choose the columns for the newly created joined dataset from the attributes of the datasets associated in the join operation.

The instructions assume that a spatial dataset and a non-spatial dataset having a common primary key data is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the non-spatial **dataset** which you want to join to a spatial dataset.
3. Select **Join to Spatial Dataset** from the **Prepare** context menu.

The following window opens:

Figure 3-10 Joining to a Spatial Dataset

Prepare a non-spatial dataset for mapping and spatial analysis by joining to a spatial dataset

Name of join result dataset * US_STATES_POPULATION_JOINED

Non-spatial dataset * US_STATES_POPULATION

Non-spatial dataset key * CODE

Spatial dataset * US_STATES_BOUNDARY(admin)

Spatial dataset key * STATE

▲ Select columns from non-spatial dataset

<input type="checkbox"/>	Column Name	Data Type
<input checked="" type="checkbox"/>	CODE	VARCHAR2
<input type="checkbox"/>	NAME	VARCHAR2
<input checked="" type="checkbox"/>	POPULATION	NUMBER

▲ Select columns from spatial dataset

<input type="checkbox"/>	Column Name	Data Type
<input checked="" type="checkbox"/>	NAME	VARCHAR2
<input checked="" type="checkbox"/>	FIPS	VARCHAR2
<input checked="" type="checkbox"/>	GEOM	SDO_GEOMETRY
<input checked="" type="checkbox"/>	STATE	VARCHAR2
<input type="checkbox"/>	COLOR_CODE	VARCHAR2

OK Cancel

4. Optionally, enter a dataset name for **Name of join result dataset**.
5. Select the **Spatial dataset** for the join.

On selection, the primary key associated with the spatial dataset is validated against the non-spatial dataset key. If the datasets key values are not suitable for a join operation, then the following error is displayed:

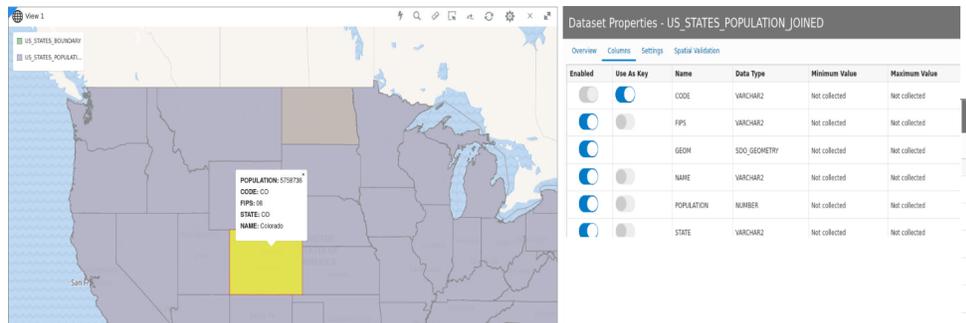
Dataset key columns to join must be the same data type

6. Optionally, select the required columns for the joined result dataset from the non-spatial and spatial datasets.

7. Click **OK**.

The joined dataset is created and it appears as a row on the Datasets Page. This dataset will contain all the column properties selected from both the spatial and non-spatial datasets. You can verify the properties of the joined dataset both in the **Dataset Properties** window on the Datasets page and when using the dataset for map visualization and analysis on the Active Projects page, as shown:

Figure 3-11 Appended Non-spatial and Spatial Properties

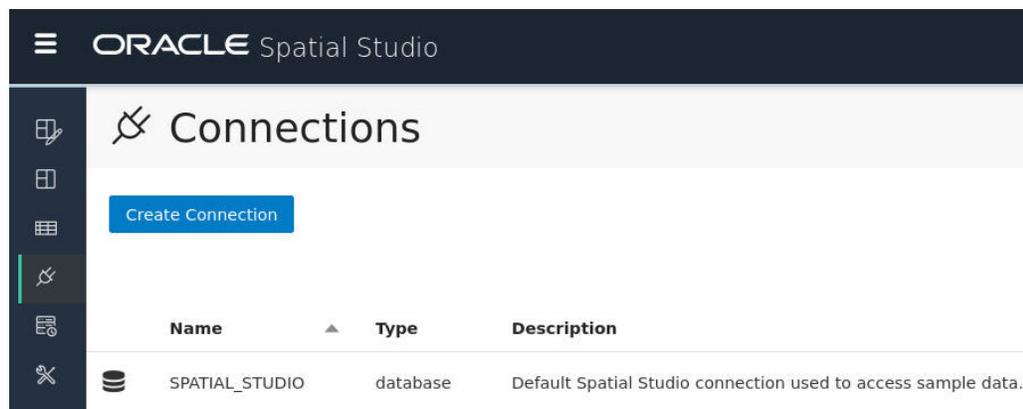


3.5 Spatial Studio Connections Page

The Connections page displays all the existing connections and also allows you to create a new connection.

The following figure shows a layout of the Connections page:

Figure 3-12 Connections Page



You can perform the following actions on the Connections page:

- You can create a new connection, by clicking **Create Connection**. You can create a connection from the following sources:
 - **Oracle Database:** by providing host, port, schema, and other database authentication details
 - **Oracle Autonomous Database:** by providing wallet details

- You can also perform the following actions by clicking the hamburger icon against any displayed connection or by right-clicking a connection row :
 - **Properties:** View or modify properties of the connection
 - **Edit:** Update the connection details

 **Note:**

You cannot edit the SPATIAL_STUDIO connection on the Connections page. Instead, refer to [If the Spatial Studio Repository Schema Password Has Been Changed](#) section.

- **Test:** Validate the connection
- **Delete:** Delete the connection along with all its datasets

 **Note:**

You cannot delete the SPATIAL_STUDIO connection.

3.6 Spatial Studio Administration Page

You can monitor the status and activity of Spatial Studio in the Administration Page. You can also view server logs, change global system configurations, manage custom basemaps, and configure safe domains.

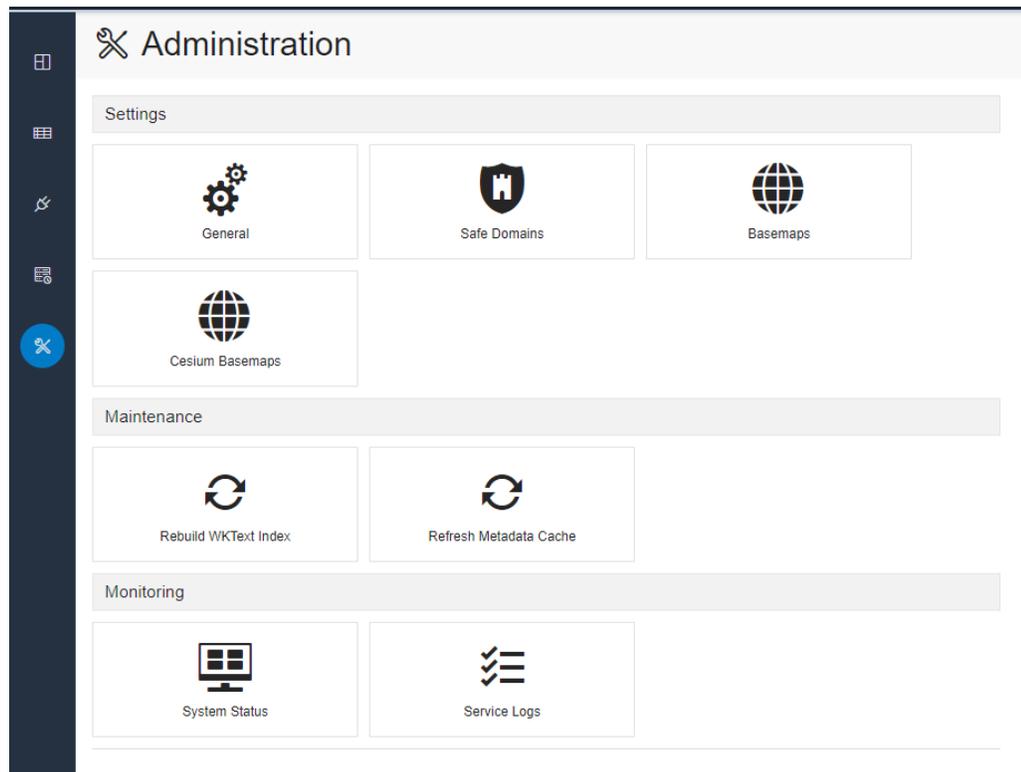
The Administration menu link directs you to the Administration page.

 **Note:**

You must be logged in as an administrator of Spatial Studio to access this menu option.

The layout the Administration page is as shown:

Figure 3-13 Administration Page



The Studio console page comprises of the following sections:

Settings

- **General:** This section allows changing the GeoCoding service URL, the web proxy used by the Studio server. It also allows you to customize the frontend branding area of the application.
- **Safe Domains:** This section allows the administrator to manage the white listing of the domains (host names or IP addresses) that are considered safe for loading various types of the resources from the Studio application. Typically, it is used to add the domain of a custom basemap to the Content Security Policy directives of the Studio. After making the changes to the safe domains list, you must reload or refresh the browser page to reload the new Content Security Policy.
- **Basemaps:** This section allows a quick view of the existing custom basemaps, and in adding new custom basemaps. Custom basemaps can be made of either raster or vector tiles, typically hosted on a third party tile server. Additionally, you can also create a custom basemap using a WMS OGC web service.
- **Cesium Basemaps:** This section gives you a quick view of the existing custom basemaps used exclusively for the 3D Cesium Map visualization. It also allows you to add new basemaps to be used by the 3D Map visualizations.

 **Note:**

Each listed host entry for Basemaps and Cesium Basemaps must be present as one of the entries in the Safe Domains list. If the host basemap comes from a domain that is not present in the Safe Domains list, then the basemap may not render correctly when visualizing the map.

Maintenance

- **Rebuild WKText Index:** Use this only when needed to rebuild the text index of the repository database schema's supported Spatial Reference Well Known text definitions. For the shapefile upload, this well known text index is used to automatically match the best SRID.
- **Refresh Metadata Cache:** Spatial Studio typically caches all of the frequently used metadata such as the definitions of Datasets, Connections, and Projects. Sometimes it is required to refresh the whole cache in case some cached metadata becomes stale or out of sync in rare events.

Monitoring

- **System Status:** This section provides read-only information about the general health and system status of the Spatial Studio server.
- **Service Logs:** This section allows loading and viewing a desired number of server-side logs. To reduce the clutter, you can filter the result using the desired logging level .

In a cluster deployment, both the preceding options display only the information of the particular Spatial Studio instance to which the current session is connected.

3.6.1 Adding a Custom Basemap

The following steps enable you to add a custom basemap.

1. Navigate to the **Administration** page.
2. Click **Basemaps** under Settings.
The **Basemaps** window listing all the available basemaps opens.
3. Click **Add Basemap** and click on one of the following basemap types:
 - XYZ Raster tiles
 - OGC WMS
 - Vector tiles
4. Enter **Name** and **URL** for the selected basemap type.
5. Optionally enter **Attribution** and **API Key**.

 **Tip:**

Once you have entered all the required fields, you can preview the basemap by clicking **Quick View**.

6. Click **Add** to add the base map.

For example, the following figure show the **OGC WMS** basemap configuration window:

Figure 3-14 Adding a OGC WMS Map

Note:

It is important to add the domain name to **Safe Domains** in order to enable the Spatial Studio application to access the required service for the basemap.

3.7 Spatial Studio Jobs Page

The Jobs page displays details of all the background jobs that run in Spatial Studio.

The following figure shows a layout of the Jobs page:

Figure 3-15 Jobs Page

Type	Object	Created By	Status	Start Time	End Time	Details
Geocode dataset	CUSTOMER	admin	DONE	7/20/2021, 5:25:39 PM	7/20/2021, 5:25:44 PM	
Geocode dataset	CUSTOMER	admin	ABORTED	7/20/2021, 4:40:11 PM	7/20/2021, 4:40:16 PM	SGTK-05000: Task aborted
Geocode dataset	CUSTOMER	admin	PENDING	7/20/2021, 4:40:11 PM	7/20/2021, 4:40:16 PM	SGTK-05000: Task aborted

You can perform the following actions on the Jobs page:

- Select a job to be displayed in the grid: **Active, Past** or **All**.
- Select a refresh interval for the jobs grid.

The grid table displays the following properties for each job entry row:

- **Type:** The job type, such as Geocode dataset, Create lon-lat index and so on.
- **Object:** The entity being altered by the job, which can be a Dataset, Table, Index or other.
- **Created by:** The user that submitted the job.

 **Note:**

System maintenance jobs are created by “\$system” account

- **Status:** Indicates the state or progress of a job, which can be:
 - PENDING
 - RUNNING
 - DONE
 - FAILED
 - ABORTED
- **Start Time:** The scheduled next run time for jobs with PENDING status, or the actual job start time for the other status.
- **End Time:** The time at which a job completed.
- **Details:** Provides extra feedback on which step a RUNNING job is currently executing, or error details for FAILED or ABORTED jobs.

3.8 Visualization in Oracle Spatial Studio

You can visualize your spatial data in Oracle Spatial Studio using different modes of visualization.

Spatial Studio supports the following visualization methods:

- Table
- Map
- Cesium Map

You can save your visualization as a Project in Spatial Studio. You can rework on a project or publish a project to share the results with other users.

The following sections explain in detail how you can use the various visualization techniques:

3.8.1 Using a Table Visualization

Spatial Studio allows you to visualize your data from the dataset in tables.

To display your data in a tabular view, you must perform the following steps.

The instructions assume that the dataset for visualization is already added to the project.

1. Select the **project** by clicking the desired project card from the Projects listed on the Project page.

This opens the project on the Active Project page.

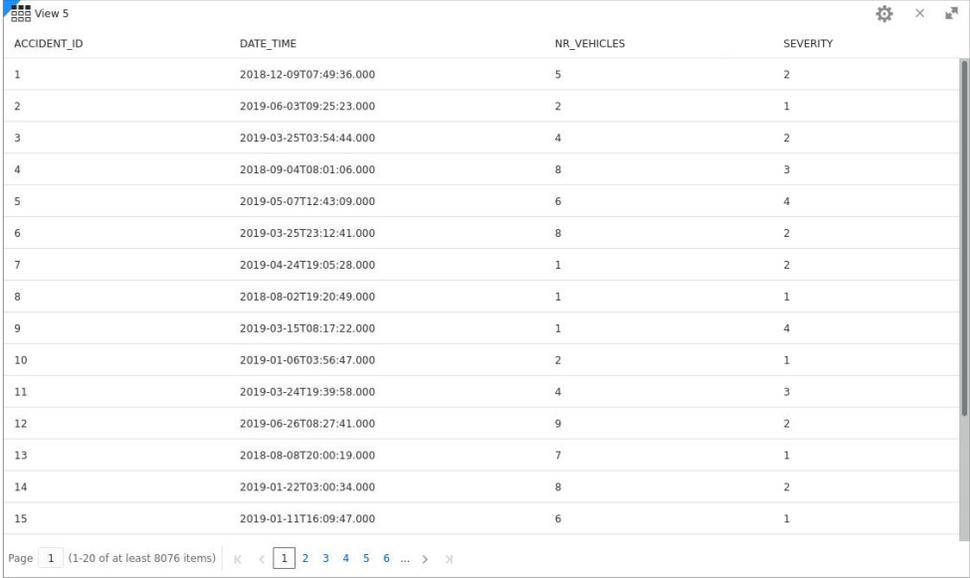
2. Click , the **Visualization** icon on the left pane in the Active Project page.
This lists the various visualization options.
3. Click and drag **Table** from the list to the visualization window on the right to create a table visualization.
This opens an empty layer in the visualization window.
4. Click , the **Data Elements** icon on the left pane in the Active Project page.
This lists all the datasets that are loaded for the project.
5. Click and drag the desired **dataset** from the list to the empty layer on the right.

 **Note:**

You can view only one dataset in a table view. If you want to view multiple datasets, you must create one table view for each dataset.

This opens the data in tabular format for visualization as shown:

Figure 3-16 Tabular Visualization



ACCIDENT_ID	DATE_TIME	NR_VEHICLES	SEVERITY
1	2018-12-09T07:49:36.000	5	2
2	2019-06-03T09:25:23.000	2	1
3	2019-03-25T03:54:44.000	4	2
4	2018-09-04T08:01:06.000	8	3
5	2019-05-07T12:43:09.000	6	4
6	2019-03-25T23:12:41.000	8	2
7	2019-04-24T19:05:28.000	1	2
8	2018-08-02T19:20:49.000	1	1
9	2019-03-15T08:17:22.000	1	4
10	2019-01-06T03:56:47.000	2	1
11	2019-03-24T19:39:58.000	4	3
12	2019-06-26T08:27:41.000	9	2
13	2018-08-08T20:00:19.000	7	1
14	2019-01-22T03:00:34.000	8	2
15	2019-01-11T16:09:47.000	6	1

You can delete the table visualization by clicking the **X** icon on the top-right.

3.8.2 Using a Map Visualization

Spatial Studio supports the following types of map visualizations:

- Geometry Data Visualization:
 - Point type

- Line type
- Polygon / Area type
- GeoRaster Data Visualization
- Hexagonal Data Visualization using H3 Aggregations

The following sections describe how to get started on these visualizations:

3.8.2.1 Visualizing a Point Map

Spatial Studio allows you to visualize the location of geographic data as points on maps.

To display your geographic data as maps, you must perform the following steps.

The instructions assume that the dataset for visualization is already added to the project.

1. Select the **project** by clicking the desired project card from the Projects listed on the Project page.

This opens the project on the Active Project page.

2. Click , the **Visualization** icon on the left pane in the Active Project page.

This lists the various visualization options.

3. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

A default base map is displayed with no data visualization points.

4. Click , the **Data Elements** icon on the left pane in the Active Project page.

This lists all the datasets that are loaded for the project.

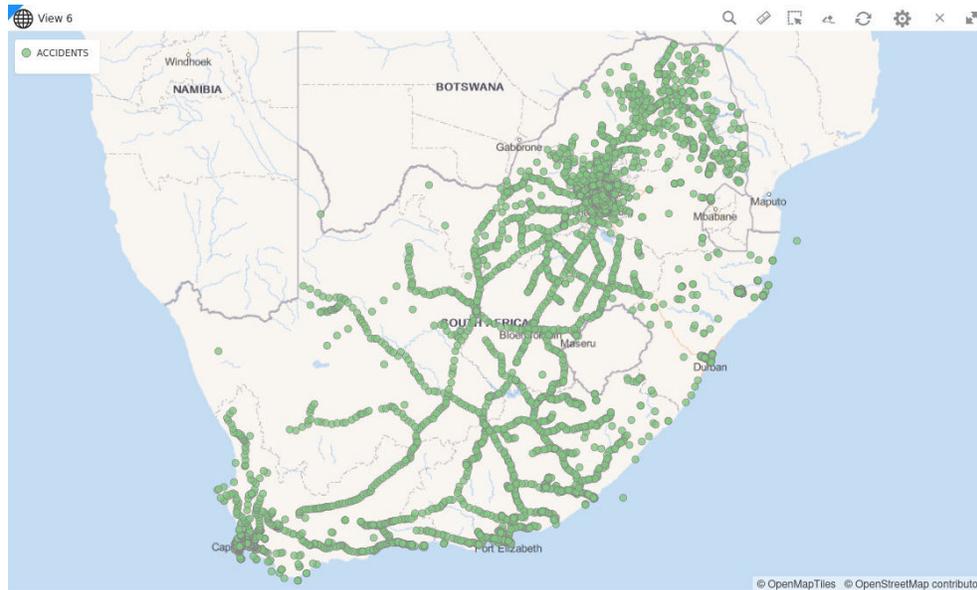
5. Click and drag the desired **dataset** from the list to the map view on the right.

 **Tip:**

You can drag and drop multiple datasets in a single action to your map view.

The map gets updated with the data points for visualization as shown:

Figure 3-17 Map Visualization



You can render your map using different rendering styles. See [Applying a Render Style For a Point Layer](#) for more information.

You can delete the map visualization by clicking the **X** icon on the top right.

3.8.2.2 GeoRaster Data Visualization

Oracle Spatial Studio allows you to visualize GeoRaster data stored in spatial GeoRaster type in Oracle Database.

Geo-referenced raster data, including satellite imagery, aerial photos from drones, and gridded data, is very useful for mapping applications. It can be directly analyzed, or layered with vector data as a background map for additional context. See [Spatial GeoRaster Developer's Guide](#) for more information on GeoRaster data.

The following sections describe how you can create and visualize GeoRaster data in Spatial Studio.

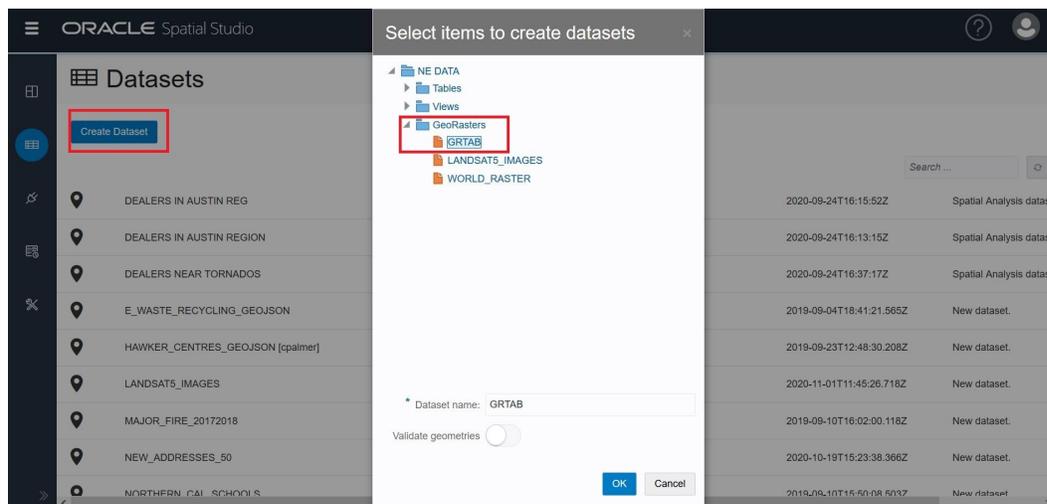
3.8.2.2.1 Creating a GeoRaster Dataset

You can create a GeoRaster dataset using the following steps.

The instructions assume that the GeoRaster data is already existing in your database schema.

1. Navigate to the **Datasets** page and click **Create Dataset**.
2. Select the required **GeoRaster** table as shown in the following figure and click **OK**:

Figure 3-18 Creating a GeoRaster DataSet



The **Geo-raster Configuration** dialog opens.

3. Choose a **Selection Mode**.

The values for the selection mode are:

- Single Raster
- Virtual Mosaic

4. Select the GeoRaster column for visualization if you have chosen the **Single Raster** mode. Otherwise, you can skip this step.

 **Note:**

If you have chosen the **Virtual Mosaic** mode, all the Georaster columns are included in the visualization.

5. Click **OK**.

The GeoRaster dataset is configured and the newly created GeoRaster dataset is displayed as a row in the Datasets page.

3.8.2.2.2 Visualizing GeoRaster Data on a Map

You can visualize georaster data on a map using the following steps.

The instructions assume that the GeoRaster dataset is already existing in Spatial Studio. To create a GeoRaster dataset, see [Creating a GeoRaster Dataset](#) for more information.

1. Select the **project** by clicking the desired project card from the Projects listed on the Project page.

This opens the project on the Active Project page.

2. Click , the **Visualization** icon on the left pane in the Active Project page.

This lists the various visualization options.

3. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

A default base map is displayed with no data visualization points.

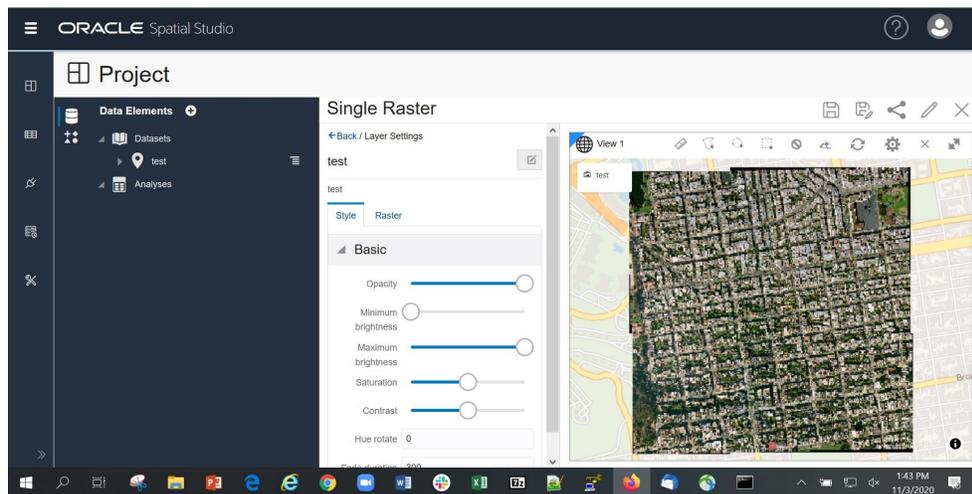
4. Click , the **Data Elements** icon on the left pane in the Active Project page.

This lists all the datasets that are loaded for the project.

5. Click and drag the desired **GeoRaster dataset** from the list to the map view on the right.

A GeoRaster layer is created on the map as shown:

Figure 3-19 GeoRaster Data Visualization



You can delete the map visualization by clicking the X icon on the top right.

 **Tip:**

You can enhance your visual display by modifying your Layer Settings using the **Style** tab and **Raster** tab. See [Applying Style for a GeoRaster Layer](#) for more information.

3.8.2.3 Hexagonal Data Visualization Using H3 Aggregations

Oracle Spatial Studio allows you to visualize point-type map data using hexagons with H3 (Hexagonal Hierarchical Spatial Index) aggregations.

Visualizing your map data as hexagons has several advantages:

- It helps you to identify patterns or clusters in a larger point dataset
- Easier interpretation of data, as in a hexagonal cell, all the points are equidistant from the hexagon center-point
- Hexagonal cells are color coded based on the number of datapoints they hold, which enables you to easily understand data patterns

The following sections describe how you can use H3 aggregations in Spatial Studio:

3.8.2.3.1 Preparing an H3 Aggregation Dataset

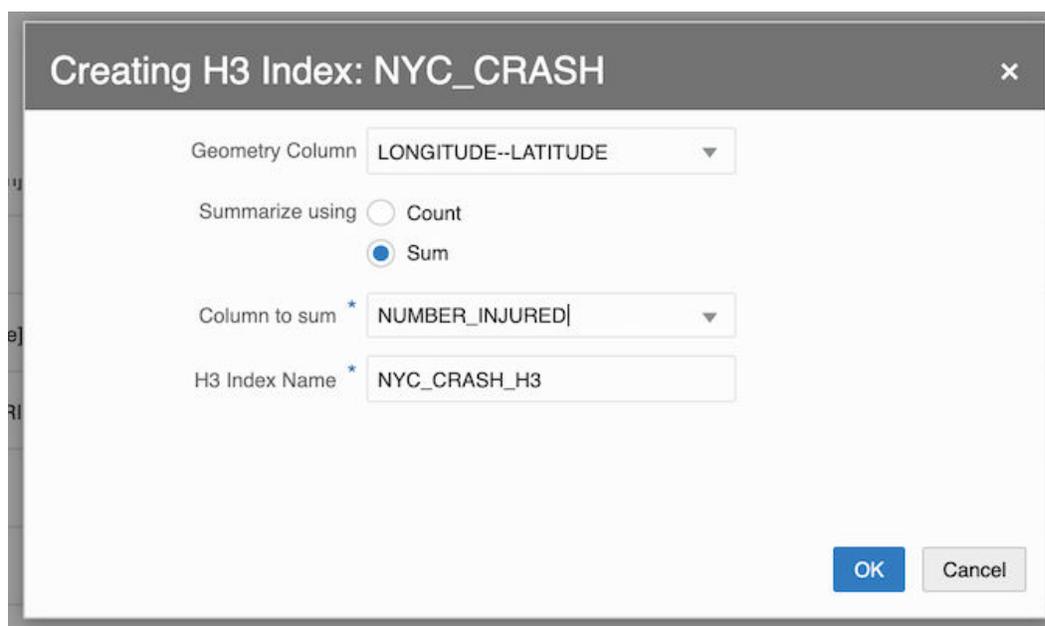
You can prepare an H3 aggregation dataset by performing the following steps.

The instructions assume that a dataset containing geometric data columns is already loaded to Spatial Studio.

1. Navigate to the **Datasets** page.
All the datasets loaded to Spatial Studio are shown listed on this page.
2. Select the required dataset **name** and right-click to open the context menu.
3. Click **Create H3 Index** on the **Prepare** submenu.

The **Creating H3 Index** dialog opens as shown:

Figure 3-20 Creating an H3 Aggregation Dataset



4. Select the **Geometry Column** for H3 aggregations.
5. Click a **Summarize using** option.
The values for summarizing are:
 - **Count:** buckets the number of datapoints in each hexagon
 - **Sum:** adds up the values for a specific column in the data set, for all the points that fall in a specific hexagon
6. Select the **Column to sum**, if you have chosen **Sum** to summarize your dataset. Otherwise, you can skip this step.
7. Optionally, modify the **H3 Index Name**.
8. Click **OK**.

An H3 aggregation dataset is created and added as a new row in the Datasets page.

3.8.2.3.2 Visualizing Data With H3 Aggregations

To visualize your map data with H3 aggregations, you must perform the following steps.

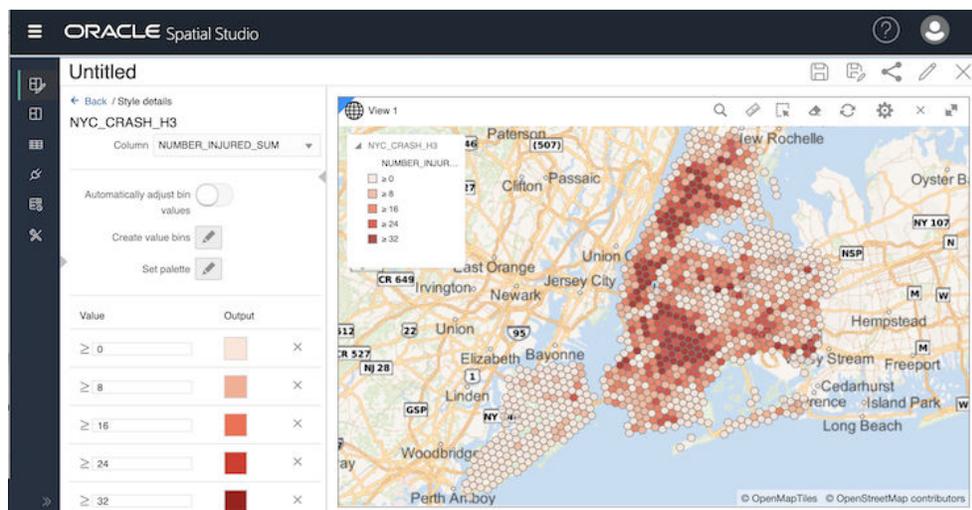
The instructions assume that an H3 aggregation dataset is already existing in Spatial Studio.

To prepare a dataset for H3 aggregation, see [Preparing an H3 Aggregation Dataset](#) for more information.

1. Select the **project** by clicking the desired project card from the Projects listed on the Project page.
This opens the project on the Active Project page.
2. Click , the **Visualization** icon on the left pane in the Active Project page.
This lists the various visualization options.
3. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.
A default base map is displayed with no data visualization points.
4. Click , the **Data Elements** icon on the left pane in the Active Project page.
This lists all the datasets that are loaded for the project.
5. Click and drag the desired **H3 Aggregation dataset** from the list to the map view on the right.

A layer showing the hexagonal binning of the data points is displayed on the map as shown:

Figure 3-21 Map Data Visualization Using Hexagonal Binning



See [Applying Data-Driven Style to a Map with H3 Aggregations](#) for more information on applying styling for a H3 map layer.

3.8.2.4 Visualization Support for Custom Map Regions

Oracle Spatial Studio allows you to create custom map regions on map layers that support polygon type geometry.

You can create a new map region by selecting multiple polygon shapes and combining them with a new key-value. You can then append or insert this new map region with the new key-value into a target dataset containing all of your other custom map regions.

These newly created custom shapes are persisted on the underlying database table of the target dataset, and therefore can be used for data visualization or reporting just like any other dataset.

The following are the main characteristics for this feature support:

- The source dataset, that is the dataset whose polygon shapes you will be selecting and then combining into a custom map region, must always be based on an Oracle Database table.
Datasets from Oracle views and Studio's Analyses are not currently supported.
- The new regions may or may not be contiguous.
- The target dataset, that is the dataset on which you want to store the newly created custom map regions, will store them in its geo-reference system.
- Only the key value and new geometry value are inserted into the target table.
- The target dataset must meet the following requirements:
 - The geometry metadata information for the target dataset must be available in the SDO_GEOM_METADATA view.
 - A spatial index must exist on the geometry column.

Note:

If a spatial index is not created on the geometry column, then the target data layer cannot be dragged on to the map visualization canvas. See [Creating a Target Dataset](#) for more information.

3.8.2.4.1 Creating Custom Regions for Visualization

You can create custom polygon regions on the source dataset that contains polygon type geometries and apply them on a target dataset using the follow steps:

The instructions assume that the source and target datasets are already added to your Project in the ActiveProject page.

1. Click , the **Visualization** icon on the left pane in the Active Project page.
This lists the various visualization options.
2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.
A default base map is displayed with no data visualization points.
3. Click , the **Data Elements** icon on the left pane in the Active Project page.

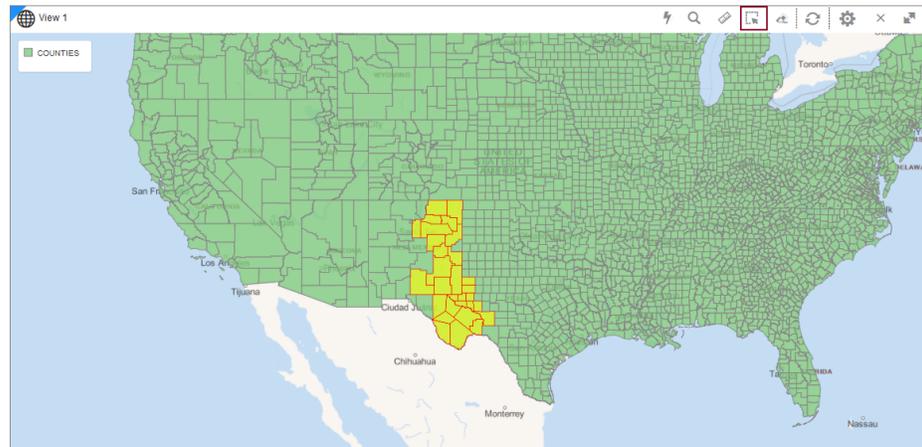
This lists all the datasets that are loaded for the project.

4. Click and drag the desired **source dataset** from the list to the map view on the right.

A map layer with polygon shapes is created.

5. Create the required custom regions by performing the following steps as many times as required:
 - a. Select the regions for aggregation using the polygon selection tool in the map tool bar, which is shown highlighted in the following figure:

Figure 3-22 Creating Custom Map Shapes



 **Tip:**

Alternatively, you can also select multiple polygons by using the keyboard shortcut `Ctrl + Click` on a Windows system.

- b. Click  on the map tool bar to launch the **Create custom region by combining shapes** dialog window.

Figure 3-23 Create a Custom Region

Create custom region by combining shapes

Combine a set of shapes and append results to existing dataset

* Combine items in: COUNTIES.GEOM

Include only selected items:

* Append result to dataset: AFFECTED_REGIONS.GEOM

* Key value for combined shape: 1

OK Cancel

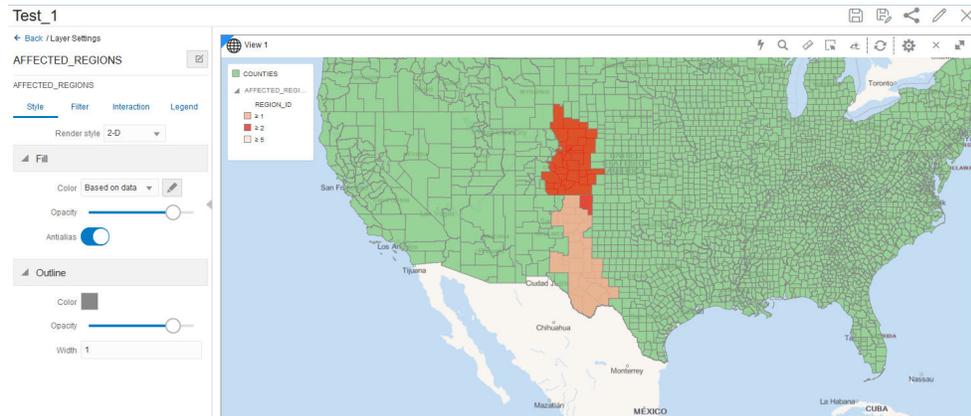
- c. Select the following mandatory options and optionally switch on or off the **Include only selected items** toggle button:
- **Combine items in:** source dataset
 - **Append result to dataset:** target dataset
 - **Key value of combined shape:** unique number

▲ Caution:

The whole source dataset may be aggregated into one region if **Include only selected items** is switched off. In this case the process may run for a long time depending on the number of features in the source dataset. Therefore, use this option only if required.

- d. Click **OK** to create the custom map region.
- Repeat steps **a** to **d** until you create the number of required custom regions.
6. Drag and drop the **target dataset** to the map view on the right to view the newly created custom regions.

The following figure shows two custom defined regions that are inserted into a target dataset.

Figure 3-24 Displaying the Custom Created shapes on the Target Dataset

3.8.2.4.2 Creating a Target Dataset

You can create a target dataset by performing the following steps:

1. Connect to an Oracle database schema using SQL Developer or any other tools.
2. Create a spatial table as shown:

```
CREATE TABLE affected_regions (region_id NUMBER PRIMARY KEY, geom
SDO_GEOMETRY);
```

3. Insert the spatial table into USER_SDO_GEOM_METADATA view. For example:

```
INSERT INTO USER_SDO_GEOM_METADATA VALUES (
'affected_regions', -- TABLE_NAME
'geom', -- COLUMN_NAME
SDO_DIM_ARRAY -- DIMINFO attribute for storing dimension bounds,
0.5 m as tolerance
(SDO_DIM_ELEMENT ('LONGITUDE', -180, 180, 0.5 ),
SDO_DIM_ELEMENT ( 'LATITUDE', -90, 90, 0.5 )),
4326 -- SRID value for specifying a geodetic coordinate system
);
COMMIT;
```

4. Create a spatial index on the SDO_GEOMETRY column.

```
CREATE INDEX affected_regions_sidx ON affected_regions(geom)
INDEXTYPE IS MDSYS.SPATIAL_INDEX_V2;
```

5. Create a dataset in Spatial Studio from the database schema used in the preceding steps.

The required target dataset is created. You may use this data layer on to which you can apply the newly created custom map regions.

3.8.3 Using a Cesium Map Visualization

Spatial Studio uses a CesiumJS plugin to enable you to view 3D visualizations using 3D Tiles on a Cesium Map.

Cesium map allows you to display your real-world geospatial 3D data in a 3D environment. In order to build interactive 3D visualizations using Cesium maps, you must upload your 3D tileset to Spatial Studio. The following formats are supported:

- Point Cloud (.pnts)
- Batched 3D Model (.b3dm)

It is important to note the following when using a Cesium map visualization:

- Generating 3D Tiles for your geospatial 3D data must be carried out using any third party software outside of Oracle Spatial Studio.
- 3D Tiles are stored in the file system on Spatial Studio's server, not in Oracle Database.
- Currently, this feature supports only displaying 3D Tiles on maps. It does not support 3D analysis.

3.8.3.1 Uploading a 3D Tileset

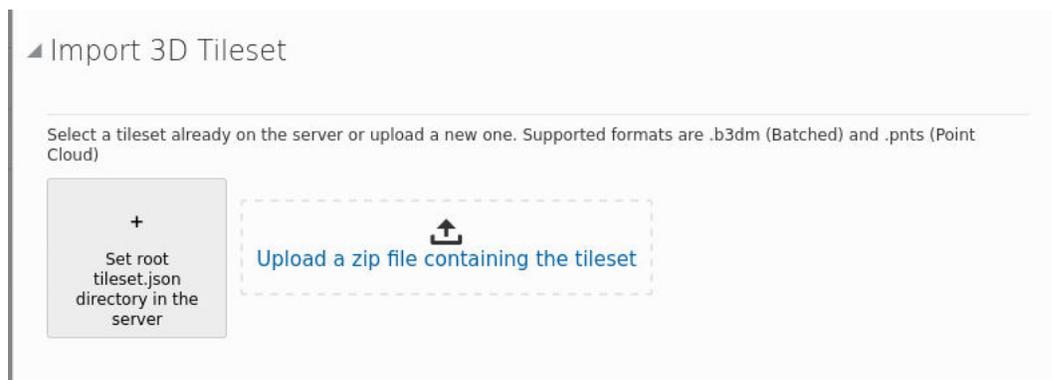
You can upload your 3D tileset to Spatial Studio using the following steps.

The instructions assume that you have a pre-generated 3D tileset containing a root `tileset.json` file.

1. Navigate to the **Datasets** page and click **Create Dataset**.
2. Select **Import 3D Tileset**.

This opens the **Import 3D Tileset** tab as shown:

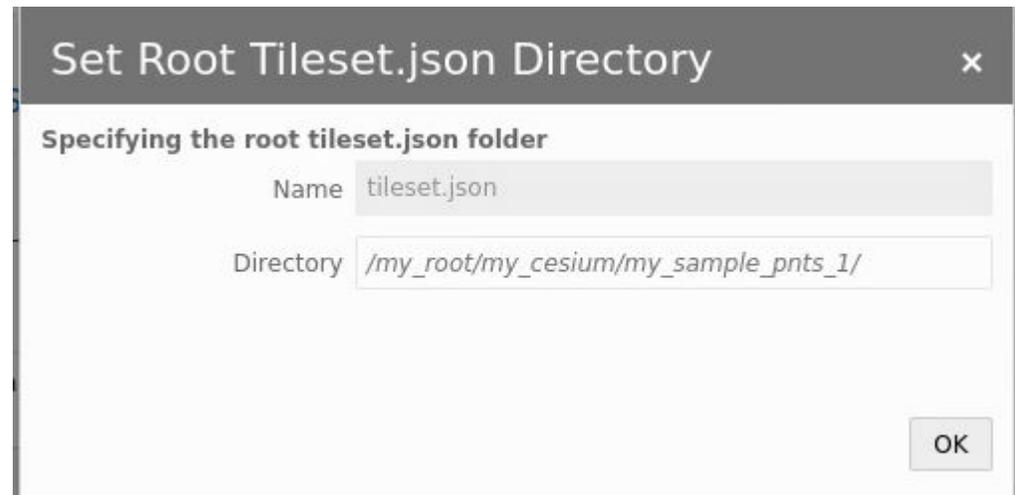
Figure 3-25 Import a 3D Tileset



As seen in the preceding figure, there are two options to import a 3D tileset:

- **Set root tileset.json directory in the server:** Select this option, if your 3D tileset is already existing in the Spatial Studio server.
 - **Upload a zip file containing the tileset:** Select this option to upload a new 3D tileset from your system.
3. Follow the instructions appropriate for your preferred option:
 - a. **Set root tileset.json directory in the server:**

Figure 3-26 Set Root Tileset.json directory



- i. Enter **Name** and specify the **Directory** path.
 - ii. Click **OK**.
- b. Upload a zip file containing the tileset:**
- i. Locate and select the zip file containing the 3D Tileset for uploading. You must increase the default size limit for zip files larger than 50 MB. You can do this by updating the `dataset_max_size` attribute for the `upload` property defined in `<user_home_folder>/sgtech/sgtech_config.json` file.
- The unzipped file limits can be updated in the General tab in the Administration page. The following two advanced settings parameters need to be modified:
- Maximum unzipped item
 - Maximum unzipped total

The dataset with 3D tileset is created.

3.8.3.2 Visualizing a 3D Tileset Using a Cesium Map

You can visualize your dataset with 3D Tiles on a Cesium map using the following steps.

The instructions assume that the 3D Tiles are uploaded and the Dataset is already existing in Spatial Studio. To create a dataset with 3D Tiles, see [Uploading a 3D Tileset](#) for more information.

1. Select the **project** by clicking the desired project card from the Projects listed on the Project page.

This opens the project on the Active Project page.

2. Click , the **Visualization** icon on the left pane in the Active Project page.

This lists the various visualization options.

3. Click and drag **Cesium Map** from the list to the visualization canvas on the right to create a Cesium map visualization.

A default Cesium map is displayed.

 **Tip:**

You can configure new background Cesium maps by adding maps from the following two sources:

- URL template
- WMTS service

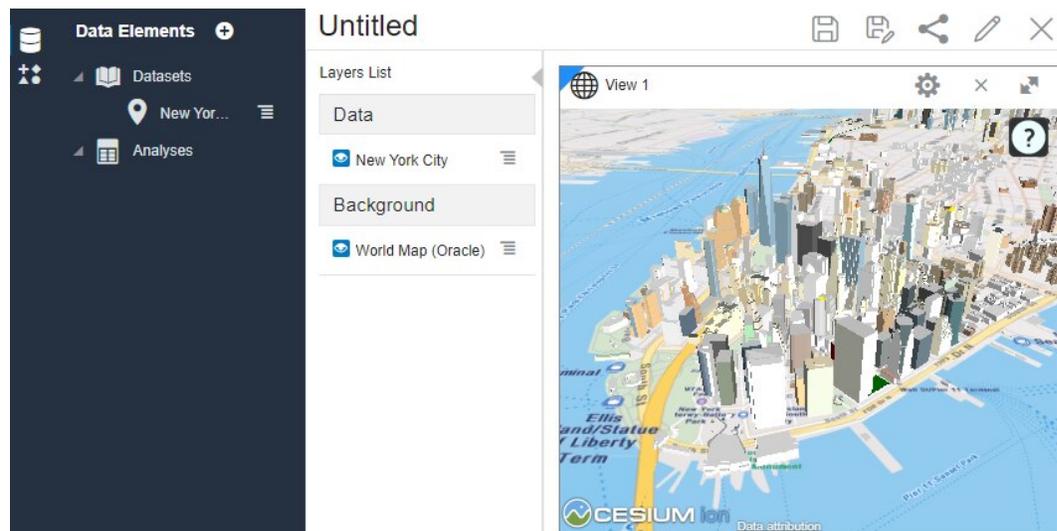
4. Click , the **Data Elements** icon on the left pane in the Active Project page.

This lists all the datasets that are loaded for the project.

5. Click and drag the desired **3D Tiles dataset** from the list to the map view on the right.

A 3D layer is created on the map as shown:

Figure 3-27 3D Cesium Map Visualizaition



To interact with the map, click the ? icon and use either of the following options shown:



3.8.4 Styling a Map Layer

Spatial Studio allows you to explore different styling options for your map layers, in order to enhance visualization and analysis.

The styling options provided to you may vary depending on the type of data you are mapping.

The following sections describe a few styling techniques for the different data types:

3.8.4.1 Applying a Render Style For a Point Layer

You can render a point map layer using one of the following render style options:

- Circle (default)
- Symbol
- Heatmap
- Cluster

The following steps enable you to apply your preferred render style option.

The instructions assume that you have point map layer displayed on your Active Project page.

1. Click  against the **dataset** in the **Data** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Choose an option from the **Render Style** drop-down list.

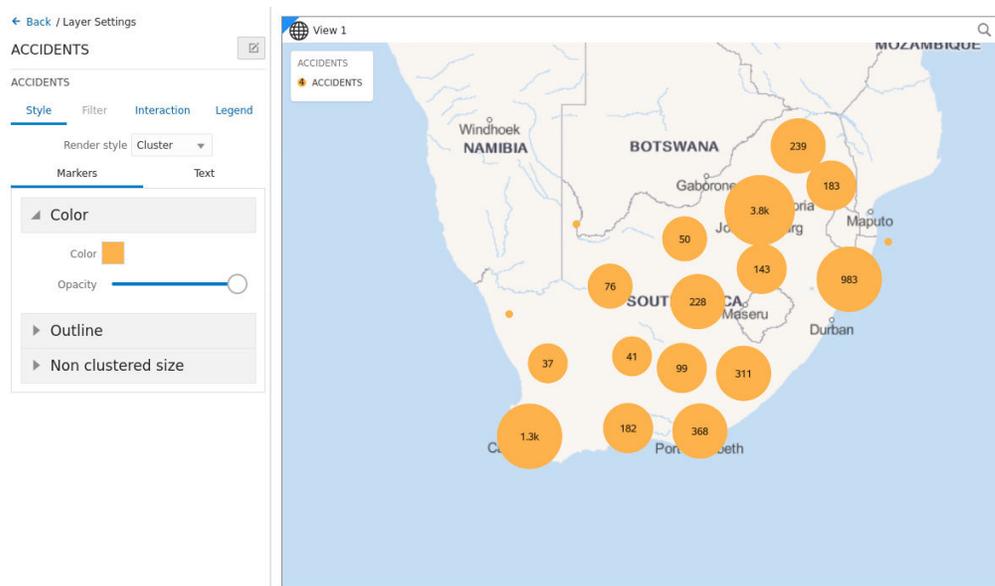
By default, a point map layer always uses Circle to represent the data points.

Note:

Each render style has its own settings.

- If you select **Cluster** as the render style option, the data points on your map are shown clustered depending on the cluster circle size.

Figure 3-28 Applying a Cluster Style



Optionally, you can change the color and the style of the text labels representing the number of points in each cluster.

- If you select **HeatMap** as the render style option, the data points on your map are rendered with continuous colors based on the concentration of points as shown:

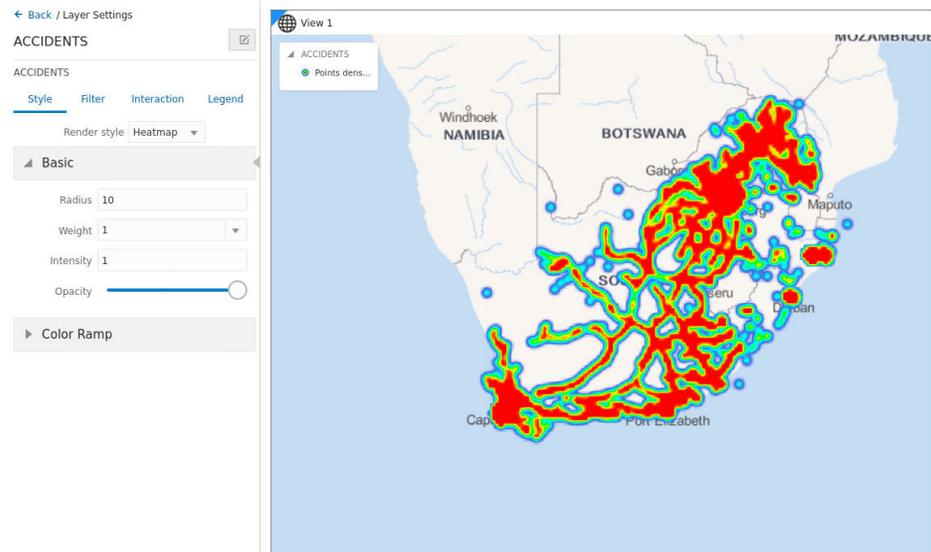
Note:

Hot colors represent concentration of points, and cool colors represent sparsity of points.

Tip:

It is recommended that you reduce the default value of the **Radius** parameter to observe a more localized view of point concentrations.

Figure 3-29 Applying a HeatMap Style

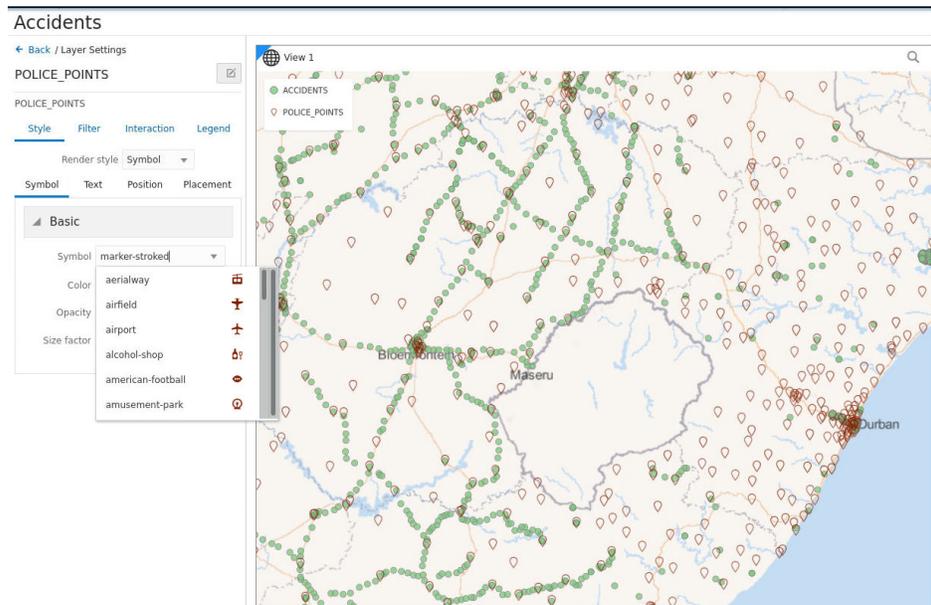


- If you select **Symbol** as the render style option, the data points on your map are rendered with your chosen symbol as shown:

 **Tip:**

You can optionally select a color for your symbol.

Figure 3-30 Applying a Symbol Style



The map layer gets rendered with the appropriate style.

3.8.4.2 Applying Style for a GeoRaster Layer

You can style a GeoRaster map layer using the following steps.

The instructions assume that you have a GeoRaster map layer displayed on your Active Project page.

1. Click  against the **dataset** in the **Data** tab of the **Layers** list.
2. Select **Settings** in the context menu.
The **Layer Settings** panel opens.
3. Optionally, modify any of the following options in the **Style** tab:
 - **Opacity**
 - **Maximum Brightness**
 - **Minimum Brightness**
 - **Saturation**
 - **Contrast**
 - **Hue Rotate**
 - **Fade Duration**
4. Optionally, modify any of the following rendering options in the **Raster** tab:
 - **Bands:** Spatial Studio, by default supports the following bands:
 - Red
 - Blue
 - Green
 - Alpha

For GeoRaster images that have more than three layers, you can choose which three layers you want to visualize.

- **Reprojection:** represents the interpolation method to be used when transforming an image from one SRS (Spatial Reference System) to another.
- **Image Processing:** represents the subprogram to be used to enhance the visual quality of the images.
- **Rendering Hints:** represents the image interpolation value that determines how each image cell's value on a view port is interpolated using the original image pixels. For example:
 - **NEAREST NEIGHBOR:** This option has no interpolation by taking the nearest image pixel's value directly.
 - **BI-LINEAR:** This option will consider 4 neighboring pixels to determine the image cell's value on a view port.

Additionally, you can also switch on or off the **Transparent NODATA** toggle, which determines if the image cells are to be transparent or not. If the switch is on, then the layers underneath will be visible for areas that have NODATA in the image.

The GeoRaster map layer is rendered with the updated settings.

3.8.4.3 Applying Data-Driven Style to a Map with H3 Aggregations

You can apply different resolutions to your H3 map layer to enhance your visualization.

In case of an H3 aggregation dataset, the hexagonal cells and the distribution of points in these hexagons automatically change at each resolution level, as you zoom in and out of the map. This implies that the color bins for one level might not be the same as for another level.

Spatial Studio provides an option to automatically calculate color bins as you alter your resolutions. You can also turn this option off if you want to test against a set of specific thresholds.

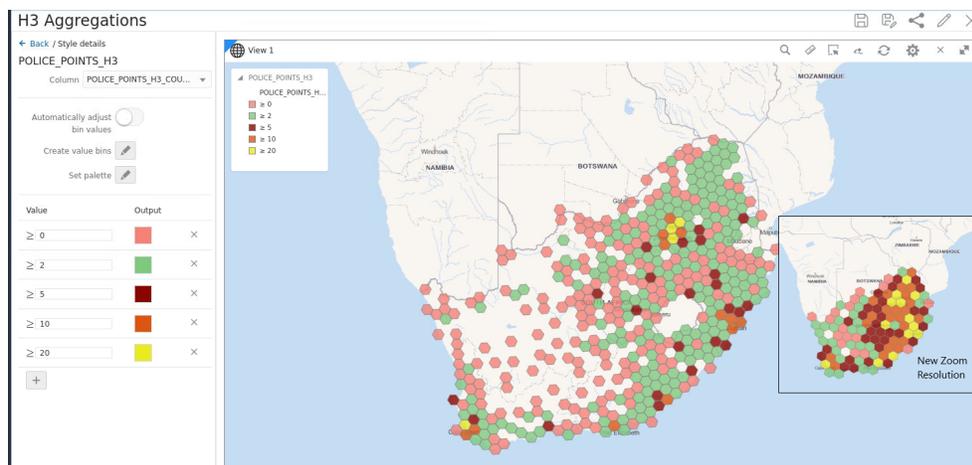
The following steps enable you to apply a data-driven styling option for your H3 map layer.

The instructions assume that you have a H3 map layer displayed on your Active Project page.

1. Click  against the **dataset** in the **Data** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Select **Based on Data** for the **Color** value in the **Style** tab.
The **Style details** panel is displayed.
4. Select the **Column** to control styling.
5. Switch on or off the **Automatically adjust bin values** toggle button.
 - If turned on, the bin values will automatically update as you zoom in or out on the map.
 - If turned off, **Create value bins** option appears.
6. Assign colors to the bins based on data values and then click the **Back** link to return to the Layers List.

The following figure shows the Style details panel options:

Figure 3-31 Applying Data-Driven Color Styling for H3 Map Layer



The color bins on the H3 map layer gets rendered appropriately for different resolutions as shown in the preceding figure.

3.8.4.4 Applying Predefined Colors to a Map Layer

Using a column with predefined color codes or values, you can create accurate and consistent choropleth map layers.

You can store a color-coded value in a column of your dataset and then use this column property to color code your map.

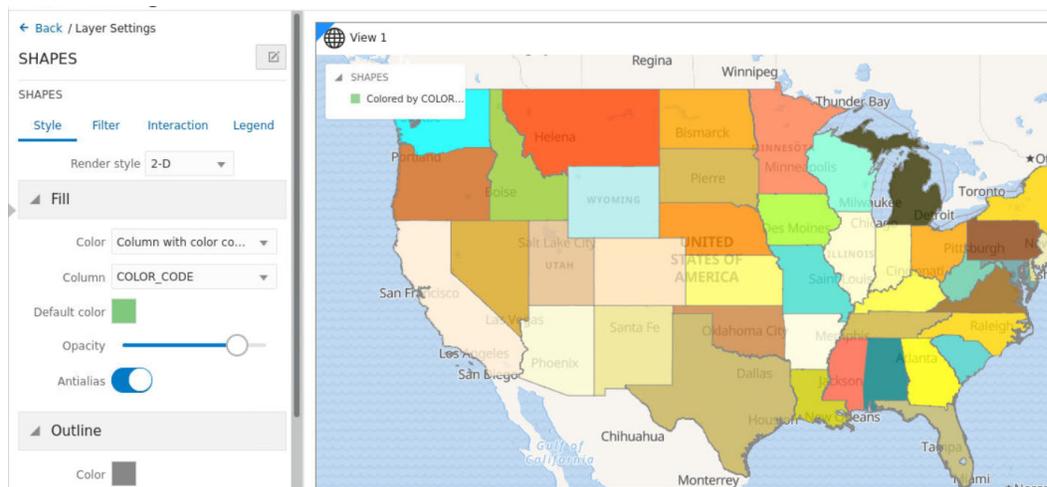
The following steps enable you to color code your map layer.

The instructions assume that the map layer displayed on your Active Project page uses a dataset having a column property that contains color-coded values.

1. Click  against the **dataset** in the **Data** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Select **Column with color codes** for the **Color** value in the **Style** tab.
4. Select the **Column** that contains the color value.

The following figure shows the styling of the map layer using the color variable in the dataset:

Figure 3-32 Color Coding a Map Layer



The color code gets applied to the map layer.

3.8.4.5 Setting Selection Tolerance on a Map Layer

Spatial Studio allows you to increase or decrease the selection tolerance on a map layer, so that selecting small and linear geometry features is easier.

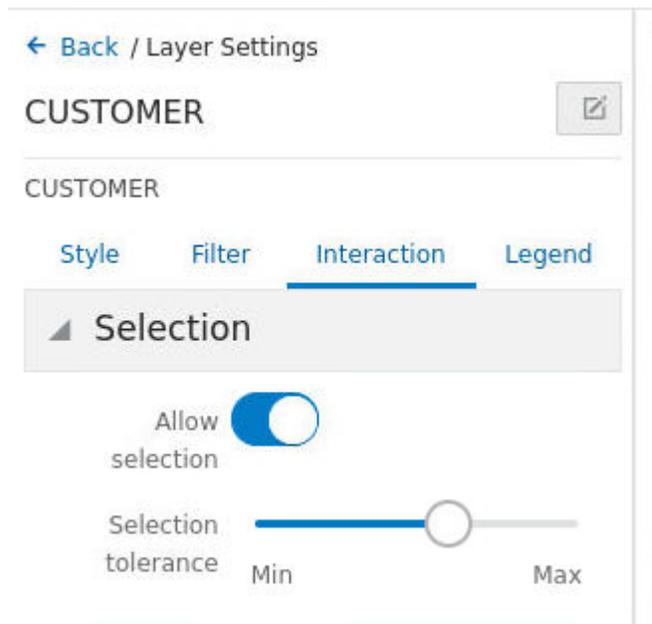
The following steps enable you to adjust and set the selection tolerance on a map.

The instructions assume that a project is open on the Active Project page.

1. Click  against the **dataset** in the **Data** tab of the **Layers** list.
2. Select **Settings** in the context menu and click the **Interaction** tab.
3. Switch on the **Allow selection** toggle button.
4. Adjust the **Selection tolerance** slider as required.

The following figure shows the **Selection** section for setting the tolerance:

Figure 3-33 Setting the Selection Tolerance



The custom selection tolerance gets applied to the map layer.

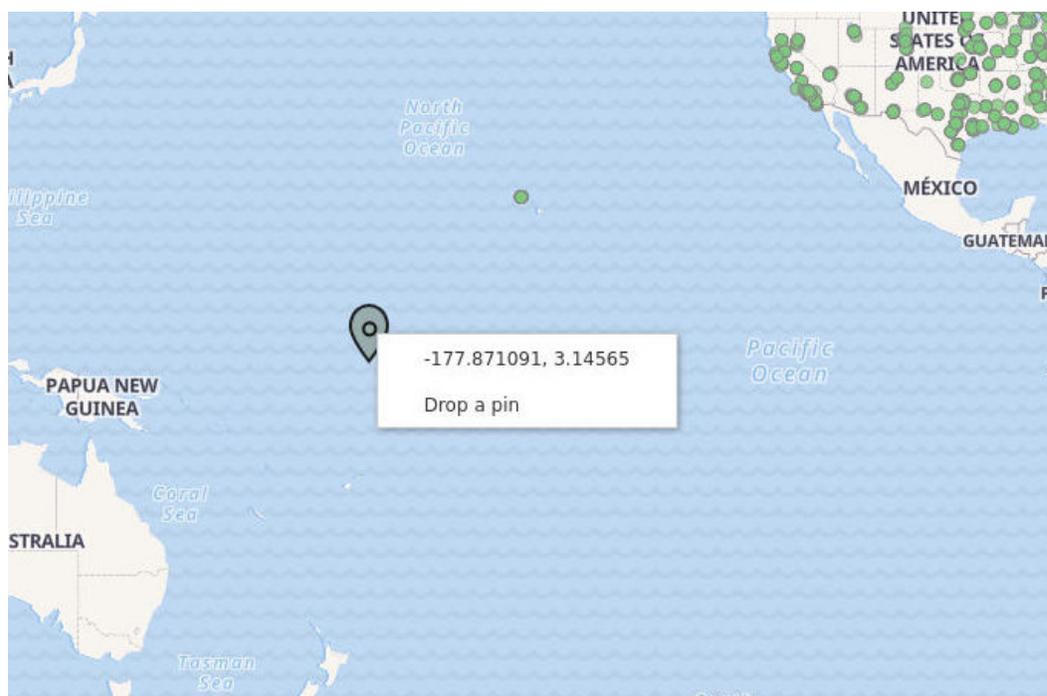
3.8.4.6 Adding a Pin on a Map

The following steps enable you to inspect the current mouse pointer's latitude and longitude coordinates and pin a location on the map layer.

The instructions assume that you have a project opened on your Active Project page and the map layer is displayed for visualization.

1. Right-click on any area on the map layer.

The coordinates for the location gets displayed as shown:

Figure 3-34 Pin a Location on the Map

2. Click **Drop a pin** to add a location marker.

The pin gets displayed on the map. Additionally, you can also copy the coordinates by clicking on the marker and then clicking the **Longitude, Latitude: click to copy** icon.

3.8.4.7 Applying Map Backgrounds

Spatial Studio provides ready-to-use map backgrounds to enhance your visualization.

You can select one of the following map backgrounds for your project visualization:

- MapTiler Vector Basemaps
- Oracle Raster Basemaps
- Blank Basemaps
- User-defined Basemaps

As an administrator, you can also register custom basemaps and use them in map visualizations. They may be raster or vector tiles that are typically hosted on third party servers, or they be created using a WMS OGC web service. See [Spatial Studio Administration Page](#) for more information on adding basemaps.

The following section describes how to apply a specific map background for your project:

3.8.4.7.1 Changing Map Backgrounds

The following steps enable you to apply different map backgrounds in your project visualization.

The instructions assume that you have a project opened on your Active Project page.

1. Click  in the **Background** tab of the **Layers** list.

2. Select **Settings** in the context menu.
3. Click the **Change the Background Map Style** drop-down and select your required background map as shown.

Figure 3-35 Changing a Map Background



All custom basemaps appear under **User-defined Basemaps** in the drop-down list shown in the preceding figure.

The selected map background gets applied to your project visualization.

3.8.5 Visualizing Map Data Over Time

Spatial Studio allows you to perform dynamic map visualizations.

In order to visualize map data over time, your dataset must contain a date column or a time column or both. You can then use the time slider feature to interact with the map.

The following steps allow you to configure and use a time slider for your map visualization.

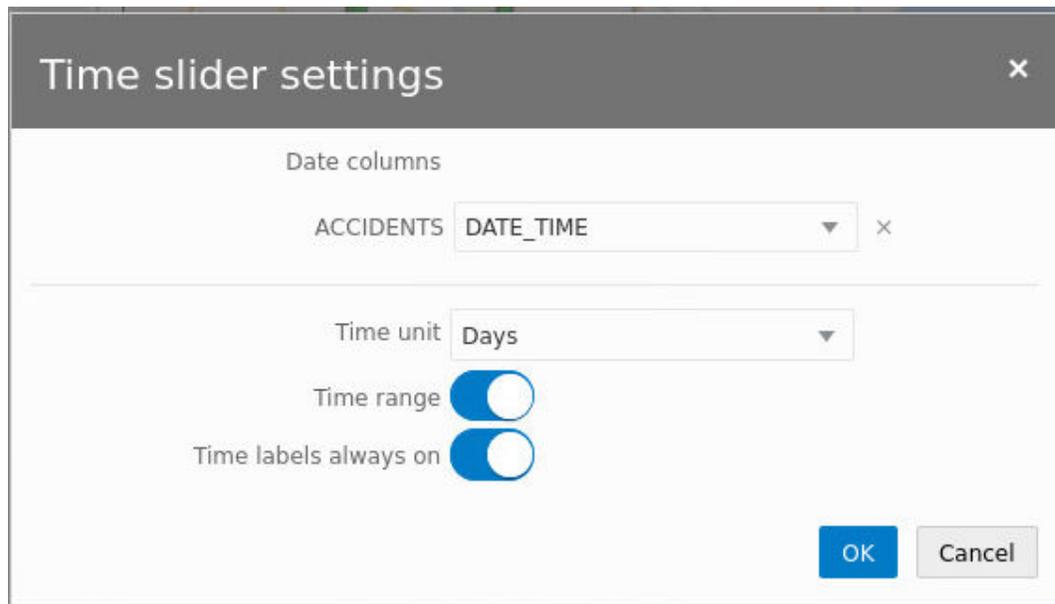
The instructions assume that you have a project linked to a dataset containing date or time data and the project is opened on your Active Project page.

1. Click the **Settings** icon in your map tool bar.
2. Switch on the **Show time slider** toggle button and click **OK**.

A time slider bar appears at the bottom of the map visualization canvas.

3. Click the **Time slider settings** icon on the time slider bar.

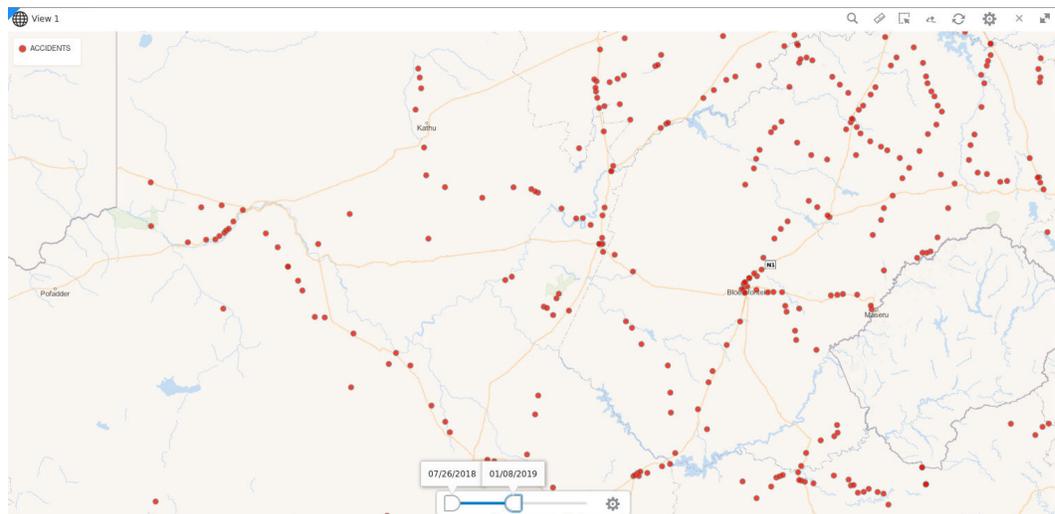
Figure 3-36 Time slider Settings



4. Select the **Date columns** and the **Time unit** to be applied for visualization.
5. Optionally, switch on or off the **Time range** and **Time labels always on** toggle buttons.
6. Click **OK**.

You can now interact with your map using the time slider to view the change of your data over time.

Figure 3-37 Using a Time slider in Map Visualization



4

Spatial Studio Accessibility Information

This topic provides information on the accessibility features for Oracle Spatial Studio.

It includes the following.

4.1 About Oracle Spatial Studio Accessibility

It is our goal to make Oracle Products, Services, and supporting documentation accessible to the disabled community.

Oracle Spatial Studio is based on the Oracle JET components. For more information about accessibility of Oracle JET components, see the [Oracle JET Documentation](#).

For additional accessibility information for Oracle products, see the Oracle Accessibility Program page at:

<http://www.oracle.com/accessibility/>

4.2 Oracle Spatial Studio Features that Support Accessibility

Oracle Spatial Studio provides features that are designed to support accessibility.

4.2.1 Keyboard Access with Spatial Studio

Oracle Spatial Studio features support keyboard access to the product's functionality; a summary is provided in this section. The following menu and toolbar functionality is provided through keyboard access:

- Users can navigate to and invoke all menu items.
- All toolbar functions are accessible through menu items.
- All menus and menu items have unique and functioning mnemonic keys.
- All context menus within the navigators and source editor can be invoked.
- Frequently used menu items have unique accelerator keys.

4.2.2 Screen Reader Readability with Spatial Studio

Here is a summary of screen readability in Spatial Studio, when it is used with a screen reader.

When used with menus and toolbars:

- All menus and menu items are read.
- All toolbar items are read.
- The hint text on all toolbar items is read.

4.2.3 Flexibility in Font and Color Choices with Spatial Studio

The user interface in Spatial Studio improves usability for people who are visually impaired by offering flexibility in color and font choices. The following font and color features are included:

- Users can specify both the font and the size in which the font displays for code editors.
- All features of the product have black text on a white or gray background.
- Colored text, underlining, or images are never used as the only method of conveying information.

4.2.4 No Audio-only Feedback with Spatial Studio

In Spatial Studio, there is no situation in which the only feedback a user receives is audible feedback. All audible feedback is accompanied by a visual indicator. For example, a prompt accompanies the bell sound that occurs when an error or illegal action has taken place.

4.2.5 No Dependency on Blinking Cursor and Animation with Spatial Studio

Spatial Studio makes minimal use of a blinking cursor and animation:

- No features in Spatial Studio use blinking indicators, with the exception of the cursor in the source editor.
- No features rely on animated sequences.

4.2.6 Screen Magnifier Usability with Spatial Studio

The Spatial Studio user interface works well with screen magnifiers. All features of the product can be magnified by a screen magnifier.

4.3 Highly Visual Features of Oracle Spatial Studio

Spatial Studio includes features that are highly visual, and these features have equivalent functionality that is available to people who are blind or visually impaired, except for the generated maps, which are only visual. However, results of an analysis can also be generated as JSON and tables, as an alternative format to the visual map.

All of the functionality is available through REST APIs.

In Spatial Studio, it is possible to create, edit, and generate an analysis result using only keystrokes.

A

REST API Endpoints for Oracle Spatial Studio

This appendix contains the OpenAPI 3.0 YAML documentation of the REST API endpoints for the Spatial Studio. You can invoke these endpoints to perform various Spatial Studio operations programmatically or through a command line tool such as curl using access tokens of the Spatial Studio.

OpenAPI 3.0 YAML Document containing the REST API Endpoints

```
openapi: 3.0.0
info:
  title: Oracle Spatial Studio REST API
  description: This file lists supported RESTful API endpoints of the Oracle
  Spatial Studio
  application. It is for advanced user only. All endpoints are subject to
  change without notification in
  future releases. To invoke a REST endpoint, ensure that the
  corresponding path is prepended with the Studio root
  context path and the /oauth part. For instance, to get the system
  status, the full URL of the endpoint should
  look like "https://localhost:4040/spatialstudio/oauth/v1/systemStatus".

  version: "1.0"
paths:
  /v1/systemStatus:
    get:
      operationId: getSystemStatus
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/logs:
    get:
      operationId: getSystemLogs
      parameters:
        - name: entries
          in: query
          schema:
            type: integer
            format: int32
            default: 30
        - name: entrylength
          in: query
          schema:
            type: integer
            format: int32
            default: 600
```

```

- name: cropentries
  in: query
  schema:
    type: boolean
    default: true
- name: filterlevel
  in: query
  schema:
    type: string
    default: INFO
responses:
  default:
    description: default response
    content:
      application/json: {}
/v1/softwareVersion:
  get:
    operationId: getVersionAndBuild
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/ping:
  get:
    operationId: ping
  responses:
    default:
      description: default response
      content:
        '*/*': {}
/v1/safe_domains:
  get:
    operationId: getSafeDomains
    parameters:
      - name: reload
        in: query
        schema:
          type: boolean
          default: false
    responses:
      default:
        description: default response
        content:
          application/json: {}
  post:
    operationId: updateSafeDomains
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
      default:
        description: default response

```

```

        content:
          application/json: {}
/v1/settings/{typeString}:
  get:
    operationId: getSGTechSettings
    parameters:
      - name: typeString
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/connections/validate:
  post:
    operationId: isValidConnection
    requestBody:
      content:
        application/json:
          schema:
            type: object
            additionalProperties:
              type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/settings/update/{typeString}:
  put:
    operationId: updateSGTechSettings
    parameters:
      - name: typeString
        in: path
        required: true
        schema:
          type: string
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/repository/status:
  get:
    operationId: getMetaDataSchemaStatus
    responses:
      default:

```

```

        description: default response
        content:
          application/json: {}
/v1/world_readable/{id}:
get:
  operationId: isWorldReadable
  parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
put:
  operationId: setWorldReadable
  parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
delete:
  operationId: removeWorldReadable
  parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/adhocdatasets:
post:
  operationId: createNewAdHocDataset
  requestBody:
    content:
      application/x-www-form-urlencoded:
        schema:
          type: object
          properties:
            query:
              type: string
            name:

```

```

        type: string
      description:
        type: string
        default: Spatial Analysis dataset.
      operator:
        type: string
      datasourceId:
        type: string
      datasetIds:
        type: string
      keyColumn:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/admin/cache:
  delete:
    operationId: cacheRebuild
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/{id}/columns:
  get:
    operationId: getColumns
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: datasetFields
        in: query
        schema:
          type: string
      - name: columnFields
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/size/{id}:
  get:
    operationId: getDatasetSize
    parameters:
      - name: id
        in: path
        required: true
        schema:

```

```

        type: string
      - name: exactValue
        in: query
        schema:
          type: boolean
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/{id}:
  get:
    operationId: getDataset
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: fields
        in: query
        schema:
          type: string
      - name: expand
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  delete:
    operationId: deleteDataSet
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: deleteDataTable
        in: query
        schema:
          type: boolean
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/row/{id}:
  delete:
    operationId: deleteDataSetRow
    parameters:
      - name: id
        in: path

```

```
      required: true
      schema:
        type: string
    - name: row_id
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/datasets:
  get:
    operationId: getDataSets
    parameters:
      - name: fields
        in: query
        schema:
          type: string
      - name: expand
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  post:
    operationId: createDataSet
    parameters:
      - name: validateGeoms
        in: query
        schema:
          type: boolean
    requestBody:
      content:
        application/json:
          schema:
            type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/rows/{id}:
  get:
    operationId: getDatasetRows
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
```

```

- name: columns
  in: query
  schema:
    type: string
- name: filter
  in: query
  schema:
    type: string
- name: orderBy
  in: query
  schema:
    type: string
- name: offset
  in: query
  schema:
    type: integer
    format: int64
- name: limit
  in: query
  schema:
    type: integer
    format: int64
- name: totalResults
  in: query
  schema:
    type: boolean
- name: jetResponse
  in: query
  schema:
    type: boolean
responses:
  default:
    description: default response
    content:
      application/json: {}
/v1/datasets/create_key_column/{datasetId}:
  post:
    operationId: createKeyColumn
    parameters:
      - name: datasetId
        in: path
        required: true
        schema:
          type: string
      - name: columnName
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/function_based_index/{id}:
  post:

```

```

    operationId: createFunctionBasedIndex
  parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: lon
      in: query
      schema:
        type: string
    - name: lat
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
delete:
  operationId: deleteFunctionBasedIndex
  parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: lon
      in: query
      schema:
        type: string
    - name: lat
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/datasets/update_statistics/{id}:
  post:
    operationId: updateDataSetStatistics
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}

```

```
/v1/datasets/statistics/{id}:
  get:
    operationId: getDatasetStatistics
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/cachesettings/{id}:
  get:
    operationId: getDatasetCacheSettings
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/refresh/{id}:
  post:
    operationId: getDatasetLastModified
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: lastModified
        in: query
        schema:
          type: integer
          format: int64
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/export/{id}:
  get:
    operationId: downloadExportedDataset
    parameters:
      - name: id
        in: path
        required: true
        schema:
```

```

        type: string
    - name: client_token
      in: query
      schema:
        type: string
    - name: format
      in: query
      schema:
        type: string
    - name: file_name
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/zip: {}
  post:
    operationId: exportDatasetAsGeoJson
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: format
      in: query
      schema:
        type: string
    - name: simplify_geoms
      in: query
      schema:
        type: string
    - name: coord_precision
      in: query
      schema:
        type: string
    - name: columns
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/datasets/geom_metadata/{id}:
  post:
    operationId: createGeometryMetadata
    parameters:
    - name: id
      in: path
      required: true
      schema:

```

```

        type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
/v1/datasets/columns/{id}:
  get:
    operationId: getDatasetColumnsContentInASingleRow
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: columns
        in: query
        schema:
          type: string
      - name: offset
        in: query
        schema:
          type: integer
          format: int64
      - name: limit
        in: query
        schema:
          type: integer
          format: int64
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasources/validate/{id}:
  post:
    operationId: validateDatasource
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasources:
  get:
    operationId: getDatasources
    parameters:
      - name: fields
        in: query
        schema:

```

```

        type: string
    - name: expand
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
  post:
    operationId: createDataSource
    parameters:
    - name: uploadToken
      in: query
      schema:
        type: string
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/datasources/{id}:
  get:
    operationId: getDatasource
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: fields
      in: query
      schema:
        type: string
    responses:
    default:
      description: default response
      content:
        application/json: {}
  put:
    operationId: updateDataSource
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    requestBody:
      content:

```

```

    '*/*':
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
  delete:
    operationId: deleteDataSource
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/enrichment/geocode/{id}:
  put:
    operationId: enrichDataSet
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  delete:
    operationId: clearEnrichment
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/uploads/geojsons/{uploadToken}/rows:
  get:

```

```

    operationId: getGeoJsonRows
    parameters:
      - name: uploadToken
        in: path
        required: true
        schema:
          type: string
      - name: fromrow
        in: query
        schema:
          type: integer
          format: int32
      - name: torow
        in: query
        schema:
          type: integer
          format: int32
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/jsonstream/{id}:
get:
  operationId: streamDatasetAsGeoJson
  parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: geo
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/public/vt/{id}/{geo}/{z}/{x}/{y}.mvt:
get:
  operationId: streamDatasetAsVectorTilePublic
  parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: geo
      in: path
      required: true
      schema:
        type: string
    - name: z

```

```

    in: path
    required: true
    schema:
      type: integer
      format: int32
  - name: x
    in: path
    required: true
    schema:
      type: integer
      format: int32
  - name: "y"
    in: path
    required: true
    schema:
      type: integer
      format: int32
responses:
  default:
    description: default response
    content:
      application/vnd.mapbox-vector-tile: {}
/v1/vt/{id}/{geo}/{z}/{x}/{y}.mvt:
get:
  operationId: streamDatasetAsVectorTile
  parameters:
  - name: id
    in: path
    required: true
    schema:
      type: string
  - name: geo
    in: path
    required: true
    schema:
      type: string
  - name: z
    in: path
    required: true
    schema:
      type: integer
      format: int32
  - name: x
    in: path
    required: true
    schema:
      type: integer
      format: int32
  - name: "y"
    in: path
    required: true
    schema:
      type: integer
      format: int32
responses:

```

```

        default:
            description: default response
            content:
                application/vnd.mapbox-vector-tile: {}
/v1/public/jsonstream/{id}:
get:
    operationId: streamDatasetAsGeoJsonPublic
    parameters:
        - name: id
          in: path
          required: true
          schema:
              type: string
        - name: geo
          in: query
          schema:
              type: string
    responses:
        default:
            description: default response
            content:
                application/json: {}
/v1/it/{id}/{z}/{x}/{y}.png:
get:
    operationId: streamDatasetAsImageTile
    parameters:
        - name: id
          in: path
          required: true
          schema:
              type: string
        - name: z
          in: path
          required: true
          schema:
              type: integer
              format: int32
        - name: x
          in: path
          required: true
          schema:
              type: integer
              format: int32
        - name: "y"
          in: path
          required: true
          schema:
              type: integer
              format: int32
    responses:
        default:
            description: default response
            content:
                image/png: {}
/v1/enrichment/geotag:

```

```
get:
  operationId: getGeonameTag
  parameters:
    - name: query
      in: query
      schema:
        type: string
        default: "{}"
    - name: simpleResponse
      in: query
      schema:
        type: boolean
        default: false
    - name: matchThreshold
      in: query
      schema:
        type: number
        format: float
        default: 10
  responses:
    default:
      description: default response
      content:
        application/json:
          schema:
            type: string
post:
  operationId: postGeonameTag
  requestBody:
    content:
      application/x-www-form-urlencoded:
        schema:
          type: object
          properties:
            query:
              type: string
              default: "{}"
            simpleResponse:
              type: boolean
              default: false
            matchThreshold:
              type: number
              format: float
              default: 10
  responses:
    default:
      description: default response
      content:
        application/json:
          schema:
            type: string
/v1/enrichment/geotag/datasets:
get:
  operationId: getGeonameTagDatasets
  parameters:
```

```

- name: query
  in: query
  schema:
    type: string
    default: "{}"
- name: simpleResponse
  in: query
  schema:
    type: boolean
    default: false
- name: matchThreshold
  in: query
  schema:
    type: number
    format: float
    default: 10
responses:
  default:
    description: default response
    content:
      application/json:
        schema:
          type: string
post:
  operationId: postGeonameTagDatasets
  requestBody:
    content:
      application/x-www-form-urlencoded:
        schema:
          type: object
          properties:
            query:
              type: string
              default: "{}"
            simpleResponse:
              type: boolean
              default: false
            matchThreshold:
              type: number
              format: float
              default: 10
  responses:
    default:
      description: default response
      content:
        application/json:
          schema:
            type: string
/v1/mapstyles/{id}:
  delete:
    operationId: deleteMapStyle
    parameters:
      - name: id
        in: path
        required: true

```

```

    schema:
      type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/mapstyles:
  post:
    operationId: createMapStyle
    requestBody:
      content:
        '*/*':
          schema:
            type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
/v1/public/mapstyles/{id}:
  get:
    operationId: getMapStyle
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/public/cesiummapstyles/{id}:
  get:
    operationId: getCesiumMapStyle
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/public/mapstyles:
  get:
    operationId: getMapStyleList
    parameters:
      - name: fields
        in: query
        schema:

```

```

        type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
/v1/public/cesiummapstyles:
  get:
    operationId: getCesiumMapStyleList
    parameters:
      - name: fields
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/cesiummapstyles:
  post:
    operationId: createCesiumMapStyle
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/cesiummapstyles/{id}:
  delete:
    operationId: deleteCesiumMapStyle
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/cache/precache/{id}:
  put:
    operationId: updateDatasetOrColumnBodyFields_1
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string

```

```

requestBody:
  content:
    '*/*':
      schema:
        type: string
responses:
  default:
    description: default response
    content:
      application/json: {}
/v1/cache/zoomLevels/{x1}/{y1}/{x2}/{y2}:
get:
  operationId: calculateZoomLevelsForBounds
  parameters:
    - name: x1
      in: path
      required: true
      schema:
        type: number
        format: double
    - name: y1
      in: path
      required: true
      schema:
        type: number
        format: double
    - name: x2
      in: path
      required: true
      schema:
        type: number
        format: double
    - name: y2
      in: path
      required: true
      schema:
        type: number
        format: double
    - name: maxTiles
      in: query
      schema:
        type: integer
        format: int32
        default: 25000
    - name: maxZoomLevel
      in: query
      schema:
        type: integer
        format: int32
        default: 14
  responses:
    default:
      description: default response
      content:
        application/json: {}

```

```
/v1/cache/purge/{id}:
  delete:
    operationId: purgeVectorTileCache
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/projects:
  get:
    operationId: getProjects
    parameters:
      - name: fields
        in: query
        schema:
          type: string
      - name: expand
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  post:
    operationId: createProject
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/projects/{id}:
  get:
    operationId: getProject
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: fields
        in: query
        schema:
```

```

        type: string
      - name: expand
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  put:
    operationId: updateProject
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  delete:
    operationId: deleteProject
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/projects/import/{file_type}:
  post:
    operationId: importProject
    parameters:
      - name: file_type
        in: path
        required: true
        schema:
          type: string
    requestBody:
      content:
        '*/*':
          schema:
            type: string

```

```

    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/projects/export/{id}:
  get:
    operationId: downloadExportedProject
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: client_token
        in: query
        schema:
          type: string
      - name: file_name
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/zip: {}
  post:
    operationId: createExportedProject
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/publishedprojects{id}:
  delete:
    operationId: deleteProject_1
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/publishedprojects/{id}:

```

```
get:
  operationId: getPublishedProject
  parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: fields
      in: query
      schema:
        type: string
    - name: expand
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
put:
  operationId: refreshProject
  parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/publishedprojects:
get:
  operationId: getPublishedProjects
  parameters:
    - name: fields
      in: query
      schema:
        type: string
    - name: expand
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
post:
  operationId: createPublishedProject
  requestBody:
    content:
```

```

    '*/*':
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/public/publishedprojects/{id}:
  get:
    operationId: getPublicProject
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: fields
        in: query
        schema:
          type: string
      - name: expand
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/uploads/shapefiles/{uploadToken}/srids:
  get:
    operationId: getShapefileMatchingSRIDs
    parameters:
      - name: uploadToken
        in: path
        required: true
        schema:
          type: string
      - name: maxResults
        in: query
        schema:
          type: integer
          format: int32
          default: 10
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/uploads/shapefiles/wktext/search:
  get:
    operationId: queryWKTextMatchingSRIDs
    parameters:
      - name: query

```

```

    in: query
    schema:
      type: string
  - name: maxResults
    in: query
    schema:
      type: integer
      format: int32
      default: 10
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/uploads/shapefiles/wktext/srids:
get:
  operationId: getWKTextMatchingSRIDs
  parameters:
  - name: wkText
    in: query
    schema:
      type: string
  - name: maxResults
    in: query
    schema:
      type: integer
      format: int32
      default: 10
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/uploads/shapefiles/{uploadToken}/rows:
get:
  operationId: getShapefileRows
  parameters:
  - name: uploadToken
    in: path
    required: true
    schema:
      type: string
  - name: fromrow
    in: query
    schema:
      type: integer
      format: int32
  - name: torow
    in: query
    schema:
      type: integer
      format: int32
  responses:
    default:
      description: default response

```

```

        content:
          application/json: {}
/v1/uploads/shapefiles/wktext/rebuild:
  post:
    operationId: rebuildWKTextIndex
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/uploads/spreadsheets/{uploadToken}/rows:
  get:
    operationId: getSpreadsheetRows
    parameters:
      - name: uploadToken
        in: path
        required: true
        schema:
          type: string
      - name: fromrow
        in: query
        schema:
          type: integer
          format: int32
      - name: torow
        in: query
        schema:
          type: integer
          format: int32
      - name: includeHeaders
        in: query
        schema:
          type: boolean
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/settings/system/unzipper/{settingName}:
  get:
    operationId: getZipUtilsSetting
    parameters:
      - name: settingName
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  post:
    operationId: setZipUtilsSetting
    parameters:

```

```

- name: settingName
  in: path
  required: true
  schema:
    type: string
requestBody:
  content:
    '*/*':
      schema:
        type: object
        additionalProperties:
          type: string
responses:
  default:
    description: default response
    content:
      application/json: {}
/v1/tables:
  get:
    operationId: getTableNames
    parameters:
      - name: datasource
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/tables/exist:
  get:
    operationId: tableExists
    parameters:
      - name: datasource
        in: query
        schema:
          type: string
      - name: table
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/tables/{table}:
  get:
    operationId: getTableColumnNamesAndTypes
    parameters:
      - name: table
        in: path
        required: true
        schema:

```

```

        type: string
    - name: datasource
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/tables/delete:
  delete:
    operationId: deleteTable
    parameters:
    - name: datasourceId
      in: query
      schema:
        type: string
    - name: tableName
      in: query
      schema:
        type: string
    - name: tableType
      in: query
      schema:
        type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/tables/rows:
  get:
    operationId: getRows
    parameters:
    - name: datasource
      in: query
      schema:
        type: string
    - name: table
      in: query
      schema:
        type: string
    - name: columns
      in: query
      schema:
        type: string
    - name: filter
      in: query
      schema:
        type: string
    - name: orderby
      in: query
      schema:
        type: string

```

```
- name: offset
  in: query
  schema:
    type: integer
    format: int64
- name: limit
  in: query
  schema:
    type: integer
    format: int64
- name: totalResults
  in: query
  schema:
    type: boolean
- name: jetResponse
  in: query
  schema:
    type: boolean
responses:
  default:
    description: default response
    content:
      application/json: {}
/v1/tasks:
  get:
    operationId: getTasks
    parameters:
      - name: status
        in: query
        schema:
          type: string
      - name: maxAge
        in: query
        schema:
          type: integer
          format: int32
      - name: maxTasks
        in: query
        schema:
          type: integer
          format: int32
      - name: includeSystem
        in: query
        schema:
          type: boolean
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/tasks/{taskId}:
  get:
    operationId: getTaskById
    parameters:
      - name: taskId
```

```

    in: path
    required: true
    schema:
      type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
/v1/uploads/{uploadToken}/stats:
  get:
    operationId: getStats
    parameters:
      - name: uploadToken
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/uploads/store:
  post:
    operationId: storeUploadedFileInDB
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/uploads/threedtileset/{uploadToken}/stats:
  get:
    operationId: get3DTilesetStats
    parameters:
      - name: uploadToken
        in: path
        required: true
        schema:
          type: string
      - name: filename
        in: query
        schema:
          type: string
      - name: setTilesetJsonDir
        in: query
        schema:
          type: boolean
    responses:
      default:

```

```

        description: default response
        content:
          application/json: {}
/v1/user/token:
  get:
    operationId: getUserTokens
    parameters:
      - name: fields
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/user/token/{id}:
  delete:
    operationId: deleteAccessToken
    parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/views/{view}:
  get:
    operationId: getViewColumnNamesAndTypes
    parameters:
      - name: view
        in: path
        required: true
        schema:
          type: string
      - name: datasource
        in: query
        schema:
          type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/views:
  get:
    operationId: getViewNames
    parameters:
      - name: datasource
        in: query
        schema:

```

```
    type: string
  responses:
    default:
      description: default response
      content:
        application/json: {}
```

B

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The initial code for shuffling an array (originally in class
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a method in class "org.apache.commons.math3.util.MathArrays") was
inspired from the algorithm description provided in
"Algorithms", by Ian Craw and John Pulham (University of Aberdeen 1999).
The textbook (containing a proof that the shuffle is uniformly random) is
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Commons Beanutils 1.9.4

Apache Commons BeanUtils 1.9.3

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HttpComponents HttpClient 4.5.12

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```
*/

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 * https://github.com/sony/jsep
 * Copyright (c) 2013 Stephen Oney, http://jsep.from.so/
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/*!
 Knockout Fast Foreach v0.6.0 (2016-07-28T11:02:54.197Z)
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 */

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 * https://github.com/yelouafi/petit-dom
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 */

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 * require-css - v0.1.10
```

```
* https://github.com/guybedford/require-css
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/*! Hammer.JS - v2.0.4 - 2014-09-28
* http://hammerjs.github.io/
*
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see: http://github.com/requirejs/i18n for details
*/

/* This component is based on original code from:
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```
/** @license
 * crossroads <http://millermedeiros.github.com/crossroads.js/>
 * Author: Miller Medeiros | MIT License
 * v0.12.0 (2013/01/21 13:47)
 */
```

ES6-Promise

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```
/*!
 * History API JavaScript Library v4.1.0
 *
 * Support: IE8+, FF3+, Opera 9+, Safari, Chrome and other
 *
 * Copyright 2011-2013, Dmitrii Pakhtinov ( spb.piksel@gmail.com )
 *
 * http://spb-piksel.ru/
 *
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 * http://www.gnu.org/licenses/gpl.html
 *
 * Update: 2014-03-24 13:14
 */
```

```
/*! jQuery UI - v1.11.4 - 2015-03-18
 * http://jqueryui.com
 * Includes: core.js, widget.js, mouse.js, position.js, draggable.js, sortable.js
 * Copyright 2015 jQuery Foundation and other contributors; Licensed MIT */
```

```
/*!
 * jQuery JavaScript Library v2.2.3
 * http://jquery.com/
 *
 * Includes Sizzle.js
 * http://sizzlejs.com/
 *
 * Copyright 2005, 2014 jQuery Foundation, Inc. and other contributors
 * Released under the MIT license
 * http://jquery.org/license
 *
 * Date: 2014-12-18T15:11Z
 */
```

```
/** @license
 * JS Signals <http://millermedeiros.github.com/js-signals/>
 * Released under the MIT license
 * Author: Miller Medeiros
 * Version: 1.0.0 - Build: 268 (2012/11/29 05:48 PM)
 */
```

```
/**
 * @license RequireJS text 2.0.12 Copyright (c) 2010-2014, The Dojo Foundation
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```

```

* see: http://github.com/requirejs/text for details
*/

/*
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see: http://github.com/jrburke/requirejs for details
*/

/*!
* Knockout JavaScript library v3.5.0
* (c) Steven Sanderson - http://knockoutjs.com/
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*/

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=====
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```

Mike Adair madairATdmsolutions.ca
Richard Greenwood richATgreenwoodmap.com
Didier Richard didier.richardATign.fr
Stephen Irons stephen.ironsATclear.net.nz
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Supercluster 3.0.2

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ajv 6.5.3

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colorbrewer 2.0

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flyway 6.4.2

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jackson-core 2.9.6

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mapbox-gl-js 1.8.0

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geojson-vt

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vector-tile

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vt-pbf

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whoots-js

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gl-matrix

<https://github.com/mapbox/gl-matrix/blob/ced516578e5e959298d22ac83b02bdedc16e1581/LICENSE.md>

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Csscolorparser

<https://github.com/deanm/css-color-parser-js/blob/master/README>

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feature-filter

<https://github.com/mapbox/feature-filter/blob/90333b6d917471e1e92b119d0c73034c98d0dcea/LICENSE>

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UnitBezier
<http://svn.webkit.org/repository/webkit/trunk/Source/WebCore/platform/graphics/UnitBezier.h>

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Unflowify

<https://github.com/leebyron/unflowify/commit/e684276059f9242a9637ab31cb7088910ebe0e4d>

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"name": "unflowify",

+ "version": "1.0.0",

+ "description": "Browserify transform for removing Flow type annotations.",

+ "author": "Lee Byron <lee@leebyron.com> (<http://leebyron.com/>)",

+ "license": "BSD-3-Clause",

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Unassertify

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Tinyqueue

<https://github.com/mourner/tinyqueue/blob/4506f90a4d5a0521677e47dd97a379486de72c95/package.json>

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turfJS 5.2

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