Oracle® Spatial Studio

Guide

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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.
italic	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 24.2.0

- Oracle Spatial Studio Release 24.2.0 is supported on Java JDK 11 or later.
- Added support for uploading GeoRaster images from files to the database, and optionally creating a GeoRaster dataset.
  See Loading Raster Images into Oracle Spatial GeoRaster for more information.
- Added support for visualizing wind animations that display streamlines on the map.
  For more information, refer to:
  - About Wind Animation
  - Creating a Wind Animation Dataset
  - Enabling Wind Animation For an Existing GeoRaster Dataset
- Added support for a new spatial analysis that creates isochrone (driving-time) polygons from a set of input locations.
  See Creating an Isochrone Map for Analysis for more information.
- Added support for *Densify Geometry* analysis which creates densified geometries.
  See Densify Geometry Analysis for more information.
- Added support for generating a fileset token on the Console page.
  See Generating a Fileset Token for more information.
- Added support for viewing GDAL installation information on the Console page.
  See Viewing GDAL Installation Info for more information.
- Added support for embedding a published project in a third-party web application.
  See Embedding a Published Project in Third-Party Web Applications for more information.
- Enhanced info window configuration to allow rearranging of columns in the popup component.
  See Configuring and Viewing an Info Window for more information.
- Added a new setting option in table visualization that allows displaying only features selected on a map visualization.
  See Using a Table Visualization for more information.
- Redesigned the layout of the projects page with published projects listed in a separate tab, and with streamlined display controls.
  See Spatial Studio Projects Page for more information.
- Added support to save the pitch and bearing of a map visualizaion as part of the project.
  See Changing the Pitch and Bearing of a Map for more information.
- Enhanced Geocoding accuracy - geocoding results now default to building rooftop instead of street segment.
- Enhanced map *Search* feature on the following:
  - Explicit inputs for longitude and latitude coordinates to precisely place pins on a map.
  - Improved type ahead address search as more relevant results are displayed first.

  - When searching using feature ID, the search operation is performed on the source data table for accurate results.

  See Searching Locations and Features on a Map for more information.

- Added various usability enhancements to the Redline map tool.
  See Using the Redline Map Tool for more information.
- Labels on the basemap are displayed in English along with the local (non-English) language of the region.

Upgrading to Spatial Studio 24.2.0

If you are running a Spatial Studio version:

- **Earlier than 22.3.0:** You must first download and successfully log into Spatial Studio 22.3.0. This is because a new version control mechanism is introduced for the metadata schema in 23.1.0 and Spatial Studio expects any existing metadata schema to already be at the version of Spatial Studio 22.3.0. Then you can upgrade to Spatial Studio 24.2.0. Otherwise, Spatial Studio version 24.2.0 will log the following SEVERE error message and abort the startup process.

  ```
  !!! Spatial Studio ver. 22.3.0 must be run at least once against your
  repository schema before upgrading to this version !!!
  ```

  See Upgrading to Spatial Studio 22.3.0 for more information.
- **22.3.0 or later:** See Upgrading Spatial Studio to upgrade to Spatial Studio 24.2.0.

1

Introduction to Oracle Spatial Studio

Oracle Spatial Studio is a visual tool for working with spatial data in Oracle Spatial format.

- 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 Terminology
  This section introduces the key concepts and domain objects of Oracle Spatial Studio.
- Spatial Studio Metadata and Connection Management
  This section provides conceptual information about the metadata schema and the connections object in Spatial Studio.
- Spatial Studio Best Practices
  This section describes the best practice recommendations when working with Spatial Studio.

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 "MapViewer"), which is not an end-user "tool" but rather a separate and distinct component.
>
> The map visualization component is documented in Spatial Map Visualization Developer's 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. (Java JDK 11 (64-bit) or later required)
>   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.

- Prerequisites and Recommendations for Spatial Studio
  This section describes the prerequisites and recommendations that apply for using Spatial Studio.
- Downloading and Installing Spatial Studio
  Spatial Studio must be downloaded and installed before anyone can use it to perform interesting work on spatial data.
- Upgrading Spatial Studio
  This section describes the process to upgrade your existing Oracle Spatial Studio deployment to 24.2.0.

- 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.
- Connection Requirements for Database Users of Spatial Studio
  This section describes the connection requirements for database users to work on Spatial Studio.
- Changing the Configuration Using the sgtech_config.json File
  This section describes the configuration of important properties in `sgtech_config.json` file.
- Recovery from Lost Master Key
  If you accidentally delete or replace the `sgtech_config.json` file, then the master key is lost and the Spatial Studio application will throw an error.
- Enabling IDCS as Identity Provider in Spatial Studio
  Starting from Oracle Spatial Studio Release 22.1.0, you can log into your Spatial Studio instance using users already managed by your own Oracle Cloud tenancy's IDCS identity domain.
- Mapping External User Principals to Built-In Spatial Studio Roles
  Spatial Studio supports mapping IDCS and other identity provider principals to the Spatial Studio built-in roles. This enables dynamically granting permissions to users by using custom groups, for instance.
- Moving the Spatial Studio Metadata Schema
  You can move your Spatial Studio metadata schema from one database to another.
- Using a CA-Signed SSL Certificate in the Quick Start Installation
  The Spatial Studio Quick Start installation typically comes with a self-signed certificate for handling SSL or HTTPS URL connection encryption.

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 JDK 11 (64-bit) or later.
- Oracle Database 19c 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 WebLogic Server 14c 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.
- All the prerequisites mentioned in Prerequisites for Uploading Raster Files Using Spatial Studio to upload raster files as Georaster to Oracle Database.

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.

See https://www.oracle.com/database/technologies/spatial-studio/get-started.html for more information on downloading and installing Spatial Studio.

The different types of installation options are described in the following sections:

- 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.
- Installing Spatial Studio on Oracle WebLogic Server
Spatial Studio can be deployed to a WebLogic Server domain, the recommended approach if multiple end users will access the same Spatial Studio application.
- Installing Spatial Studio on Apache Tomcat
Starting with Oracle Spatial Studio patch release 23.1.1, you can deploy and run the Spatial Studio web application on Apache Tomcat version 9.
- Installing Spatial Studio from Oracle Cloud Marketplace
You can provision Spatial Studio to Oracle Cloud from Oracle Cloud Marketplace.

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 (JDK 11 or later) and your own database schemas.
Before installing the Quick Start, ensure that you meet the following prerequisite requirements:

- You must have Java installed on your system and the `JAVA_HOME` environment variable is pointing to the full JDK installation of Java SE Development Kit. Note that the Quick start installation requires Java JDK 11 (64-bit) or later.
- Ports `8080` and `4040` on your system are not being used by any other (web) applications. Port `8080` is used with the `http://` protocol, while port `4040` is for the `https://` protocol. Although you can direct Spatial Studio to use different ports, `8080` and `4040` are the default. Note that by default Spatial Studio allows access using `https` only.

  If you prefer to enable `http` access, then perform the following steps:

  - Edit the `conf/server.json` file in the `Oracle_Spatial_Studio` directory and update the `httpEnabled` property to `true`.
  - Edit the `sgtech_config.json` file and update the `https_only` property to `false` (see Changing the Configuration Using the sgtech_config.json File).
  - Restart the Spatial Studio application.
  - Verify that the `http` port is opened in the host OS firewall.

You can perform the following steps to install and configure the Spatial Studio Quick Start:

1. Download the Quick Start zip archive `OracleSpatialStudio_qs.zip`.
2. Unzip (extract) the `OracleSpatialStudio_qs.zip` file.

   This results in the `Oracle_Spatial_Studio` directory.
3. Navigate to the `Oracle_Spatial_Studio` directory from a command window (Windows) or terminal (Linux or Mac).

   This directory contains several `.bat` or `.sh` files.
4. Start the Spatial Studio application by running `start.sh` or `start.bat`.

   On Linux or Mac you may need to ensure that the `.sh` files are executable by first running the command: `chmod u+x *.sh`
5. Launch Spatial Studio in your browser using the `https://localhost:4040/spatialstudio` URL and log into the web application.

   You can login using the default admin user login credentials - `admin`/`welcome1`. However, it is strongly recommended that you immediately change the password. See the README file in the Quick Start on how to change the (encrypted) password for the admin user.

   Also, note the following:

   - The default port is 4040. However, you can change the port by editing the `conf/server.json` file in the `Oracle_Spatial_Studio` directory. You must restart the application after you make any change to this file. (The same applies if you change the HTTP port value from the default 8080.)
   - The Quick Start provides the following predefined web user login accounts:
     - `admin`: Administrator user account
     - `daustin` and `bruce`: Two regular user accounts

     These predefined users and their login passwords are defined in the `conf/jetty-realm.properties` configuration file. The passwords are all stored in encrypted form. Before you start the application for the first time, it is strongly recommended that you change the password of the default administrator user `admin`. See the README file in the Quick Start on how to change the (encrypted) password for the admin user and other regular Spatial Studio users.

     Also, 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.
   - If you wish to configure the Spatial Studio server to use a CA-signed certificate, then see Using a CA-Signed SSL Certificate in the Quick Start Installation for more information.
   - The README file also contains information about starting and stopping the web application. 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.

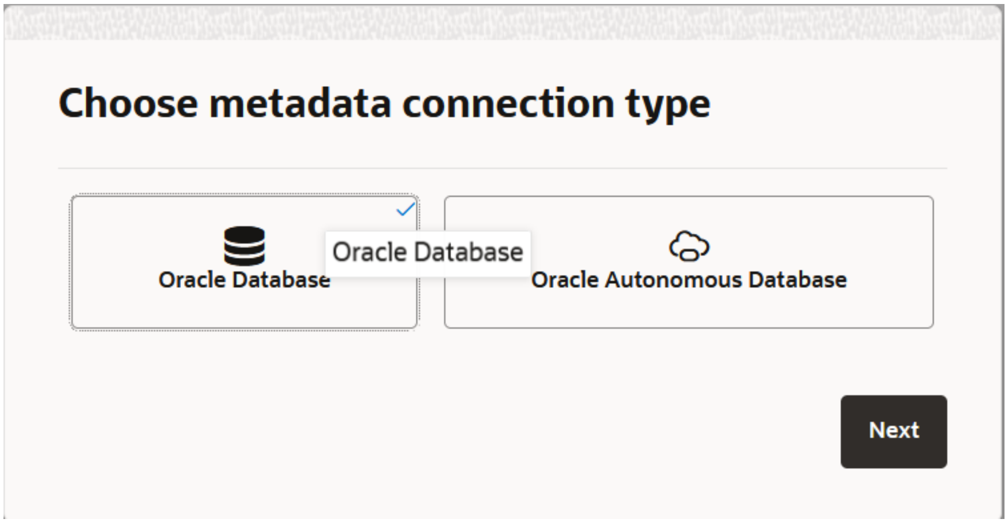
If your metadata connection detail is already stored in the `sgtech_config.json` file, then see Using Oracle Spatial Studio to get started with Spatial Studio.

Otherwise, proceed to step-6.

6. Optionally, select the metadata connection type.

   Perform this step only if you are starting a new instance of Spatial Studio on your system. This step is required to set the metadata repository in the database where Spatial Studio stores and manages the metadata for all its objects (such as the connections, dataset, and so on). See Setting Up the Spatial Studio Metadata Schema for more information on the metadata schema and the privileges required for the schema user.

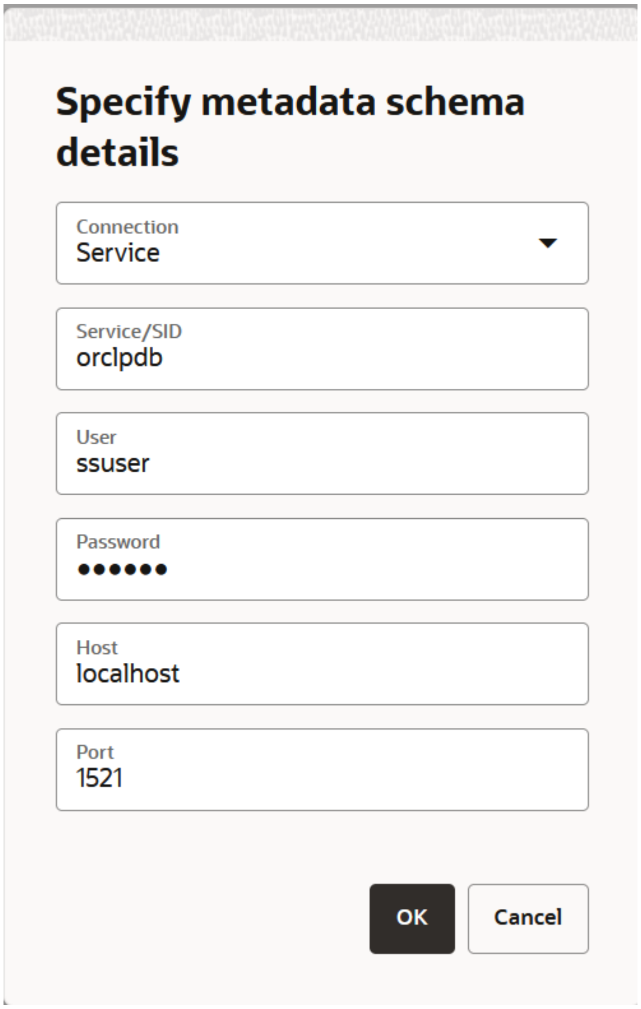
   Figure 2-1 Metadata Connection Type

   Perform the following steps depending on your choice of **Metadata connection type**:

   - **Oracle Database**
     The **Specify metadata schema details** dialog opens as shown:

Figure 2-2 Metadata Schema Connection to Oracle Database



Specify metadata schema details

Connection: Service

Service/SID: orclpdb

User
ssuser

Password: ••••••

Host: localhost

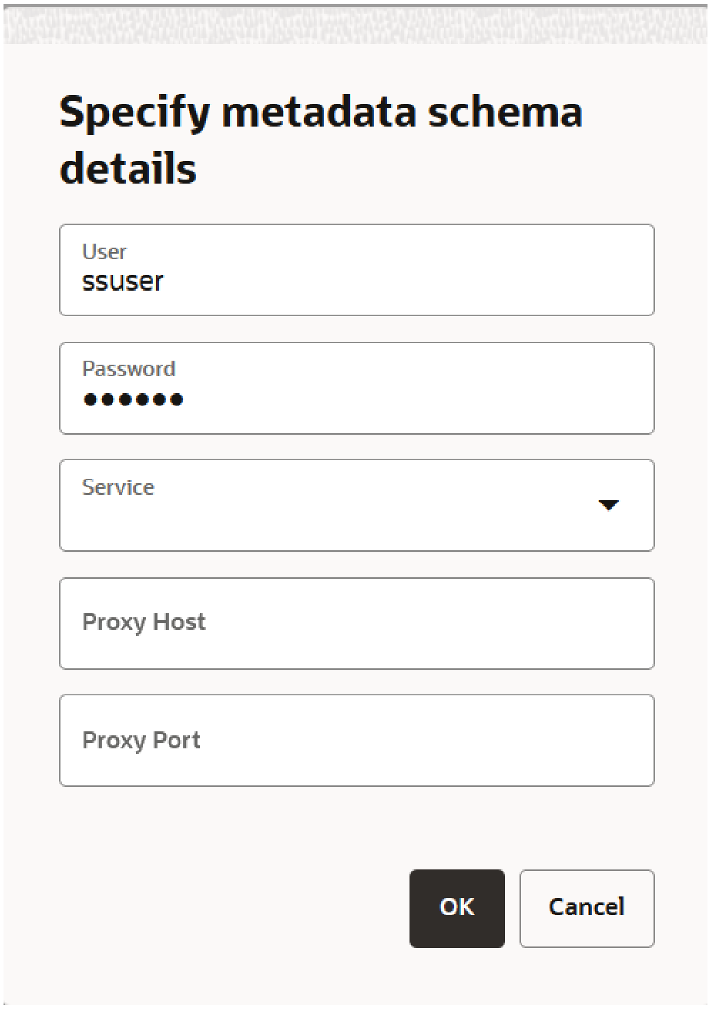
Port: 1521

a. Select the database **Connection**.
   Supported values are:
   - **Service**
   - **SID**
b. Enter the **Service/SID** value depending on the connection value selected in the earlier step.
c. Enter the database **User** name and the **Password** for the user.
d. Enter the **Host** and **Port** details.
e. Click **OK**.

- **Oracle Autonomous Database**
  The **Upload wallet** dialog opens.

  a. Drag and drop the wallet file (for your Autonomous Database instance) or click to upload the wallet from your system.
  b. Click **OK**.
     The **Specify metadata schema details** dialog opens as shown:

Figure 2-3 Metadata Schema Connection to Autonomous Database



Specify metadata schema details

User
ssuser

Password
●●●●●●

c. Enter the Autonomous database **User** name and the **Password** for the user.
d. Select the appropriate **Service** from the drop-down list.
e. Optionally, enter the **Proxy Host** and **Proxy Port** details.
f. Click **OK**.

The provided metadata schema details get stored in the `sgtech_config.json` file. The **Getting Started** page opens in the web application. See Using Oracle Spatial Studio to get started with Spatial Studio.

2.2.2 Installing Spatial Studio on Oracle WebLogic Server

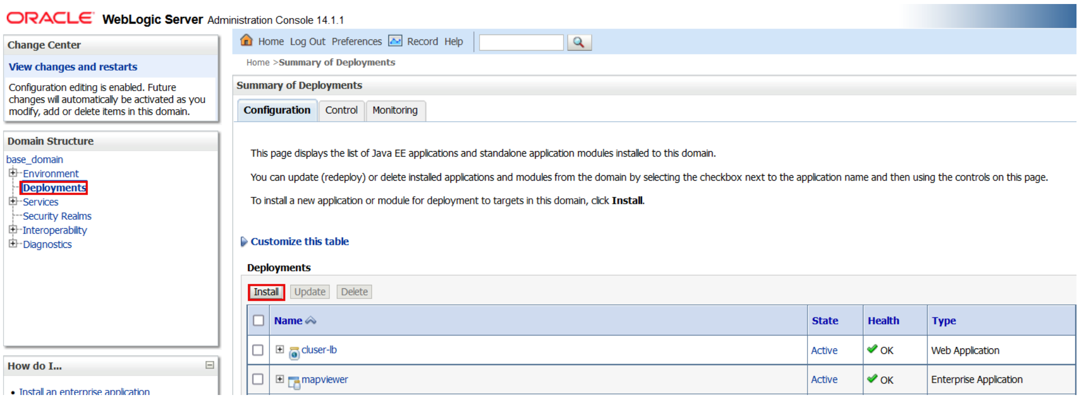
Spatial Studio can be deployed to a WebLogic Server domain, the recommended approach if multiple end users will access the same Spatial Studio application.

> **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 2-4 WLS Admin Console for Deploying Spatial Studio



Configuration editing is enabled. Future changes will automatically be activated as you modify, add or delete items in this domain.

This page displays the list of Java EE applications and standalone application modules installed to this domain.

You can update (redeploy) or delete installed applications and modules from the domain by selecting the checkbox next to the application name and then using the controls on this page.

To install a new application or module for deployment to targets in this domain, click **Install.**

Deployments

☐	Name	State	Health	Type
☐	cluser-lb	Active	✓ OK	Web Application
☐	mapviewer	Active	✓ OK	Enterprise Application

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`

- Preventing a Spatial Studio Admin User from General WLS Administration

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.

Also, note the following:

- 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.
- When using WebLogic's default embedded LDAP security realm as identity provider, if the user name and the assigned application role name differ only by casing (for example, **admin** and **Admin** respectively), then it is recommended that you adjust both the names to lowercase. This is to avoid case sensitivity issues in Spatial Studio between user, group, and security policies.

2.2.3 Installing Spatial Studio on Apache Tomcat

Starting with Oracle Spatial Studio patch release 23.1.1, you can deploy and run the Spatial Studio web application on Apache Tomcat version 9.

The following are the general steps for deploying and running Spatial Studio on Tomcat:

1. Download and install the latest Apache Tomcat version 9.

   See the Apache Tomcat Documentation for setting up Tomcat.

2. Unzip the Tomcat zip file and configure it as required, such as removing all default web applications found in the `<TOMCAT_HOME>/webapps` directory.
3. Download the Spatial Studio Tomcat specific WAR archive from Oracle Software Delivery Cloud.
4. Copy the downloaded WAR archive into the `<TOMCAT_HOME>/webapps/` directory.
5. Ensure to rename the WAR file to just `spatialstudio.war`.

   Note that there is no version or build string in the file name. See About the Spatial Studio WAR Archive for Tomcat for more information.

6. Configure Tomcat users and roles.

   Ensure to configure the `ADMIN` user for Spatial Studio. See Configuring Tomcat Users for Spatial Studio for more information.

7. Start the Tomcat server using the startup script in the `<TOMCAT_HOME>/bin` directory.

   Note that you may need to wait a few seconds for Tomcat and Spatial Studio to fully initialize before attempting to access the Spatial Studio web application.

8. Launch Spatial Studio in your browser by opening the URL - `https://localhost:8443/spatialstudio`.

   Note that in the preceding URL, port *`8443`* is the default `https` port for Apache Tomcat. If you wish to enable `http` access (default port *`8080`*), then see Allow HTTPS-ONLY Access for more information.

   You can then log in using one of the users you defined on step-6.

Note that the Spatial Studio access URL uses the default host name and port. If you change the default Tomcat network and port configurations, then you need to adjust the URL accordingly.

If for some reason you cannot access the URL, then you can always check the following log files:

- Tomcat's server logs in the `<TOMCAT_HOME>/logs` directory.
- Spatial Studio's own log files in the `<USER_HOME>/.sgtech/logs` directory, where `<USER_HOME>` is the home directory of the operating system user.

- About the Spatial Studio WAR Archive for Tomcat
  You must download the `spatialstudio_tomcat.war` archive for running Spatial Studio on Tomcat.
- Configuring Tomcat Users for Spatial Studio
  In order to run Spatial Studio on Tomcat, you need to configure at least one Tomcat user who can act as the administrator for Spatial Studio.

2.2.3.1 About the Spatial Studio WAR Archive for Tomcat

You must download the `spatialstudio_tomcat.war` archive for running Spatial Studio on Tomcat.

This archive file bundles all the required dependencies that enables it to run on a freshly downloaded and installed Tomcat instance.

It is important to note the following:

- You must rename the `spatialstudio_tomcat.war` file to **`spatialstudio.war`** when it is placed in the Tomcat's webapps directory. This is because Tomcat uses the file name as the web application's context root, and for Spatial Studio it is typically **/spatialstudio**.
- If you have an existing Tomcat installation with other web applications running on it or different versions of the dependency libraries are already installed, then there might be issues running Spatial Studio due to library and version conflicts. In such cases, you can raise a service request with My Oracle Support in order to have the issues resolved.

2.2.3.2 Configuring Tomcat Users for Spatial Studio

In order to run Spatial Studio on Tomcat, you need to configure at least one Tomcat user who can act as the administrator for Spatial Studio.

Note that when you access the Spatial Studio web application, the `username` and `password` that you enter in the login page are passed to Tomcat for authentication. Once the user is authenticated, Spatial Studio inspects the result principal. If the principal has a role named **SGTech_SystemAdmin**, then the logged in user will be considered an admin user for Spatial Studio.

If your Tomcat instance has already been configured to provide authentication using an external identity provider, then ensure one or some of the users provided by the external identity provider are assigned the **SGTech_SystemAdmin** role so they can administrate Spatial Studio.

If your Tomcat installation relies on its simple built-in user management mechanism, then you will likely be adding the role and user to `tomcat-user.xml` configuration file, which is found in the `<TOMCAT_HOME>/conf` directory.

The following simple example defines two users and two roles, with one being **SGTech_SystemAdmin** in `tomcat-user.xml` configuration file:

```
<role rolename=”role1”/>
<role rolename="SGTech_SystemAdmin"/>
<user username="admin" password="Welcome1" roles="manager-gui, manager-
script, SGTech_SystemAdmin"/>
<user username="scott" password="Welcome1" role="role1"/>
```

Once the roles are defined, then you can log into Spatial Studio using either the user name *scott* or *admin*. Since the *admin* user has the **SGTech_SystemAdmin** role, the user will be able to administrate Spatial Studio once logged in, whereas *scott* user will just be a regular Spatial Studio user.

2.2.4 Installing Spatial Studio from Oracle Cloud Marketplace

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

See Deploy Spatial Studio from Cloud Marketplace for more information on deploying Spatial Studio from Cloud Marketplace.

2.3 Upgrading Spatial Studio

This section describes the process to upgrade your existing Oracle Spatial Studio deployment to 24.2.0.

Note:

If you are running a Spatial Studio version **earlier than 22.3.0**, then you must first download and successfully log into Spatial Studio 22.3.0 (see Downloading Spatial Studio 22.3.0 from Oracle Software Delivery Cloud). This is because a new version control mechanism is introduced for the metadata schema in 23.1.0 and Spatial Studio expects any existing metadata schema to already be at the version of Spatial Studio 22.3.0. Therefore, you must log into the 22.3.0 web application at least once, before you can download and run the latest version. Otherwise, Spatial Studio version 24.2.0 will log the following `SEVERE` error message and abort the startup process.

```
!!! Spatial Studio ver. 22.3.0 must be run at least once against your
repository schema before upgrading to this version !!!
```

Tip:

To check the version of your current Spatial Studio installation, log into the web application, then click the **About** menu item from the **Avatar** drop-down menu. The version number gets displayed.

If you are already using Spatial Studio 22.3.0 or a newer version, then the following sections explain the steps for upgrading Spatial Studio in an existing host (in-place upgrade) or when deploying to a new host (out-of-place upgrade).

- Prerequisite Tasks for Upgrading Spatial Studio
- In-Place Upgrade
- Out-of-Place Upgrade
- Downloading Spatial Studio 22.3.0 from Oracle Software Delivery Cloud
  You can download Spatial Studio 22.3.0 from Oracle Software Delivery Cloud.

2.3.1 Prerequisite Tasks for Upgrading Spatial Studio

Perform the following prerequisite steps to prepare for Spatial Studio upgrade:

1. Stop all running Spatial Studio instances.
2. Take a backup of the following artifacts:
    - Repository metadata schema tables such as:
        - SGTECH_META_VERSION
        - SGTECH_OBJECT
        - SGTECH_SYS_TYPE
        - SGTECH_TASK_BROKER
        - SGTECH_TASK_QUEUE

      You can export the preceding files to a dump file using the data pump utilities. For example, the following shows a data pump export command, assuming the metadata schema name is **studio_metadata** with the database service name **orclpdb**:

      ```
      expdp studio_metadata/<password>@orclpdb directory=dumpdir
            dumpfile=spatial_studio_metadata_backup.dmp

      tables=SGTECH_META_VERSION,SGTECH_OBJECT,SGTECH_SYS_TYPE,SGTECH_TASK_BRO
      KER,SGTECH_TASK_QUEUE
      ```

    - Working directory (generally, **`~/.sgtech`**)
    - **`sgtech_config.json`** configuration file which is generally located in the working directory
    - For Quick Start, back up **`<spatial_studio_home_dir>/conf/jetty-realm.properties`** file which defines Spatial Studio users (user names, encrypted credentials, and roles).
3. Download the Spatial Studio 24.2.0 version and upload it to the host to be upgraded.

2.3.2 In-Place Upgrade

Perform the following step for an in-place Spatial Studio upgrade:

- Redeploy the Spatial Studio 24.2.0 application.
    - **For Quick Start:** Rename the old Quick Start folder. Expand the newly downloaded ZIP file, replace `<spatial_studio_home_dir>/conf/jetty-realm.properties` with the backup copy, and run **start.sh** (Linux) or **start.cmd** (Windows).
    - **For EAR deployment:** Follow the instructions of your application server to delete the old deployment version. Then, deploy the new version and start the application.

2.3.3 Out-of-Place Upgrade

Perform the following steps for an out-of-place Spatial Studio upgrade:

1. Create the working directory in the new host.

   ```
   mkdir ~/.sgtech
   ```

2. Copy the `sgtech_config.json` configuration file from the working directory of the old host to the new host.

   ```
   cp old/sgtech_config.json ~/.sgtech
   ```

   If the **master_seed** entry in the configuration file is lost, all connection passwords will be broken. If this occurs, proceed with the upgrade, then log into the upgraded Spatial Studio instance, edit each connection by re-entering the password, and reconnect.

3. Deploy the Spatial Studio application.
   - **For Quick Start:** Expand the newly downloaded ZIP file, replace `<spatial_studio_home_dir>/conf/jetty-realm.properties` with the backup copy, and run **start.sh** (Linux) or **start.cmd** (Windows).
   - **For EAR deployment:** Follow the instructions of your application server to deploy the new version and start the application.

   When the application is started, the repository database schema will automatically be upgraded.

2.3.4 Downloading Spatial Studio 22.3.0 from Oracle Software Delivery Cloud

You can download Spatial Studio 22.3.0 from Oracle Software Delivery Cloud.

1. Log into https://edelivery.oracle.com/.
2. Search **Oracle Spatial Studio** in the search bar.
3. Click **Oracle Spatial Studio 22.3.0.0.0**.

   The software gets added to the cart.
4. Click **Continue** at top right of the page.
5. Click **Continue** again at top right of the page.
6. Review the license agreement, select **I reviewed and accept the Oracle License Agreement** checkbox, and click Continue.
7. Click the **`V1032893-01.zip`** link next to *Spatial_Studio_qs_22.3.0.zip*.

   The software gets downloaded to your system.

2.4 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 by 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.
```

In such a scenario, see Recovery from Lost Master Key to resolve the issue.

2.5 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.

2.6 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 application EAR to a WebLogic domain or you are just using the Quick Start.

> **Note:**
>
> You must safeguard the `sgtech_config.json` file and ensure it has a backup on a regular basis. If this file is lost, you will lose the master key that Spatial Studio used to encrypt sensitive information, such as the database schema password for your data connections. This means that next time you start up Spatial Studio, it will no longer be able to decrypt such information, and none of your data connections will be usable, as well as all the datasets in them. In such a scenario, refer to Recovery from Lost Master Key for more information.

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

- Allow HTTPS-ONLY Access
- Connecting to the Spatial Studio Metadata Schema
- Caching Metadata Objects
- Importing Additional Configuration Files in Spatial Studio
- If the Spatial Studio Repository Schema Password Has Been Changed

2.6.1 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 you wish to enable `http` access, change the value of `https_only` to `false`, and then restart the Spatial Studio application or the JavaEE container where Spatial Studio is deployed.

Please note that enabling `http` access also requires the following:

- `http` is enabled in the JaveEE container.
  If you are running Spatial Studio Quick Start, then see Installing and Configuring the Spatial Studio Quick Start which explains how to enable HTTP access in the Jetty container.
- The `http` port is opened in the host OS firewall.

2.6.2 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 SPATAL_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.

2.6.3 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.

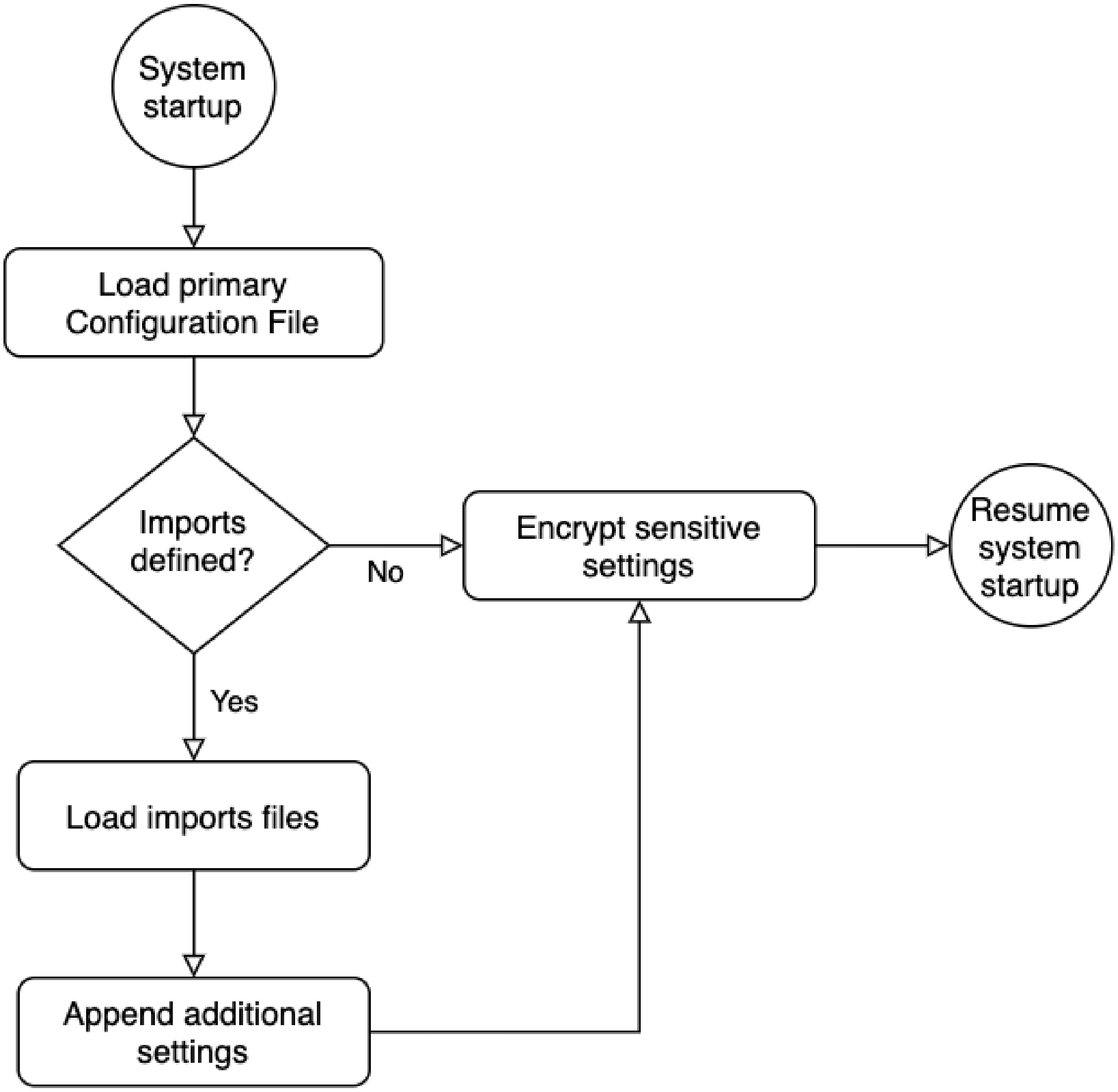
The *`cache`* section of the `sgtech_config.json` file lets you specify whether to enable such an in-memory cache of metadata objects. If the cache is enabled, then you can further specify how many such objects can be cached and for how long. A general rule is that *`max_size`* (the maximum number of 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.

2.6.4 Importing Additional Configuration Files in Spatial Studio

Spatial Studio 22.1 allows you to import different configuration files into the main **`sgtech_config.json`** configuration file.

The following describes the workflow for handling multiple configuration files:

Figure 2-5 Workflow to Handle Multiple Configuration Files


System startup
Load primary Configuration File
Imports defined?
No
Encrypt sensitive settings
Resume system startup
Yes
Load imports files
Append additional settings

1. At startup, Spatial Studio loads the primary configuration file, `sgtech_config.json`.
   All the settings defined in `sgtech_config.json` are used as the *base settings*.
2. If the `sgtech_config.json` file contains the `imports` directive, then it loads the import files in the order (top to bottom) in which they are declared.
   For each loaded import file, the system reads and appends the settings to the *base settings*.
3. Once the *base settings* are all read in, the system encrypts any sensitive items and saves them back to their corresponding file.
4. Spatial Studio resumes loading the rest of the system.

Adding `imports` to `sgtech_config.json`

You can edit the `sgtech_config.json` file and add the new top-level `imports` directive as shown:

```
"imports" : {
   "<import_name>" : {
      "module" : "<import_file_path>",
      "description" : "<import_description>"
   }
}
```

In the preceding code:

- **<import_name>**: Name of the import file which must be unique. This is used mainly by Spatial Studio to report errors when loading `imports` files.
- **<import_file_path>**: The file path for the `imports` files must be relative to the containing directory of the main configuration file (*`~/.sgtech/sgtech_config.json`*).
- **<import_description>**: To describe the purpose of the import.
  `description` is an optional parameter for the `imports` property.

For example, configure the `metadata_schema` details as shown in the following code in ***`sgtech_config.dbsettings.json`*** file. The file path can be `~/.sgtech/extras/sgtech_config.dbsettings.json`:

```
{
  "metadata_schema" : {
    "connection_manager" : "CONTAINER",
    "container_managed" : {
      ...
    },
  }
}
```

Also, configure the `jobs` details separately in ***sgtech_config.jobs.json*** following the file path `~/.sgtech/extras/sgtech_config.jobs.json`:

```
{
  "jobs" : {
    "init_threads_count" : 45
  }
}
```

You can now include the preceding two configuration files in the `imports` directive in the main `sgtech_config.json` file (*`~/.sgtech/sgtech_config.json`*) as shown:

```
{
  "version" : "22.1.0",
  "work_dir" : "",
  "https_only" : true,
  "master_seed" : "<somerandommasterseed>",
  "logging" : {
    "level" : "INFO"
  },
  "imports" : {
    "jobs" : {
      "module" : "extras/sgtech_config.jobs.json"
    },
    "db" : {
      "module" : "extras/sgtech_config.dbsettings.json",
      "description" : "Database settings optimized for clustering"
    }
  }
}
```

Import Files Requirements

It is important you adhere to the following requirements when handling multiple import files:

- Files for `imports` must be located inside the same directory as the primary `sgtech_config.json` file, or any of its subdirectories.
- Settings included in the `imports` files must not make collision with settings declared already in other configuration files, including the primary `sgtech_config.json` configuration file.
- Since `imports` files can contain sensitive data, only the file owner must have read, write or both access.
- `version`, `work_dir`, `master_seed` and `imports` are settings which are restricted to the primary configuration file, `sgtech_config.json` .

2.6.5 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 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.

2.7 Recovery from Lost Master Key

If you accidentally delete or replace the `sgtech_config.json` file, then the master key is lost and the Spatial Studio application will throw an error.

The `sgtech_config.json` file includes a `master seed` property which contains the master key value that enables decryption of encrypted items such as database passwords. It is therefore recommended to backup your `sgtech_config.json` file in a safe location.
However, if you lose the `sgtech_config.json` file, then it is possible to recover from a lost master key by performing the following steps:

1. Stop the Spatial Studio instance by running the following command from the application installation directory:

   ```
   ./stop.sh
   ```

   If you installed the application from the Cloud Marketplace, then use the following command:

   ```
   sudo systemctl stop spatialstudio
   ```

2. Run the following command in your Spatial Studio repository using a SQL client (such as Database Actions, SQL Plus or SQL Developer):

   ```
   DELETE
       "SGTECH_OBJECT"
   WHERE
       "TENANTID" = 'GLOBAL'
       AND (
           "ID" IN ('id__sgtech.safe_text.magicword',
   'id__sgtech.key_pair.rsa')
           OR "OBJECTTYPE" = 'access_token'
       );
   COMMIT;
   ```

3. Start Spatial Studio by running the following command from the application installation directory:

   ```
   ./start.sh
   ```

   If you installed the application from the Cloud Marketplace, then use the following command:

   ```
   sudo systemctl start spatialstudio
   ```

4. Log into Spatial Studio as the `admin` user.
5. Navigate to the **Connections** page.
6. Right-click on each connection, select **Edit**, and re-enter the password for each connection.
7. Open **Access Tokens** dialog and delete each active token.
8. Navigate to the **Console** page.

9. Optionally, if you had created a custom basemap with a separate API key, then re-enter the **API Key** by editing the required custom basemap.

   Click **Basemaps** under **Settings** to view and edit your custom basemap.

10. Optionally, if you had created a Cesium basemap with a separate API key, then re-enter the **API Key** by editing the required Cesium basemap.

    Click **Cesium Basemaps** under **Settings** to view and edit your Cesium basemap.

Make sure to back up the `sgtech_config.json` configuration file safely this time so you do not have to repeat this process in the future.

2.8 Enabling IDCS as Identity Provider in Spatial Studio

Starting from Oracle Spatial Studio Release 22.1.0, you can log into your Spatial Studio instance using users already managed by your own Oracle Cloud tenancy's IDCS identity domain.

The workflow to setup IDCS as the identity provider for Spatial Studio involves the following three steps:

1. Adding Spatial Studio roles as Groups in IDCS.
2. Creating an Application in IDCS.
3. Copying IDCS settings into Spatial Studio's configuration file.

Before you begin, see Prerequisite Requirements for Setting Up IDCS with Spatial Studio to ensure that you meet all the prerequisite requirements.

- Prerequisite Requirements for Setting Up IDCS with Spatial Studio
- Adding Spatial Studio Role as a Group in IDCS
  You must add the system administrator role supported in Spatial Studio as a group in IDCS.
- Creating an Application in IDCS
  This section describes the steps to add the Spatial Studio application in IDCS.
- Copying IDCS Settings into Spatial Studio's Configuration File
  To integrate Spatial Studio with IDCS, you must add the IDCS settings into the **`sgtech_config.json`** configuration file.
- Testing IDCS Login
  After all the setup steps are completed, you can test and verify the IDCS login.

2.8.1 Prerequisite Requirements for Setting Up IDCS with Spatial Studio

To integrate IDCS with Spatial Studio, you must obtain the following details:

- Identify your **IDCS tenant**: See Retrieving IDCS Instance details .
- Identify your **IDCS host**: See Retrieving IDCS Instance details .
- Identify the **Spatial Studio URL**: *https://localhost:4040/spatialstudio/* is the default.
- Setup an **IDCS admin account**: See About Oracle Identity Cloud Service User Accounts and Groups for details.
- Identify **IDCS console URL**: See Determining the IDCS Console URL for more information.

Retrieving IDCS Instance details

You can obtain the IDCS instance details by inspecting any of the IDCS URLs. For instance, you can inspect the IDCS login URL which you receive in the email when you are added as a user in IDCS. For example, consider the following sample IDCS cloud account login URL:

https://**idcs-54656e616e742d4578616d706c652121.identity.oraclecloud.com**/ui/v1/signin

You can now derive the IDCS instance details from the preceding URL as shown:

- **IDCS tenant**: *idcs-54656e616e742d4578616d706c652121*
- **IDCS host**: *identity.oraclecloud.com*
- Determining the IDCS Console URL
  OCI tenancies include a default IDCS instance and you can obtain the IDCS console URL using the OCI console.

2.8.1.1 Determining the IDCS Console URL

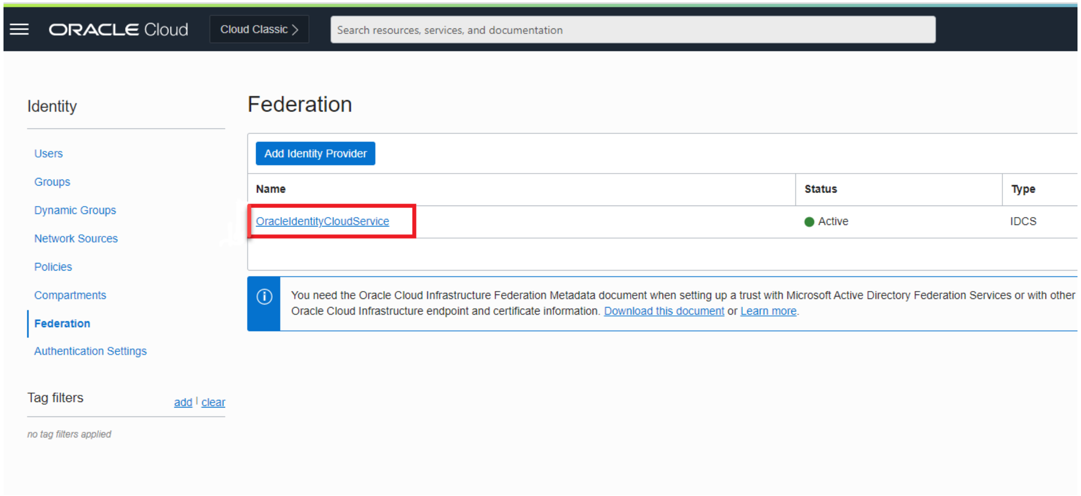
OCI tenancies include a default IDCS instance and you can obtain the IDCS console URL using the OCI console.

Perform the following steps to identify the URL to access IDCS console:

1. Sign in to the OCI console using your Oracle Cloud credentials.
2. Open the navigation menu and select **Identity and Security**.
3. Click **Federation** under **Identity**.

   The Federation page opens as shown:

Figure 2-6 Default IDCS Instance on the Federation Page



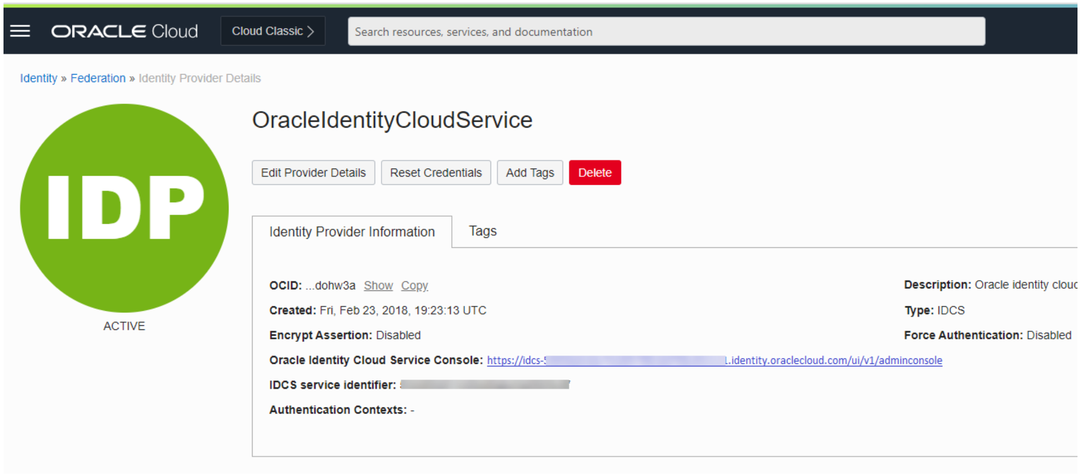
Name	Status	Type
OracleIdentityCloudService	● Active	IDCS

You need the Oracle Cloud Infrastructure Federation Metadata document when setting up a trust with Microsoft Active Directory Federation Services or with other Oracle Cloud Infrastructure endpoint and certificate information. Download this document or Learn more.

4. Click on the default IDCS instance, shown highlighted in the preceding figure.

   The **Identity Provider Details** page opens.
5. Note the IDCS console URL in the **Oracle Identity Cloud Service Console** field as shown:

Figure 2-7 IDCS Console URL


ORACLE Cloud
Cloud Classic >
Search resources, services, and documentation
Identity » Federation » Identity Provider Details
IDP
ACTIVE
Edit Provider Details
Reset Credentials
Add Tags
Delete
Identity Provider Information
Tags

OracleIdentityCloudService

OCID: ...dohw3a Show Copy

Created: Fri, Feb 23, 2018, 19:23:13 UTC

Encrypt Assertion: Disabled

Oracle Identity Cloud Service Console: https://idcs-[redacted].identity.oraclecloud.com/ui/v1/adminconsole

IDCS service identifier: [redacted]

Authentication Contexts: -

Description: Oracle identity clou

Type: IDCS

Force Authentication: Disabled

2.8.2 Adding Spatial Studio Role as a Group in IDCS

You must add the system administrator role supported in Spatial Studio as a group in IDCS.

The system administrator role in Spatial Studio is identified by ***SGTech_SystemAdmin***. This implies that the administrator has full access to the entire system.
You need to add this role as an IDCS group. However, the following applies:

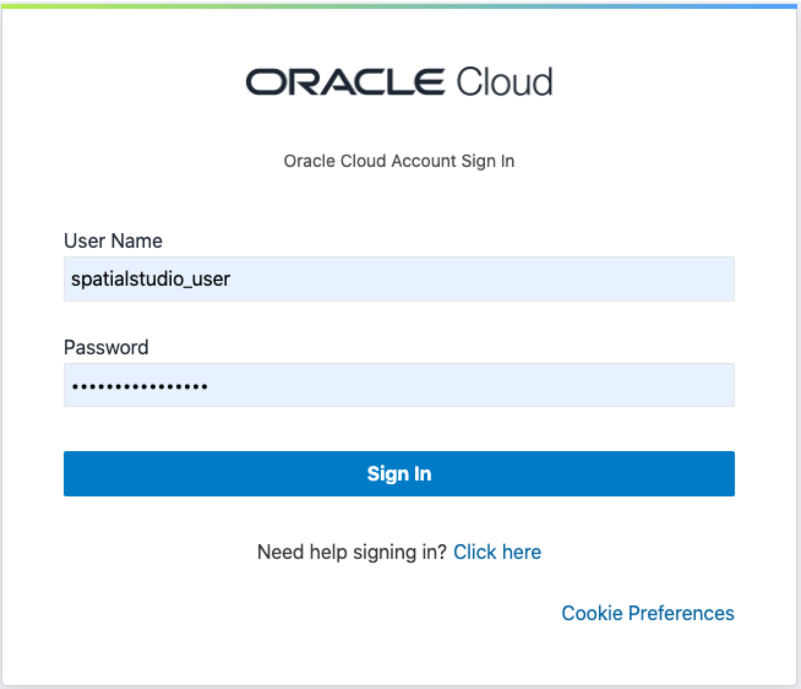
- Users assigned to this group will have admin rights in the Spatial Studio instance that is being set up.
- Users who do not belong to this group will have regular access to the Spatial Studio instance when added to the IDCS application.

As a prerequisite, you must obtain the IDCS console URL. See Determining the IDCS Console URL for details.

Perform the following steps to create the groups in IDCS:

1. Open the IDCS login page using the IDCS console URL in your browser.
2. Enter the ADMIN user credentials and sign in as shown:

Figure 2-8   IDCS Login



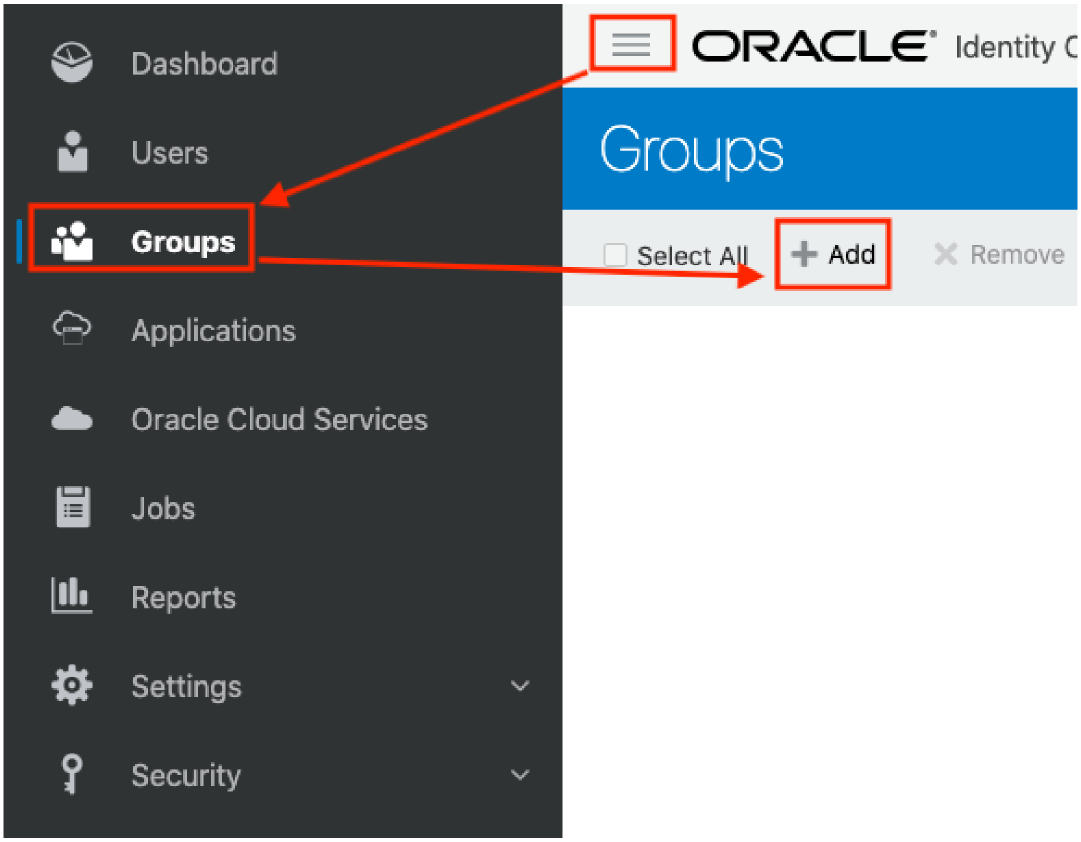
Oracle Cloud Account Sign In

User Name: spatialstudio_user

Password: ••••••••••••••••

3. Open the navigation menu on top left, select **Groups** and click **Add** to create a new group as shown:

Figure 2-9   Adding an IDCS Group



The **Add Group** dialog opens and displays the **Step 1: Group Details** page.

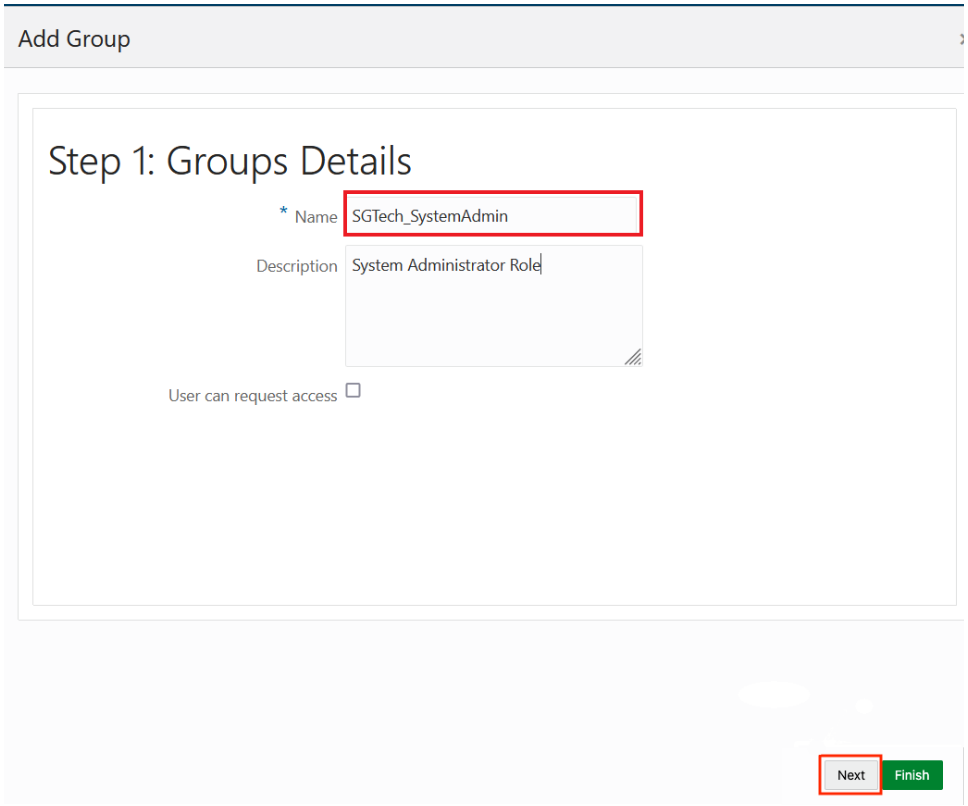
4. Enter **Name** as *SGTech_SystemAdmin*.

   Note that the role name is case sensitive.

5. Optionally, enter a **Description**.

6. Click **Next** as shown:

Figure 2-10 Step-1: Group Details



Add Group

Step 1: Groups Details

* Name: SGTech_SystemAdmin

Description: System Administrator Role

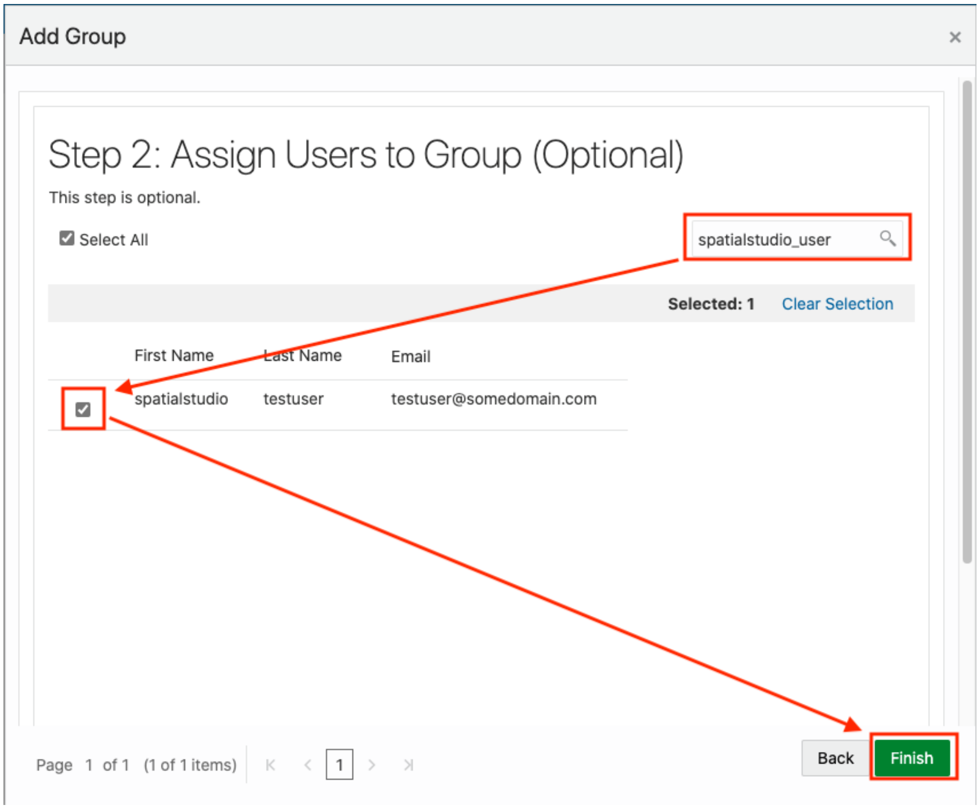
User can request access ☐

Step 2: Assign Users to Group (Optional) page opens listing all the existing users.

7. Select the required user and click **Finish**.

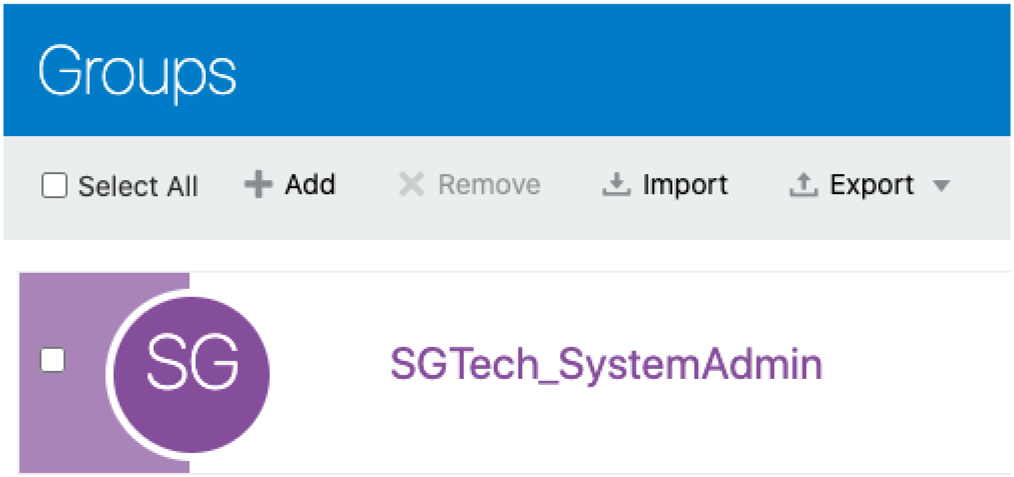
   For example, the following figure shows assigning *spatialstudio_user* to the group role *SGTech_SystemAdmin*:

Figure 2-11   Step2: Assign Users to a Group



8. Verify that the newly added group is listed on the **Groups** page:

Figure 2-12   List of Groups

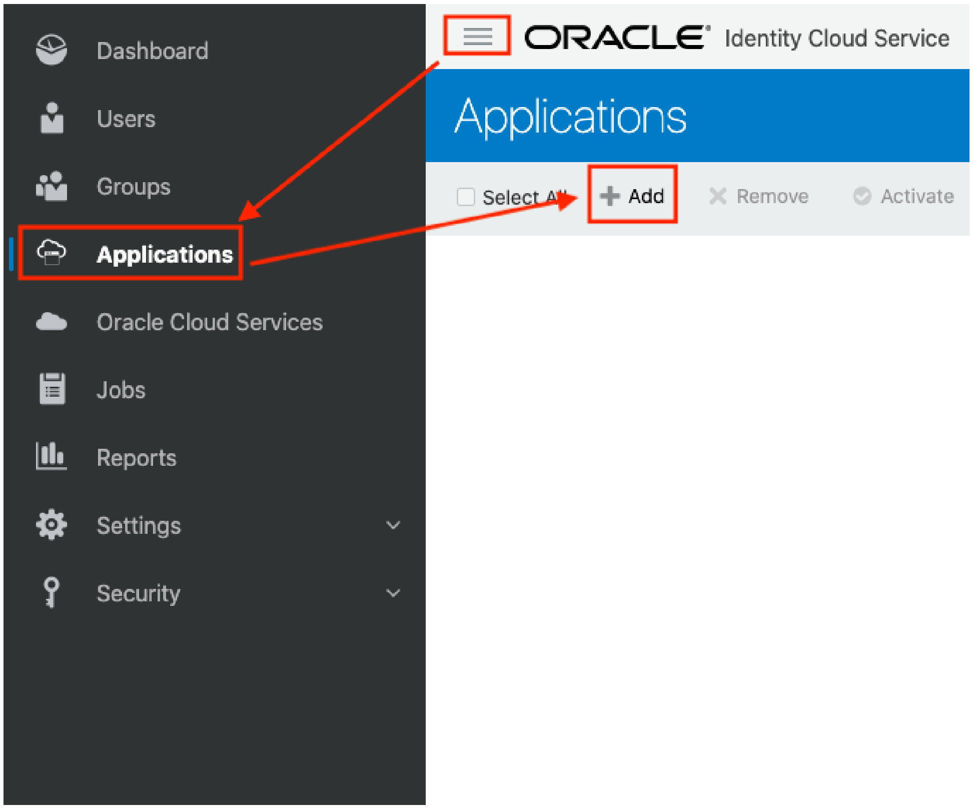


2.8.3 Creating an Application in IDCS

This section describes the steps to add the Spatial Studio application in IDCS.

1. Sign in to IDCS using ADMIN user credentials.
2. Open the navigation menu on top left, select **Applications** and click **Add** to add a new application as shown:

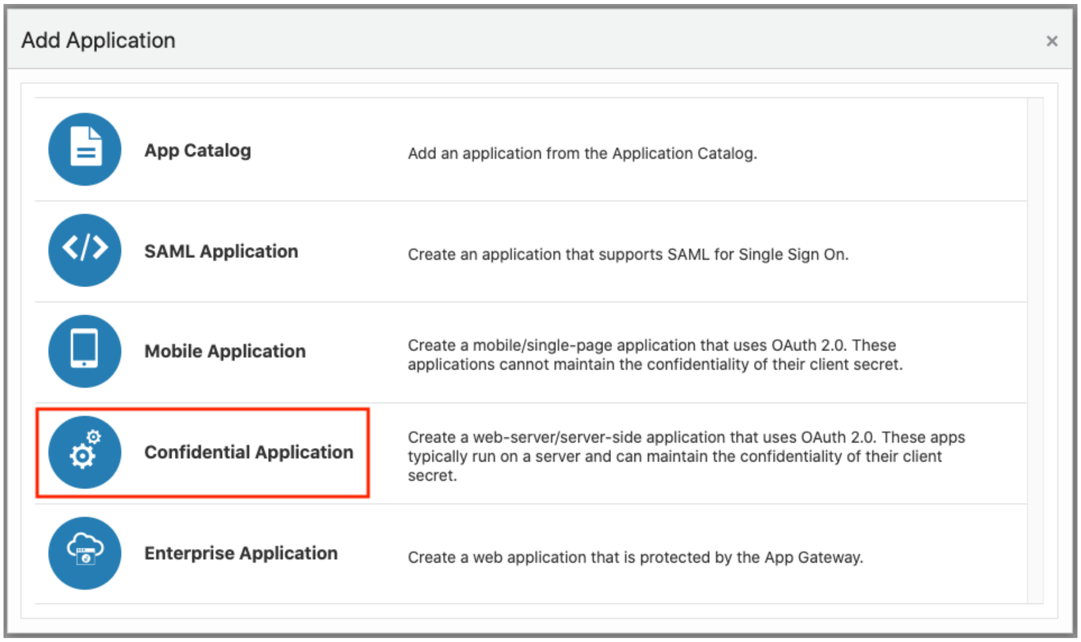
Figure 2-13   Adding an Application



The **Add Application** dialog opens.

3. Select **Confidential Application**.

Figure 2-14   Add Application Dialog

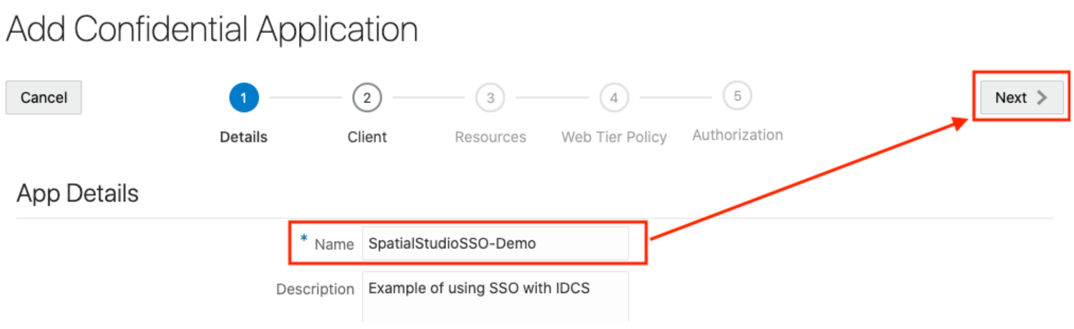


App Catalog	Add an application from the Application Catalog.
SAML Application	Create an application that supports SAML for Single Sign On.
Mobile Application	Create a mobile/single-page application that uses OAuth 2.0. These applications cannot maintain the confidentiality of their client secret.
Confidential Application	Create a web-server/server-side application that uses OAuth 2.0. These apps typically run on a server and can maintain the confidentiality of their client secret.
Enterprise Application	Create a web application that is protected by the App Gateway.

The **Add Confidential Application** wizard opens displaying the **Details** page.

4. Enter the application **Name**.
5. Optionally, add a **Description** and click **Next**.

Figure 2-15   Add Confidential Application: Details Page



* Name: SpatialStudioSSO-Demo

Description: Example of using SSO with IDCS

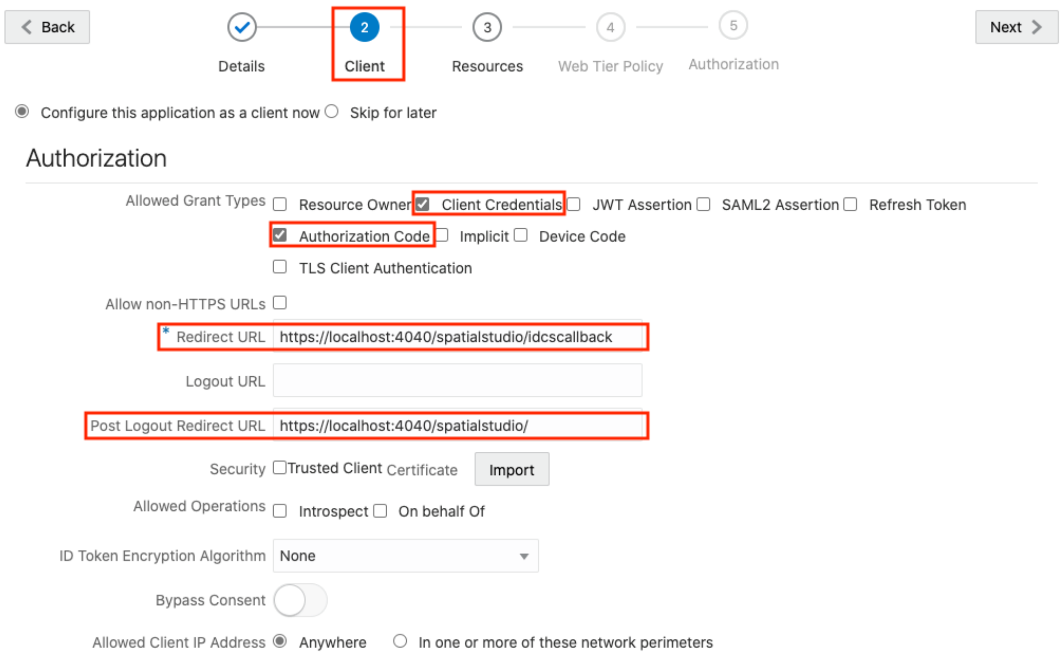
The **Client** page opens.

6. Click **Configure this application as a client now** to configure the authorization information for the new application.

   Perform the following in the **Authorization** section:

   a. Enable **Client Credentials** and **Authorization Code** for **Allowed Grant Types**.
   b. Enter *<spatial_studio_url>/idcscallback* in **Redirect URL**.
   c. Enter *<spatial_studio_url>* in **Post Logout Redirect URL**.
   d. Optionally, for **Security**, you can enable **Trusted Client** to import a custom certificate.

Figure 2-16   Configuring Client Details



● Configure this application as a client now ○ Skip for later

Allowed Grant Types: ☐ Resource Owner ☑ Client Credentials ☐ JWT Assertion ☐ SAML2 Assertion ☐ Refresh Token ☑ Authorization Code ☐ Implicit ☐ Device Code ☐ TLS Client Authentication

Allow non-HTTPS URLs: ☐

* Redirect URL: https://localhost:4040/spatialstudio/idcscallback

Logout URL:

Post Logout Redirect URL: https://localhost:4040/spatialstudio/

Security: ☐ Trusted Client Certificate

Allowed Operations: ☐ Introspect ☐ On behalf Of

ID Token Encryption Algorithm: None

Bypass Consent: ○

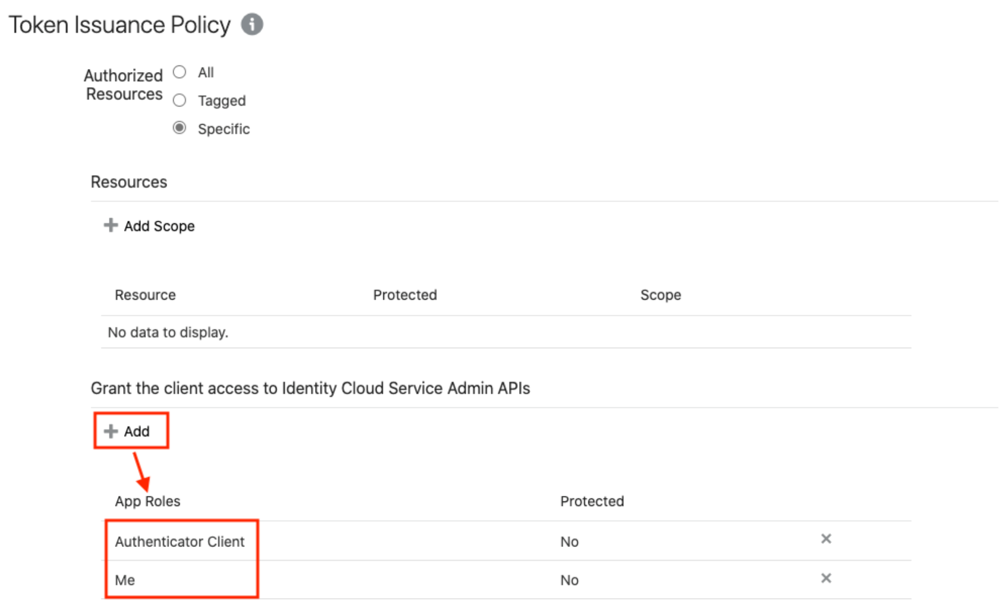
Allowed Client IP Address: ● Anywhere ○ In one or more of these network perimeters

Perform the following in the **Token Issuance Policy** section:

a. Click **Add** under **Grant the client access to Identity Cloud Service Admin APIs** to enable the application to access IDCS APIs.
   The **Add App Role** window opens listing the application roles.

b. Select *Me* and *Authenticator Client* and click **Add** to assign these application roles to the application as shown:

Figure 2-17 Configuring Token Issuance Policy



Token Issuance Policy

Authorized Resources: ○ All ○ Tagged ● Specific

Resources

Resource	Protected	Scope
No data to display.		

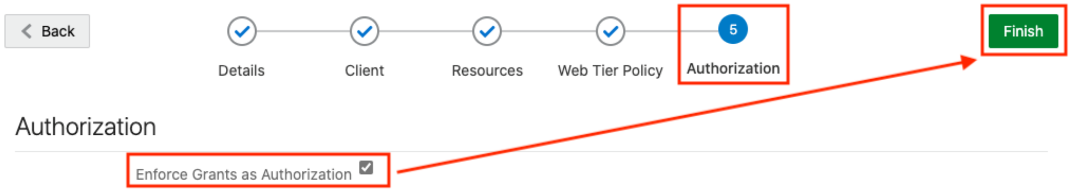
Grant the client access to Identity Cloud Service Admin APIs

App Roles	Protected	
Authenticator Client	No	×
Me	No	×

c. Click **Next** on the top right of the page to continue.

7. Skip **Resources** and **Web Tier Policy** by clicking the **Next** button and navigate to the **Authorization** page.
8. Enable the **Enforce Grants as Authorization** option.
9. Click **Finish**.

Figure 2-18 Configuring Authorization

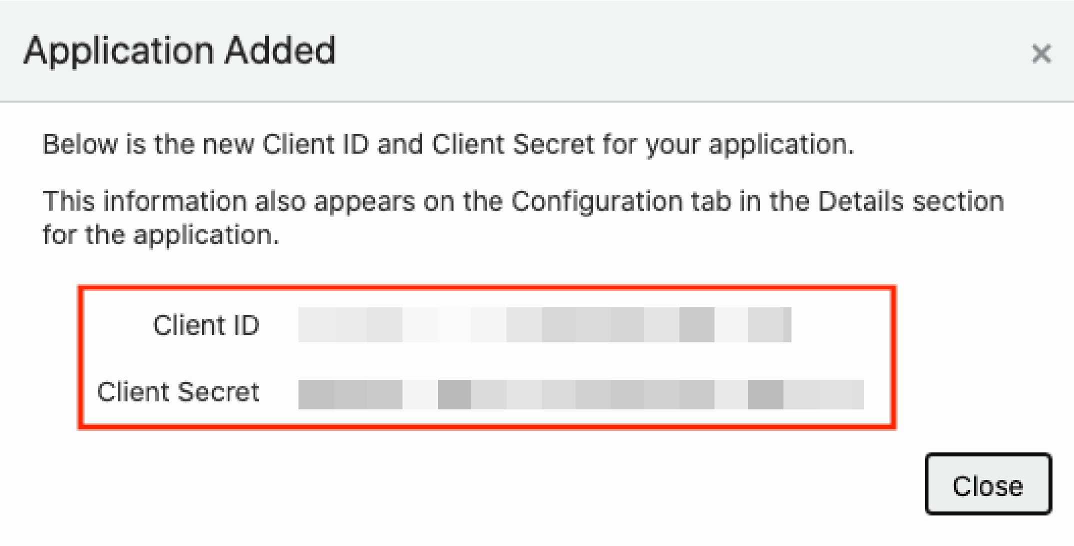


Authorization

Enforce Grants as Authorization ☑

The application is added and the **Application Added** dialog box opens.

Figure 2-19 Confirmation Dialog



Application Added

Below is the new Client ID and Client Secret for your application.

This information also appears on the Configuration tab in the Details section for the application.

Client ID [redacted]

Client Secret [redacted]

10. Note the **Client ID** and **Client Secret** to be used later to complete the configuration.

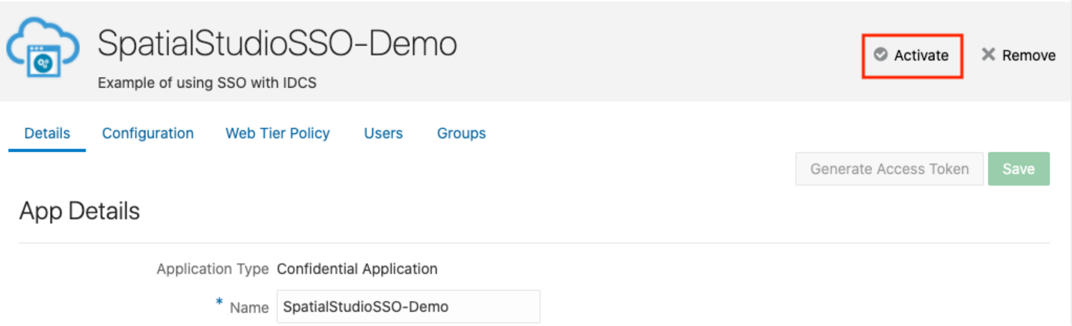
> **Tip:**
>
> You can also obtain the client credentials for the application from the **Configuration** tab in the **General Information** section, once the application is activated.

11. Click **Close**.

    The new application's **Details** page is displayed.

12. Click **Activate** to grant users access to the application and confirm the operation on the prompt that follows.

Figure 2-20 Confirmation for Activating Application



SpatialStudioSSO-Demo

Example of using SSO with IDCS

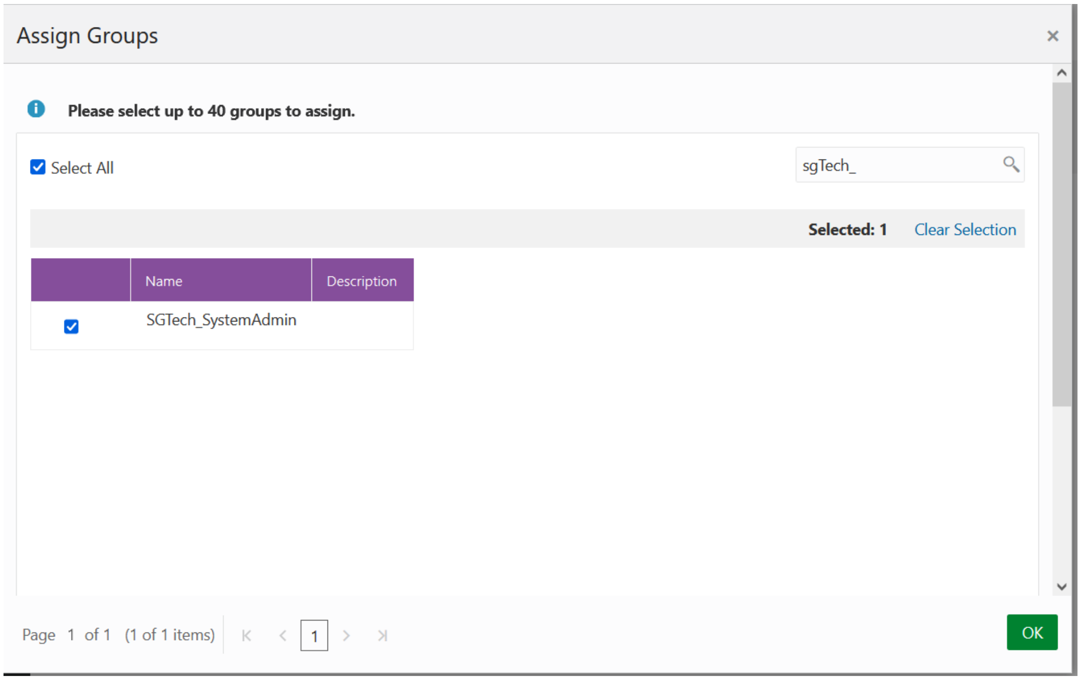
App Details

Application Type Confidential Application

* Name SpatialStudioSSO-Demo

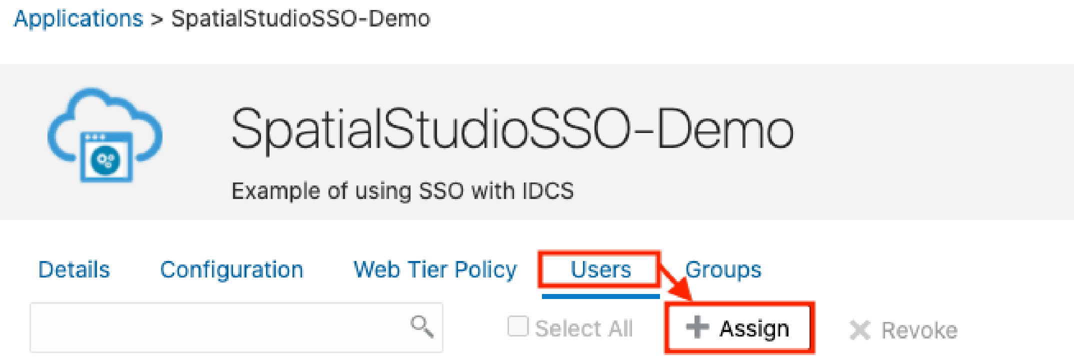
13. Click the **Groups** tab and then click **Assign** to add the group created in Adding Spatial Studio Role as a Group in IDCS as shown:

Figure 2-21 Assigning Groups to an Application



14. Optionally, add non-admin users through the **Users** tab or using other groups.

Figure 2-22 Assigning Non-Admin Users



2.8.4 Copying IDCS Settings into Spatial Studio's Configuration File

To integrate Spatial Studio with IDCS, you must add the IDCS settings into the **`sgtech_config.json`** configuration file.

The configuration file is located at `~/.sgtech/sgtech_config.json` path. You can directly append the IDCS settings into the **`sgtech_config.json`** file. However, the best practice is to have the IDCS settings in a separate configuration file and then import this file into the main configuration file.

Perform the following steps to create a configuration file for the IDCS settings and to import this configuration in **`sgtech_config.json`**:

1. Create a new empty `JSON` configuration file in the `~/.sgtech` directory.

   For example:

`~/.sgtech/sgtech_config.idcs.json`

2. Edit the created file with a file editor of your choice and add the IDCS settings information as shown:

```
{
  "idcs" : {
    "Host" : "identity.oraclecloud.com",
    "ClientTenant" : "<tenant_id>",
    "ClientId" : "<client_id>",
    "ClientSecret" : "<client_secret>",
    "redirectURL" : "https://localhost:4040/spatialstudio/idcscallback",
    "postLogoutRedirectURL" : "https://localhost:4040/spatialstudio/"
  }
}
```

   In the preceding file:

   - **`Host`:** IDCS host.
   - **`Client Tenant`:** IDCS tenant.
   - **`ClientId`** **:** Generated when creating the IDCS application.
   - **`ClientSecret`** **:** Generated when creating the IDCS application.
   - **`redirectURL`** **:** Same as the `Redirect URL` used when creating the IDCS application.
   - **`postLogoutRedirectURL`** **:** Same as the `Post Logout Redirect URL` used when creating the IDCS application.

3. Save the **`sgtech_config.idcs.json`** file.

4. Edit the main **`sgtech_config.json`** file and add the import configuration as shown:

```
{
  "version" : "24.2.0",
  "work_dir" : "",
  ...
  "jobs" : {
    "init_threads_count" : 15
  },
  "imports" : {
    "idcsclient" : {
      "module" : "sgtech_config.idcs.json"
    }
  }
```

   It is important to note that there can be only one `imports` object in the main `sgtech_config.json` file. Therefore, if an `imports` configuration is already existing in the main `sgtech_config.json` file, then you can add the `idcsclient` entry to the imports block as shown:

```
{
  "version" : "24.2.0",
  "work_dir" : "",
  ...
  "jobs" : {
    "init_threads_count" : 15
  },
  "imports" : {
    "idcsclient" : {
      "module" : "sgtech_config.idcs.json"
    },
    "rolesmapping" : {
      "module" : "sgtech_config.security.json"
    }
  }
```

5. Save the **`sgtech_config.json`** file.

2.8.5 Testing IDCS Login

After all the setup steps are completed, you can test and verify the IDCS login.

1. Ensure you have logged out from IDCS.
2. Ensure all Spatial Studio instances are stopped.

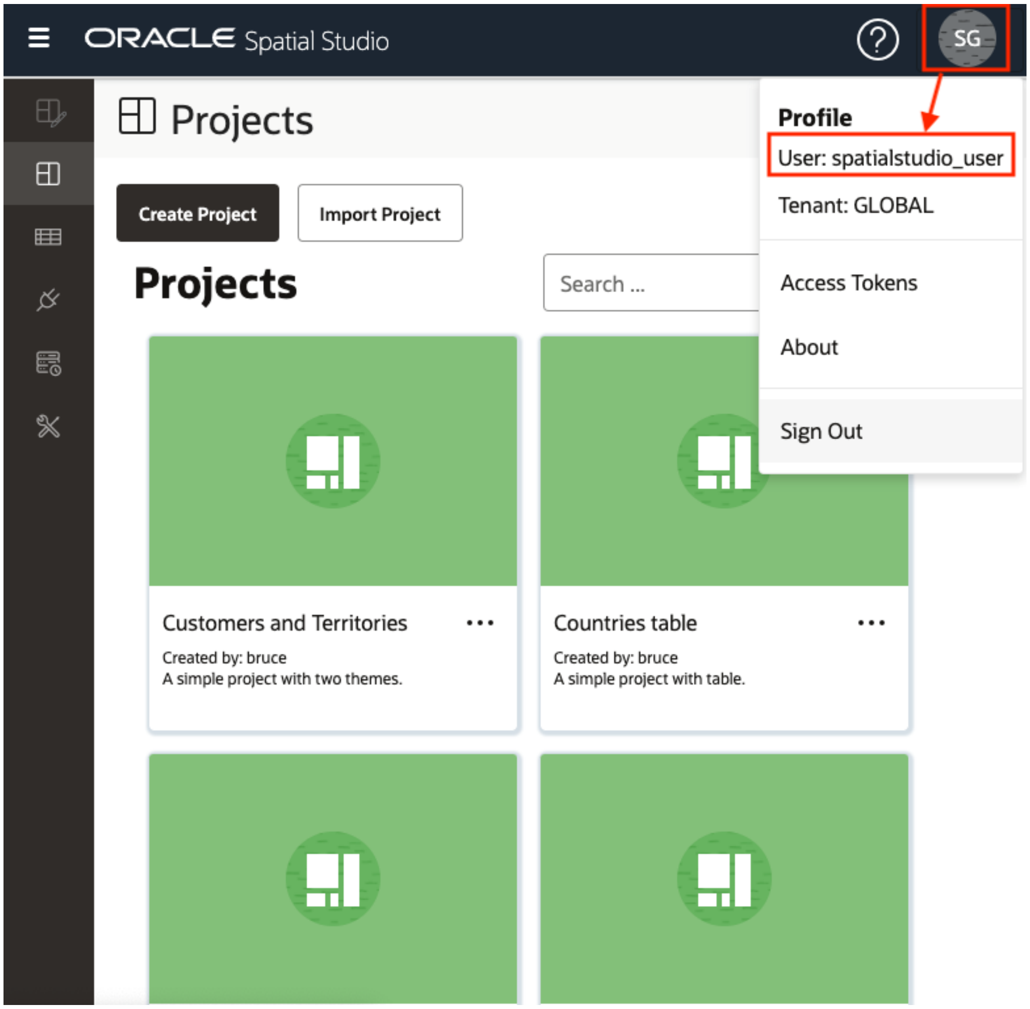
   You can stop a Spatial Studio instance by executing `stop.sh` for Linux and `stop.cmd` for Windows.
3. Run Spatial Studio by executing `start.sh` (Linux) or `start.cmd` (Windows).
4. Open the main URL in your browser, once Spatial Studio is running. For example:

   `https://localhost:4040/spatialstudio/`

   The IDCS login screen as shown in Figure 2-8 opens instead of Spatial Studio's standard login screen.
5. Enter your credentials and click **Sign In**.

   You will be automatically redirected to the Spatial Studio instance. You can verify the logged in user by clicking on the **Avatar** icon as shown:

Figure 2-23 Profile Menu



6. Click **Sign out** in the **Profile** menu to logout from Spatial Studio.

   Note, this will also log you out from any other application that is running on IDCS.

2.9 Mapping External User Principals to Built-In Spatial Studio Roles

Spatial Studio supports mapping IDCS and other identity provider principals to the Spatial Studio built-in roles. This enables dynamically granting permissions to users by using custom groups, for instance.

In order to map the principals to Spatial Studio roles, you must add the **security** settings into the **sgtech_config.json** configuration file.

The configuration file is located at `~/.sgtech/sgtech_config.json` path. You can directly append the security settings into the **`sgtech_config.json`** file. However, the best practice is to have the security settings in a separate configuration file and then import this file into the main configuration file.

Perform the following steps to create a configuration file containing the security settings and then import this configuration in **`sgtech_config.json`**:

1. Create a new empty `JSON` configuration file in the `~/.sgtech` directory.

   For example:
   `~/.sgtech/sgtech_config.security.json`

2. Edit the created file with a file editor of your choice and add the security settings information as shown:

   ```
   {
     "security" : {
       "role-assignments" : [
           {
             "role" : "<role_name>",
             "principals" : [
               "<principal_name>"
              ]
           }
       ]
     }
   }
   ```

   In the preceding file:

   - **`role`:** This refers to one of Spatial Studio built-in roles, specifically **SGTech_SystemAdmin** or **SGTech_TenantAdmin**. Note that the role name is case-sensitive.
   - **`principals`:** List of all principals' names that must be mapped to the specified role. For example, `["Power_User_Members", "IT_Support_Team"]`, which might be IDCS or WebLogic Server groups, or properties designated in `conf/jetty-realm.properties` file in QuickStart.
   - **`role-assignments`:** List of the roles mapping. You can specify as many entries as required.

3. Save the **`sgtech_config.security.json`** file.

4. Edit the main **`sgtech_config.json`** file and add the import configuration as shown:

   ```
   {
     "version" : "23.1.0",
     "work_dir" : "",
     ...
     "jobs" : {
       "init_threads_count" : 15
     },
     "imports" : {
       "rolesmapping" : {
         "module" : "sgtech_config.security.json"
       }
     }
   ```

   It is important to note that there can be only one `imports` object in the main `sgtech_config.json` file. Therefore, if an `imports` configuration is already existing in the main `sgtech_config.json` file, then you can add the `rolesmapping` entry to the imports block as shown:

```
{
  "version" : "24.2.0",
  "work_dir" : "",
  ...
  "jobs" : {
    "init_threads_count" : 15
  },
  "imports" : {
    "idcsclient" : {
      "module" : "sgtech_config.idcs.json"
    },
    "rolesmapping" : {
      "module" : "sgtech_config.security.json"
    }
  }
```

5. Save the **`sgtech_config.json`** file.

   This grants all users from the groups configured for the **principals**, the respective role that was specified in the **role** configuration, when logging into Spatial Studio.

2.10 Moving the Spatial Studio Metadata Schema

You can move your Spatial Studio metadata schema from one database to another.

Perform the steps in the following sections to move your Spatial Studio metadata schema to a different database:

- Moving or Copying the Metadata Tables
- Connecting Spatial Studio to the Relocated Metadata Schema

2.10.1 Moving or Copying the Metadata Tables

You must first move or copy the following metadata tables from your current database to the new database:

```
SGTECH_SYS_TYPE
SGTECH_SYS_JSON_SCHEMA
SGTECH_OBJECT
SGTECH_OBJECT_RESOURCE
SGTECH_TASK_QUEUE
SGTECH_TASK_BROKER
SGTECH_REPOCHANGELOG
SGTECH_REPOCHANGELOG_LOCK
```

You can use one of the following methods to move or copy the preceding Spatial Studio metadata tables:

- Use Oracle Data Pump to transfer the metadata schema objects to a different database. See Oracle Data Pump in *Oracle Database Utilities* for more information.

- Manually copy the metadata schema objects to the new database. The Database Copy feature in Oracle SQL Developer is useful for this option. See Database Copy in *Oracle SQL Developer User's Guide* for more information.
  When copying manually, the metadata **MUST** be copied in the order as shown in the preceding list.

2.10.2 Connecting Spatial Studio to the Relocated Metadata Schema

After Moving or Copying the Metadata Tables, perform the following steps to reconnect your existing Spatial Studio instance to the newly relocated metadata schema.

1. Rename the Spatial Studio configuration file (`~/.sgtech/sgtech_config.json`) to `sgtech_config.backup`.
2. Start Spatial Studio.

   This will generate a new Spatial Studio configuration file (default location is `~/.sgtech/sgtech_config.json`).
3. Stop Spatial Studio after confirming that the new configuration file is generated.
4. Open `sgtech_config.backup`, copy the value of the tag `master_seed`, and paste to replace this value in the new configuration file.
5. Start Spatial Studio.
6. Login to Spatial Studio and provide the credentials for the metadata schema in the new database.

2.11 Using a CA-Signed SSL Certificate in the Quick Start Installation

The Spatial Studio Quick Start installation typically comes with a self-signed certificate for handling SSL or HTTPS URL connection encryption.

However, this is not desirable as the browser always warns you about an insecure connection. Starting with Spatial Studio Release 23.2.0, you can use your own (CA-signed) X.509 certificate.

Review the following sections and perform the steps that apply to your scenario.

- Preparing a CA-Signed Certificate and Private Key for the Spatial Studio Server
  You can prepare a CA-signed certificate and a private key for the Spatial Studio server.
- Configuring the Spatial Studio Server to Use a Java Keystore
  You can configure your server to use a Java keystore file containing an X.509 certificate.
- Configuring Reverse Proxy for the Quick Start Installation
  If your Spatial Studio Quick Start installation is running on the same host, where you already have an Apache HTTP or NGINX server running, then you can simply use a reverse proxy to ensure a secure connection.

2.11.1 Preparing a CA-Signed Certificate and Private Key for the Spatial Studio Server

You can prepare a CA-signed certificate and a private key for the Spatial Studio server.

1. Obtain an SSL certificate from a publicly recognized certificate authority (CA).

The certificate is generally presented as two files that are linked to the domain of your web site:

- **`yourdomain.crt`** (X.509 certificate)
- **`yourdomain.key`** (private key)

Sometimes the `yourdomain.crt` file is in the PEM format, in which case the file name appears as `yourdomain.pem` or `fullchain.pem`, and the key file may be named like `privatekey.pem`.

However, Java cannot make use of such files directly for SSL support, as these files are generated and supported only by OpenSSL ecosystem tools. Therefore, you must first convert the CA certificate file and the private key file into a Java key store, which can then be used in the Spatial Studio Quick Start.

2. Convert the X.509 certificate and private key into a PKCS12 file using the following `openssl` command:

```
openssl pkcs12 -export -in yourdomain.crt -inkey yourdomain.key \
              -out yourdomain.p12 -name [some-alias] \
              -CAfile yourdomain.crt -caname root
```

   Also, note the following while running the preceding command:

   - Ensure that you provide a password when requested.
   - Optionally, add the `-chain` option to the command to preserve the full certificate chain when working with a real CA-signed certificate.
   - Apply the same `openssl` command for all CA certificate and private key file extensions.

3. Convert the PKCS12 file into a Java keystore file using the following Java `keytool` command.

```
keytool -importkeystore \
        -deststorepass ChangeIt -destkeypass ChangeIt -destkeystore 
yourdomain.keystore \
        -srckeystore yourdomain.p12 -srcstoretype PKCS12 -srcstorepass 
[password_from_step2] \
        -alias [some-alias]
```

   The preceding command generates a Java keystore file, **`yourdomain.keystore`**, which is protected with the password `ChangeIt`.

4. Configure the Spatial Studio server to use the Java keystore file.

   See Configuring the Spatial Studio Server to Use a Java Keystore for more information.

2.11.2 Configuring the Spatial Studio Server to Use a Java Keystore

You can configure your server to use a Java keystore file containing an X.509 certificate.

This section assumes that you already have a Java keystore file (`yourdomain.keystore`) generated from an X.509 certificate and private key as explained in Preparing a CA-Signed Certificate and Private Key for the Spatial Studio Server. It is important to note that the keystore file generated in a different manner may not work with Spatial Studio.

1. Edit the `conf/server.json` configuration file in the `Oracle_Spatial_Studio` directory and modify the following three SSL fields to reflect the location of `yourdomain.keystore` file and its password.

   ```
   "sslKeyStorePath": "<path_to_yourdomain.keystore_file>",
   "sslKeyStorePassword": "ChangeIt",
   "sslKeyManagerPassword": "ChangeIt",
   ```

2. Optionally, obfuscate your keystore protection password (`sslKeyStorePassword` and `sslKeyManagerPassword`) by performing the following steps.
   1. Navigate to the `Oracle_Spatial_Studio` directory and run the following command.

      ```
      java -cp ./servletContainer/jetty-util-9.4.51.v20230217.jar
      org.eclipse.jetty.util.security.Password <
      user> ChangeIt
      ```

      The `ChangeIt` password for the *user* is obfuscated and the output is as shown.

      ```
      ChangeIt
      OBF:1pam1o661saj1v9i1v941sar1o4g1pdc
      MD5:72df16e805e7d9c88437b9ea5f8995d6
      CRYPT:blSK4yQrQaaxo
      ```

   2. Copy the string starting with *OBF* and update the `sslKeyStorePassword` and `sslKeyManagerPassword` fields in the `server.json` file to use the obfuscated password instead of the plain text password.
3. Restart the Spatial Studio server to make the changes take effect.

   You should see a similar log towards the beginning of the console output:

   ```
   2023-07-27 01:31:50.740:INFO:oejus.SslContextFactory:main:
   x509=X509@5e5073ab([followed by some organization name or alias info related
   to your CA cert]
   ```

   You can now securely access the Spatial Studio Quick Start using the URL `https://yourdomain.com:4040/spatialstudio`.

2.11.3 Configuring Reverse Proxy for the Quick Start Installation

If your Spatial Studio Quick Start installation is running on the same host, where you already have an Apache HTTP or NGINX server running, then you can simply use a reverse proxy to ensure a secure connection.

With this approach, you are not required to make any configuration changes to the Spatial Studio server itself.

1. Configure a CA-signed certificate on your Apache HTTP or NGINX server by following the official documentation for the respective server.
2. Reverse proxy the URL `https://youdomain.com/spatialstudio` to `http://localhost:8080/spatialstudio` in Apache HTTP or NGINX server configuration file.

For instance, if your Apache HTTP server is listening on port `80` and `443` and your Spatial Studio Quick Start is running on port `8080` on the same host, then you can simply add the proxy directive to your Apache HTTP server configuration file as shown:

```
<VirtualHost *:443>
    ServerName yourdomain.com
    DirectoryIndex index.html index.php

    SSLCertificateFile /etc/letsencrypt/live/yourdomain.com/fullchain.pem
    SSLCertificateKeyFile /etc/letsencrypt/live/yourdomain.com/privkey.pem
    Include /etc/letsencrypt/options-ssl-apache.conf

    ProxyRequests On
    ProxyPass /spatialstudio http://localhost:8080/spatialstudio
    ProxyPassReverse /spatialstudio http://localhost:8080/spatialstudio

</VirtualHost>

<VirtualHost *:80>
    ServerName yourdomain.com
    DirectoryIndex index.html index.php
    RewriteEngine on
    RewriteCond %{SERVER_NAME} =yourdomain.com
    RewriteRule ^ https://%{SERVER_NAME}%{REQUEST_URI} [END,NE,R=permanent]

    ProxyRequests On
    ProxyPass /spatialstudio http://localhost:8080/spatialstudio
    ProxyPassReverse /spatialstudio http://localhost:8080/spatialstudio
</VirtualHost>
```

3. Restart the Apache HTTP or NGINX server.

   You can now securely access Spatial Studio using a url like `https://yourdomain.com/spatialstudio`.

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.

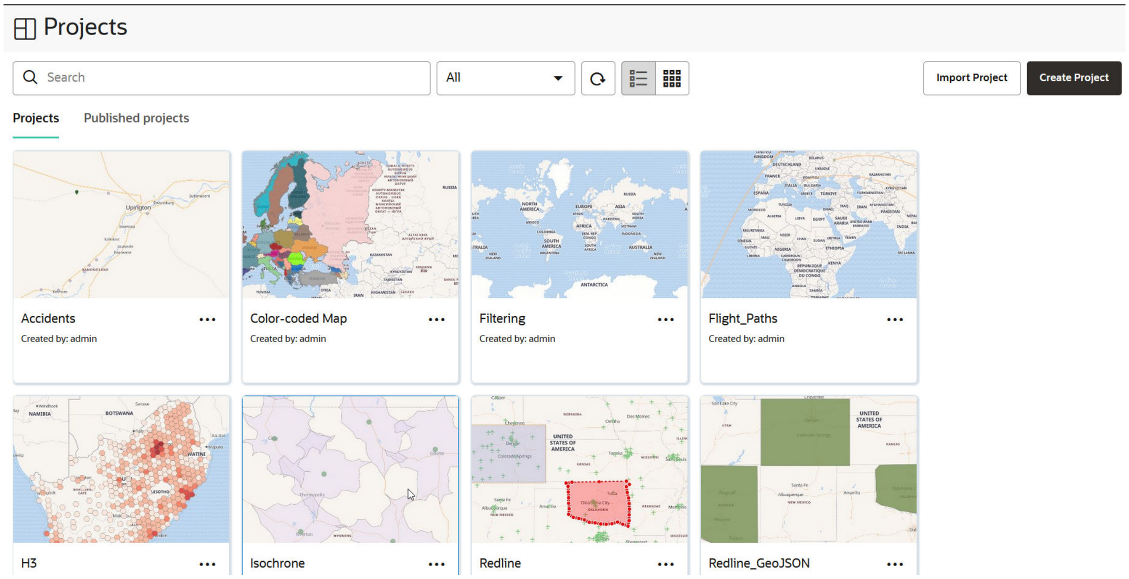
It is important you understand the following terminologies when working on Spatial Studio:

- 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
  - SG: 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.
- **Console:** Directs you to the Console page where you can monitor the status and activity of Spatial Studio. It contains tabs for Settings, Maintenance, and Monitoring.

- Logging into Spatial Studio
  Once you have installed Spatial Studio, either as a standalone tool (Quick Start) or as a Java EE deployment, you can log in to the application.
- Getting Started Using Spatial Studio
  Spatial Studio includes a page with information and links to help you get started using the tool.
- About Tokens in Spatial Studio
  Spatial Studio allows you to create different types of access tokens. In addition, starting from Release 23.2.1, a system generated access-generator token is supported for each Spatial Studio user.
- Spatial Studio Active Project Page
  The Active Project page displays your current working project.
- Spatial Studio Projects Page
  The Projects page lists all the projects that have been created, both unpublished and published.
- Spatial Studio Datasets Page
  The Datasets page lets you view and edit existing datasets, and also create new ones.
- Spatial Studio Connections Page
  The Connections page displays all the existing connections and also allows you to create a new connection.

- Spatial Studio Console Page
  You can monitor the status and activity of Spatial Studio in the Console Page. You can also view server logs, change global system configurations, manage custom basemaps, and configure safe domains.
- Spatial Studio Jobs Page
  The Jobs page displays details of all the background jobs that run in Spatial Studio.

3.1 Logging into Spatial Studio

Once you have installed Spatial Studio, either as a standalone tool (Quick Start) or as a Java EE deployment, you can log in to the application.

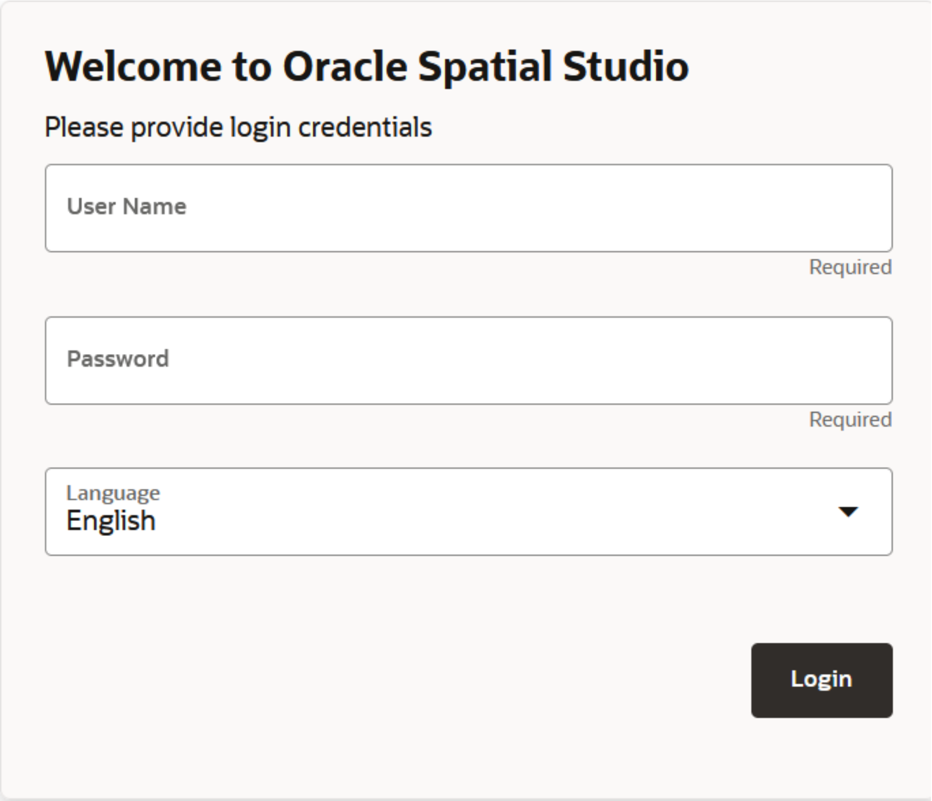
To log into Spatial Studio:

1. Launch Spatial Studio in your browser using the URL provided for your installation.
   - See Installing and Configuring the Spatial Studio Quick Start for the URL to access Spatial Studio as a stand alone tool.
   - See Installing Spatial Studio on Oracle WebLogic Server for the URL details when Spatial Studio is deployed to a WebLogic server.

   For example, if you are using the Quick Start deployment, then open the URL, `https://localhost:4040/spatialstudio`, in your browser.

   Spatial Studio login page appears as shown:

   Figure 3-2 Spatial Studio Login Page



Welcome to Oracle Spatial Studio

Please provide login credentials

Language: English

2. Enter the **User Name**.

3. Enter the **Password**.
4. Select your preferred language to be used in Spatial Studio from the **Language** drop-down list.
5. Click **Login**.

   You are now logged in to Spatial Studio.

- About Internationalization in Spatial Studio
  Oracle Spatial Studio supports internationalization of its user interface.

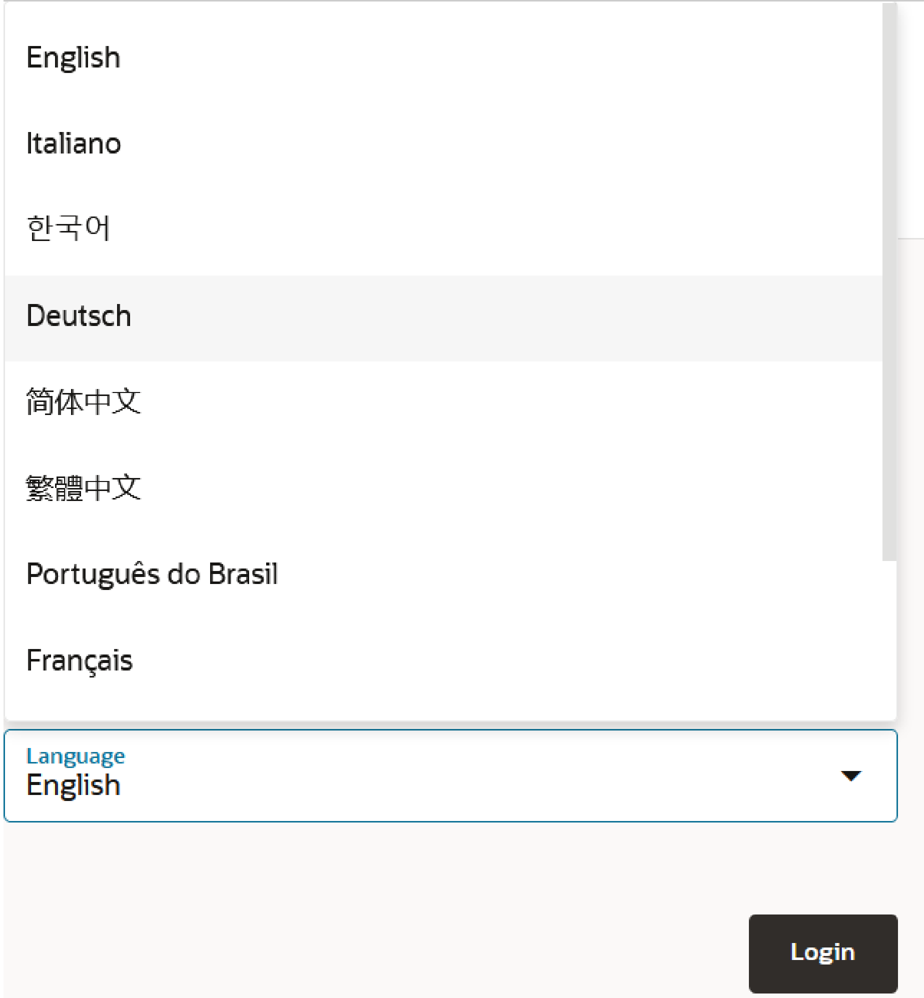
3.1.1 About Internationalization in Spatial Studio

Oracle Spatial Studio supports internationalization of its user interface.

You can choose to adapt the Spatial Studio user interface to use one of the following supported languages when logging in to the application:

- `English (default)`
- `German`
- `Spanish`
- `French`
- `Italian`
- `Japanese`
- `Korean`
- `Portuguese-BR`
- `Simplified Chinese`
- `Traditional Chinese`

Figure 3-3 Internationalization Support in Spatial Studio



Note, however, any server generated messages or errors will continue to be displayed in `English`. If you want to switch to a different language after logging in, then you must first log out and select the required language when logging in again.

In case you have configured Spatial Studio to use IDCS as the login provider, then there is no explicit language selector. This is because the login dialog belongs to IDCS. In this case, Spatial Studio will check the locale and language settings in your IDCS profile, and use that to automatically select the best matched language from the list of supported languages. For instance, if your IDCS profile has `Canadian French` set as the preferred language, then Spatial Studio will use `French` to display its UI as it does not support `Canadian French`.

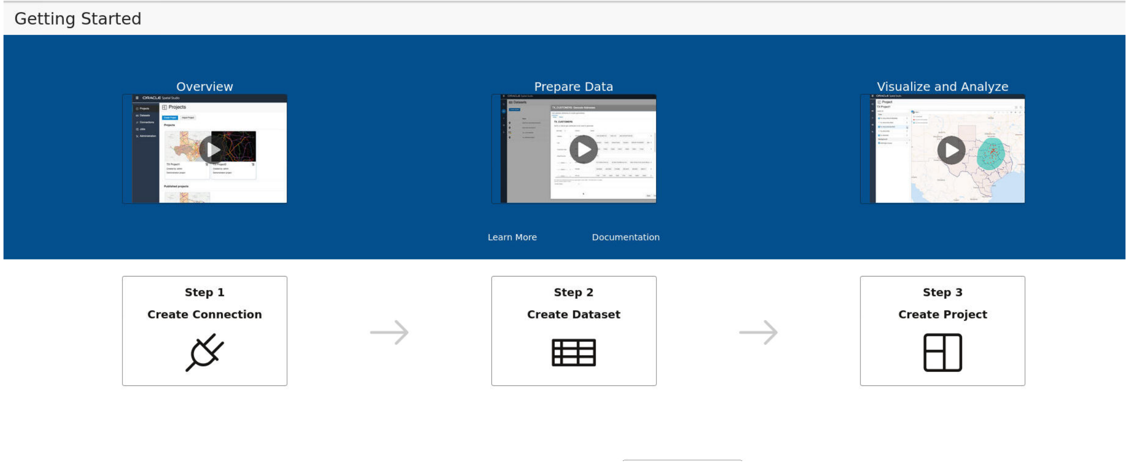
3.2 Getting Started Using Spatial Studio

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) and click **Getting Started** from the context menu.

The Getting Started page opens as shown:

Figure 3-4   Getting Started Page



You can learn more about Spatial Studio by clicking one of the following options:

- **Overview**: Watch this video to understand the user interface and see how to perform the 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.
- **Documentation**: See *Oracle Spatial Studio Guide* documentation to learn more about administering and using Spatial Studio.
- Get started using Spatial Studio through the following workflow:
  1. **Step 1 - Create Connection**: Begin by creating your database connection.
  2. **Step 2 - Create Dataset**: Create a Dataset and load spatial data.
  3. **Step 3 - Create Project**: Create a Project for visualizing and analyzing the spatial data.

3.3 About Tokens in Spatial Studio

Spatial Studio allows you to create different types of access tokens. In addition, starting from Release 23.2.1, a system generated access-generator token is supported for each Spatial Studio user.

The following describes the supported token types:

- **Access Tokens:**
  - **General-purpose token:** Full access to all resources. The token grants read-only or read-write access as required.
    In most cases you should avoid using a general-purpose token as it grants too much access. Instead, generate and use a specific token that applies to your scenario.
  - **Streaming-only token:** Access only to REST endpoints related to dataset streaming. Also, the token grants read-only access that be used only with `HTTP GET` methods.

  - **Streaming and tile refreshing token:** The scope of this token is extended to refresh the existing vector tiles of the streaming dataset on the recent updates.
  - **Embedding Published Projects token:** This token allows embedding of private published projects.

  See Generating an Access Token to create the preceding access tokens.

- **Access-Generator token:** This is a special type of token that is used to (programmatically) create short-lived access tokens (of types shown in the preceding list under Access Tokens).
  This token cannot be created or deleted directly. You can only copy the system generated access-generator token. Note that the system generates this token on a per-user basis. This implies that different Spatial Studio users will have different access-generator tokens.

  Also, you can request Spatial Studio to regenerate the access-generator token for you.

  - See Copying the Access-Generator Token to copy the token.
  - See Generating Access Tokens Programmatically for using the access-generator token.

- Generating an Access Token
- Copying the Access-Generator Token
- Generating a Fileset Token

3.3.1 Generating an Access Token

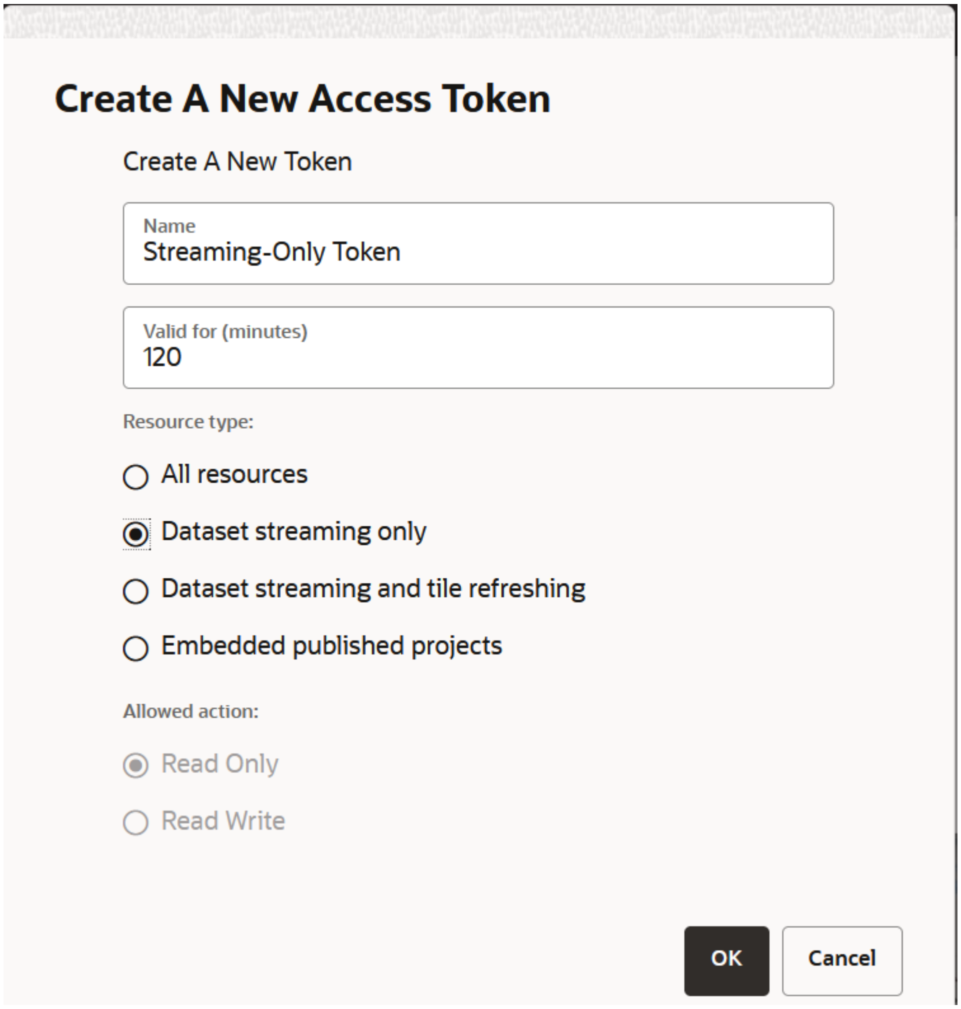
To generate an access token:

1. Navigate to the **Console** page.
2. Click **Access Tokens** under **Security**.

   The **Access Tokens** slider opens and the existing tokens are displayed.
3. Click **Create New Token**.

   Create A New Access Token dialog opens as shown:

Figure 3-5 Creating a New Access Token



Create A New Access Token

Create A New Token

Name: Streaming-Only Token

Valid for (minutes): 120

Resource type:

○ All resources
● Dataset streaming only
○ Dataset streaming and tile refreshing
○ Embedded published projects

Allowed action:

● Read Only
○ Read Write

4. Enter the token **Name**.
5. Enter the time **Valid for (minutes)** after which the token expires.

   If you specify `-1`, then Spatial Studio will never expire the token, unless you explicitly revoke it.
6. Select **Resource type**.
7. Optionally, select the **Allowed action** for granting access to a general-purpose token.
8. Click **OK** to create the token.

   The token gets created successfully.

- Generating Access Tokens Programmatically
  Your web application can also create or obtain a short-lived access token from Spatial Studio programmatically, by using an Access-Generator Token.

3.3.1.1 Generating Access Tokens Programmatically

Your web application can also create or obtain a short-lived access token from Spatial Studio programmatically, by using an Access-Generator Token.

The following provides the Spatial Studio REST API endpoint details to create an access token:

Endpoint: `/spatialstudio/oauth/v1/user/token?name=<NAME>&validTime=<MINUTES>&action=<ACTION>&resourceType=<RESOURCE>`

Required HTTP Request Header: Name of the header must be **Authorization** and its value must start with **Bearer** followed by a space, then followed by a valid access-generator token string.

The following table describes the query parameters used in the preceding endpoint.

Table 3-1 Query Parameters

Query Parameters[1]	Data Type	Description
`name`	Up to 128 chars (non-null)	Specifies the name of the token to be created.
`validTime`	An `integer` *x*, where *-1* >= *x* >= *9999*	Specifies for how many minutes the new token remains valid. **Note**: A value of *-1* indicates that the token will not expire.
`action`	`enum[read_only, read_write]`	Specifies the actions the new token is allowed to perform.
`resourceType`	`enum[dataset_streaming, dataset_streaming_refreshing , embedded_published_project, all`	Specifies the types of resources the new token is allowed to access (act on).

[1] All the query parameters are mandatory.

It is important to note that currently only five different types of tokens can be created with the following combinations of `action` and `resourceType`:

- `action=read_only&resourceType=all`
- `action=read_write&resourceType=all`
- `action=read_only&resourceType=dataset_streaming`
- `action=read_write&resourceType=dataset_streaming_refreshing`
- `action=read_only&resourceType=embedded_published_project`

Any other combination of `action` and `resourceType` (outside the valid combinations shown in preceding list) will be rejected.

The following shows a sample request (using `Curl` command line) to obtain an access token that allows a web application to get the streaming access to a dataset as well as allowing the refreshing of the dataset's vector tiles.

```
curl -X POST 'http://localhost:8080/spatialstudio/oauth/v1/user/token?
name=test123&validTime=60&action=read_write&resourceType=dataset_streaming_refres
hing' --header 'Authorization: Bearer $GENERATORTOKEN'
```

The preceding request returns a JSON document containing the new token. Its value is stored in the `token` field in the response:

```
{"name":"test123","token":"eyJ0eXAiOiJzZ3RlY2...", … }
```

3.3.2 Copying the Access-Generator Token

Perform the following steps to copy the access-generator token:

1. Click SG on the top right corner of the page.
2. Click **Access Tokens** from the drop-down menu.

   The **Access Tokens** dialog opens.
3. Click **Show Access-Generator Token**.

   The **Access-Generator Token** dialog opens which shows the existing access-generator token.
4. Click **Copy Token** to copy the token string.
5. Optionally, click **Regenerate Token** to request the system to regenerate the access-generator token, and then copy the token.

3.3.3 Generating a Fileset Token

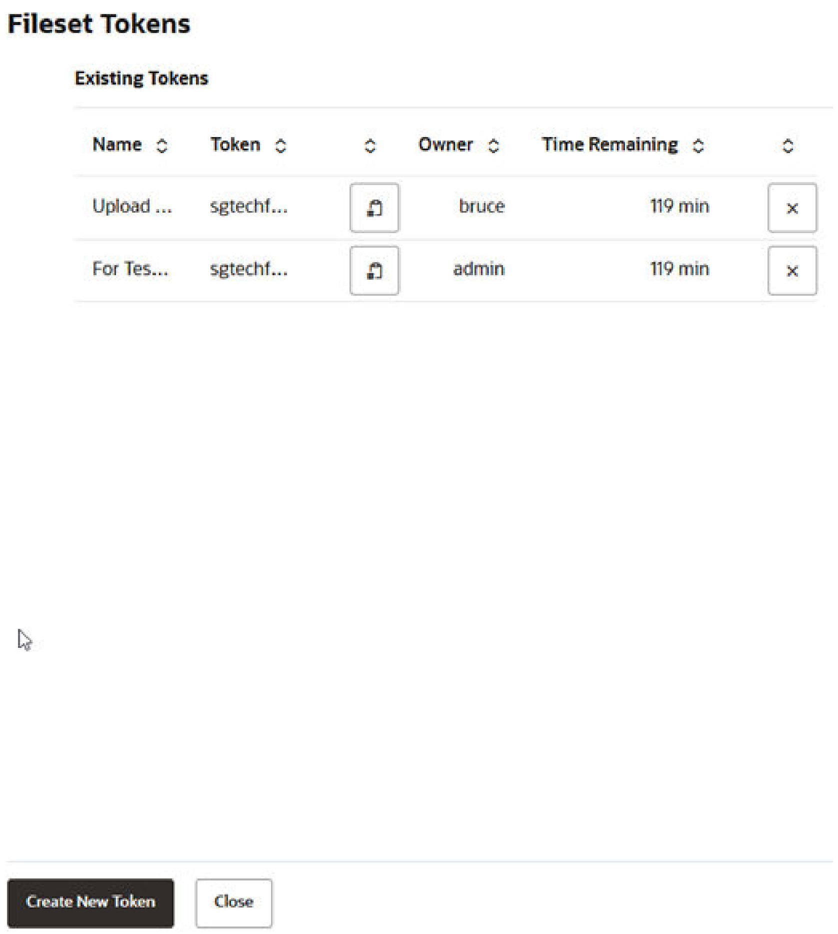
Fileset tokens are required to upload the raster files to the database in Spatial Studio in order to create a GeoRaster dataset (see Using the GeoRaster Dataset Creation Wizard).

As the adminisitrator for Spatial Studio, perform the following steps to generate or copy a fileset token:

1. Navigate to the **Console** page.
2. Click **Fileset Tokens** under **Security**.

   The **Fileset Tokens** slider opens and the existing tokens for the various users are displayed as shown.

Figure 3-6   Fileset Tokens



Fileset Tokens

Existing Tokens

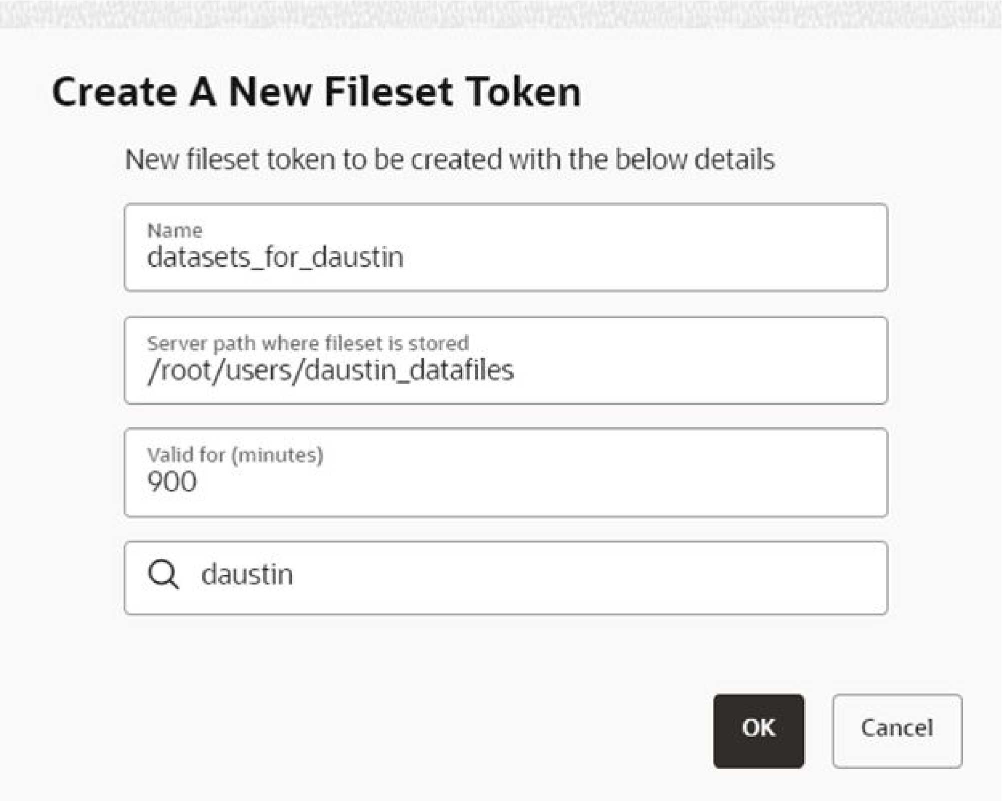
Name	Token		Owner	Time Remaining	
Upload ...	sgtechf...		bruce	119 min	×
For Tes...	sgtechf...		admin	119 min	×

The token value for any specific user can be copied on this page.

3. Click **Create New Token** if you wish to generate a new token.

   Create A New Fileset Token dialog opens as shown:

Figure 3-7 Creating a New Fileset Token



Create A New Fileset Token

New fileset token to be created with the below details

Name: datasets_for_daustin

Server path where fileset is stored: /root/users/daustin_datafiles

Valid for (minutes): 900

daustin

4. Enter the token **Name**.
5. Enter the **Server path where fileset is stored**.

   It is recommended that you assign an exclusive folder for each Spatial Studio user for storing raster files in the server's file system.
6. Enter the time **Valid for (minutes)** after which the token expires.

   The valid range is 1 to 9999 minutes.
7. Select the **user** to whom the token needs to be shared.
8. Click **OK** to create the token.

   The token gets created in the given folder path for the specified user and the token details are listed under **Existing Tokens** on the **Fileset Tokens** page. The required token can be copied and forwarded to the required user.

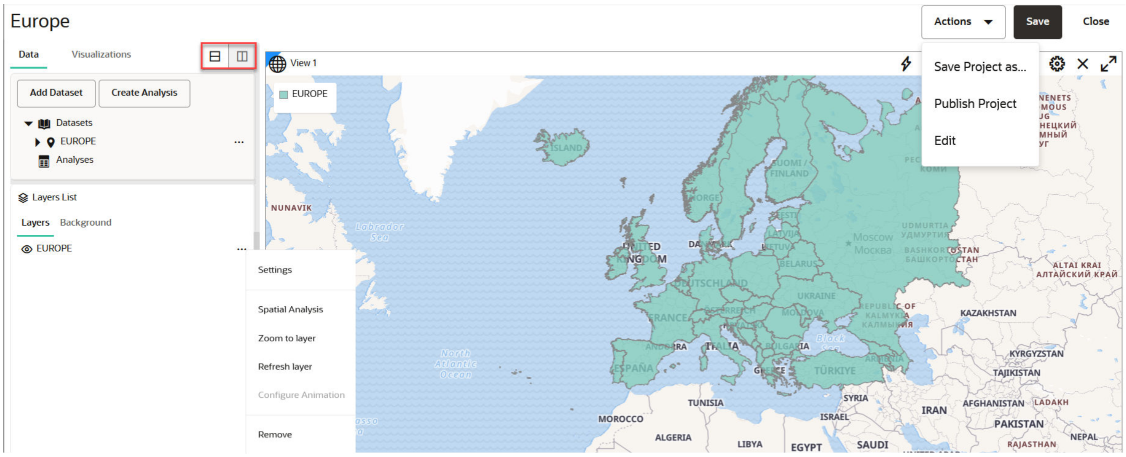
3.4 Spatial Studio Active Project Page

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 3-8 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.
- Organizing the **Layers List** panel to be arranged vertically below or to the right of the project **Data** and **Visualizations** panel using the icons shown highlighted in the preceding figure.
- Adjusting the style setting or the zoom resolution for your visualization layer. You can click the menu selector next to the map layer in the **Layers** tab to display the following available options:
  - **Settings**: Shows display options for Style, Filter, Interaction, and Legend.
  - **Spatial Analysis**: Allows you to 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.
  - **Configure Animation**: Allows you to configure animation settings to visualize a moving object.
  - **Remove**: Removes the layer from the project.
- Using the project management options displayed on the top-right area of the Active Project page:
  - **Actions**: The drop-down menu allows you to:
    - **Save Project as**: Creates a new copy of the project.
    - **Publish Project**: Publishes the project.
    - **Edit**: Allows you to edit the project details (such as, Name, Created By and Description).
  - **Save**: Saves your updates to the project.
  - **Close**: Closes the project.

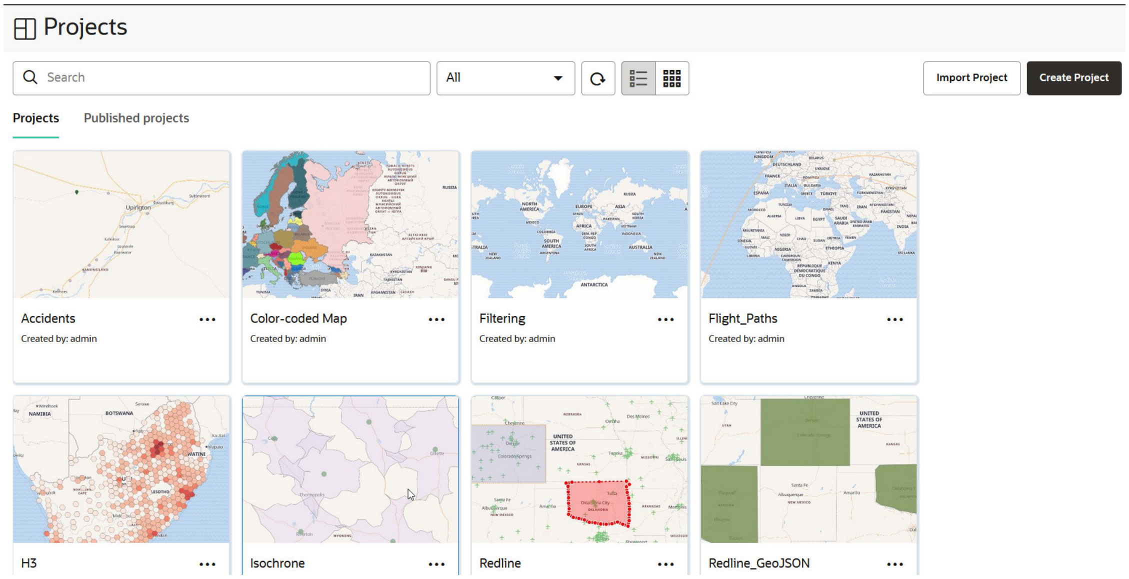
- Using the map tool bar options on the top right of the map visualization pane:
  - : The **Actions** drop-down menu allows you to:
    - **Create Custom Region**: Creates custom region for the selected polygons.
    - **Save Selections**: Saves selected features on the map layer to a dataset.
    - **Save Pins**: Saves the pins dropped on a map layer to a dataset.
  - : **Search** based on address, latitude or longitude.
  - : The **Measure Menu** allows you to measure liner or radial distances.
  - : The **Select By Shape** drop-down menu allows you to make a rectangular, circular, or a polygonal selection.
  - : The **Clear Menu** allows you to clear selections, pins, tool drawings, or all.
  - : **Refresh Layers** allows you to refresh the map layers.
  - : **Settings** allows you to configure your visualization settings.
  - : **Delete** icon allows you to remove the map visualization from the project.

3.5 Spatial Studio Projects Page

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

The layout of the project page is as shown:

Figure 3-9 Spatial Studio Main Page



The Projects page comprises two tabs:

- **Projects**: Displays the list of projects created in Spatial Studio.
- **Published projects**: Displays the list of published projects.

You can perform the following actions on the Projects page:

- You can select and view a project or published project in the respective tabs.
- 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 alter the display settings to have the projects listed as cards or in a tabular format in the respective tabs.
- You can search for both unpublished and published projects and view the search results in the respective tabs.
- You can filter to view projects that are either created by you, or shared with you, or both in the respective tabs.
- You can open, export or delete a project in the **Projects** tab by clicking the ••• icon for any of the listed projects.
- See About Published Projects for the actions supported on published projects.

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

- About Published Projects
  You can share your Spatial Studio project with other users by publishing it.

3.5.1 About Published Projects

You can share your Spatial Studio project with other users by publishing it.

Once your project is completed on the **Active Project** page, then you can save and publish the project. The published project gets displayed on the Projects page in the **Published projects** tab.

You can perform the following actions on a published project:

- **Open:** Opens the project.
- **URL:** Provides the URL for the published project. You can use the URL to embed the project in an external web application through iFrames.
  However, note that this is typically only used for published projects that contain only public datasets. A public published project can be accessed through its URL by any user on the internet without logging into the Spatial Studio application.
- **Sync with source project:** Keeps the project synchronized with the source.
- **Permissions:** Allows you to make a published project public (or private if it is already public).
  Note that this option will be enabled only if all the datasets that are in the published project themselves are already public. In such cases, you may choose to use the **Permissions** option to make the published project itself also be public.
- **Edit:** Allows you to edit the project name and description.

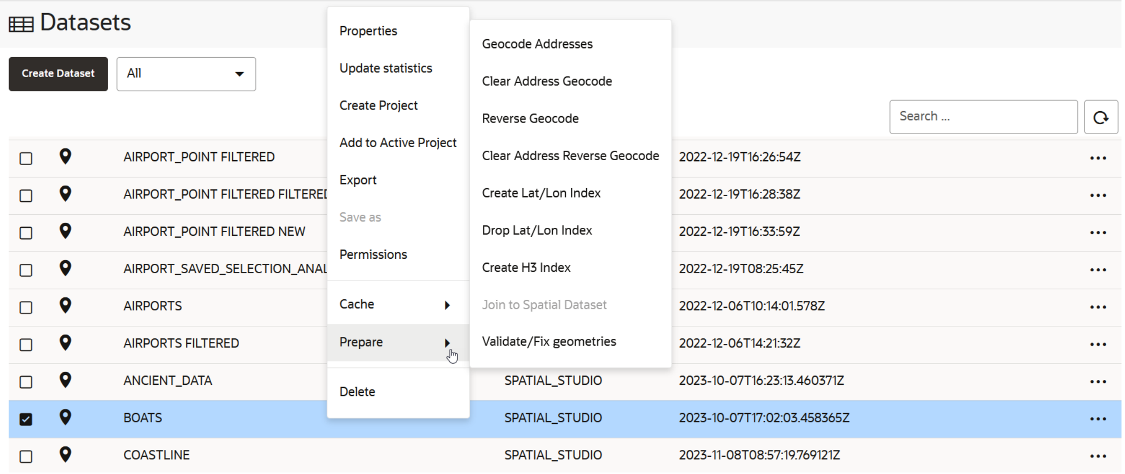
- **Delete:** Deletes the published project.

3.6 Spatial Studio Datasets Page

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

The following figure shows the Datasets page:

Figure 3-10 Datasets Page



☐	AIRPORT_POINT FILTERED		2022-12-19T16:26:54Z	⋯
☐	AIRPORT_POINT FILTERED FILTEREI		2022-12-19T16:28:38Z	⋯
☐	AIRPORT_POINT FILTERED NEW		2022-12-19T16:33:59Z	⋯
☐	AIRPORT_SAVED_SELECTION_ANAL		2022-12-19T08:25:45Z	⋯
☐	AIRPORTS		2022-12-06T10:14:01.578Z	⋯
☐	AIRPORTS FILTERED		2022-12-06T14:21:32Z	⋯
☐	ANCIENT_DATA	SPATIAL_STUDIO	2023-10-07T16:23:13.460371Z	⋯
☑	BOATS	SPATIAL_STUDIO	2023-10-07T17:02:03.458365Z	⋯
☐	COASTLINE	SPATIAL_STUDIO	2023-11-08T08:57:19.769121Z	⋯

Datasets that are displayed on the **Datasets** page belong to one of the following two categories:

- Manually created by clicking **Create Dataset** or when you perform a **Save as** operation with the **Create Dataset** option enabled. This dataset can then be added to the project for visualization.
- Automatically created when you perform spatial analysis, save selected features, or store pins as a map layer.
  This dataset gets instantly added to the map visualization and also appears listed in the **Datasets** page. Such a dataset is known as a spatial analysis dataset.

You can perform the following actions on the Datasets page:

- You can manually create a new dataset, by clicking **Create Dataset**.
- You can filter to view datasets that are either created by you, or shared with you, or both.
- 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 (refer to Updating Statistics for Datasets)
  - **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 (refer to About Cache in Spatial Studio)
  - **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
    - **Clear Address Reverse Geocode:** Remove address information from 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
    - **Validate/Fix geometries:** Validate the geometries in the dataset and also fixes the geometries where it is possible for Spatial Studio to do so in an automatic manner.
  - **Delete:** Delete the dataset

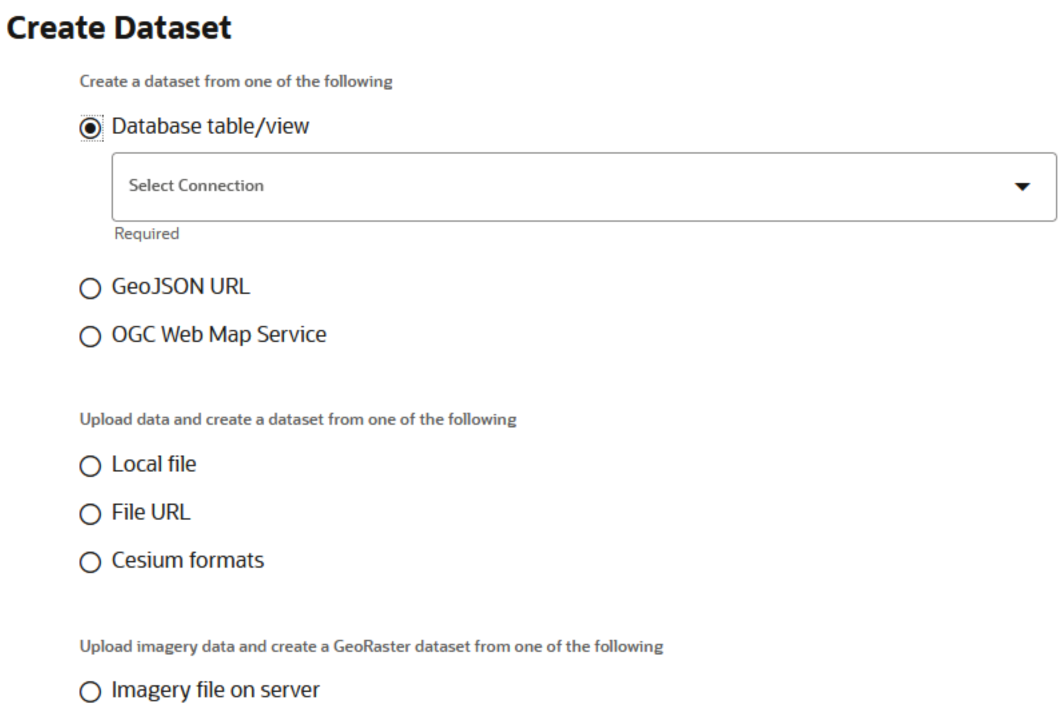
- About Creating a Dataset From the Datasets Page
  Spatial Studio allows you to create different types of datasets from the Datasets page.
- About Spatial Analysis Datasets
  Spatial Studio stores the results of a spatial analysis operation in a spatial analysis dataset. Also, storing selected geographic features or pins on a map layer gets saved as a new spatial analysis dataset.
- Datasets with Issues
  All datasets in Spatial Studio must meet certain data requirements in order to be used for map visualization and analysis.
- Geocoding a Dataset
  Geocoding is the process of deriving the latitude and longitude coordinates from location details that are geo address types.
- Reverse Geocoding a Dataset
  Reverse geocoding is the process of deriving the address information from a set of latitude and longitude coordinates.
- Enabling Spatiotemporal for a Dataset
  In order to visualize and animate spatiotemporal data, you must enable **Spatiotemporal** for the dataset on the Datasets page.
- 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.
- Exporting a Dataset to GeoJSON
  You can export a dataset from Spatial Studio to GeoJSON.
- Updating Statistics for Datasets
  The **Update statistics** feature in Spatial Studio gathers statistics of the dataset columns.
- About Cache in Spatial Studio
  Starting with Spatial Studio release 22.3, all vector tiles generated for all datasets are cached to the file system by default.

3.6.1 About Creating a Dataset From the Datasets Page

Spatial Studio allows you to create different types of datasets from the Datasets page.

The following figure describes the supported options to create a dataset:

Figure 3-11 Creating a Dataset



Create Dataset

Create a dataset from one of the following

● Database table/view

Select Connection

Required

○ GeoJSON URL

○ OGC Web Map Service

Upload data and create a dataset from one of the following

○ Local file

○ File URL

○ Cesium formats

Upload imagery data and create a GeoRaster dataset from one of the following

○ Imagery file on server

As seen in the preceding figure, you can create a dataset from the following sources:

- Oracle Database table or view using a database connection
- By specifying a GeoJSON URL
- By configuring an OGC Web Map Service
- By uploading dataset files with different formats as supported by Spatial Studio
- By importing geospatial data directly from an external file URL
- By importing 3D Tiles Tileset
- By uploading imagery file on the Spatial Studio server

The following sections explain in detail the steps to create a dataset using the supported options:

- Creating a Dataset from Database Tables or Views
  Using a database connection, you can create a dataset from tables and views in Oracle Database.

- Loading Raster Images into Oracle Spatial GeoRaster
  You can upload raster data files, such as remote sensing images and digital elevation models, into Oracle Spatial GeoRaster database using Spatial Studio. Optionally, you can create a GeoRaster dataset using this uploaded data.
- Creating a GeoRaster Dataset
  Spatial Studio allows you to create Georaster datasets.
- Creating a GeoJSON URL Dataset
  You can create a dataset by specifying a GeoJSON URL.
- Creating an OGC WMS Dataset
  Starting with Spatial Studio release 22.3, you can define datasets that are based on the `GetMap` responses from any external OGC (Open Geospatial Consortium) WMS (Web Map Service) services.
- Creating a Dataset by Uploading a File
  You can create a dataset by uploading a file in a format supported by Spatial Studio.
- Creating a Dataset Using a File URL
  You can create a dataset by specifying the URL of an external server which hosts the geospatial file.
- Creating a Dataset from Cesium Datasets
  Spatial Studio supports Cesium map visualization by allowing you to create a dataset from a 3D dataset or a CZML file.
- Creating a Wind Animation Dataset
  You can create a wind animation dataset which can be used for visualizing wind speeds and dynamic flow on a map.
- Enabling Wind Animation For an Existing GeoRaster Dataset
  You can enable wind animation for an existing GeoRaster dataset only if the raster image is encoded with the red (R) and green (G) channels representing the x and y velocities, respectively.

3.6.1.1 Creating a Dataset from Database Tables or Views

Using a database connection, you can create a dataset from tables and views in Oracle Database.

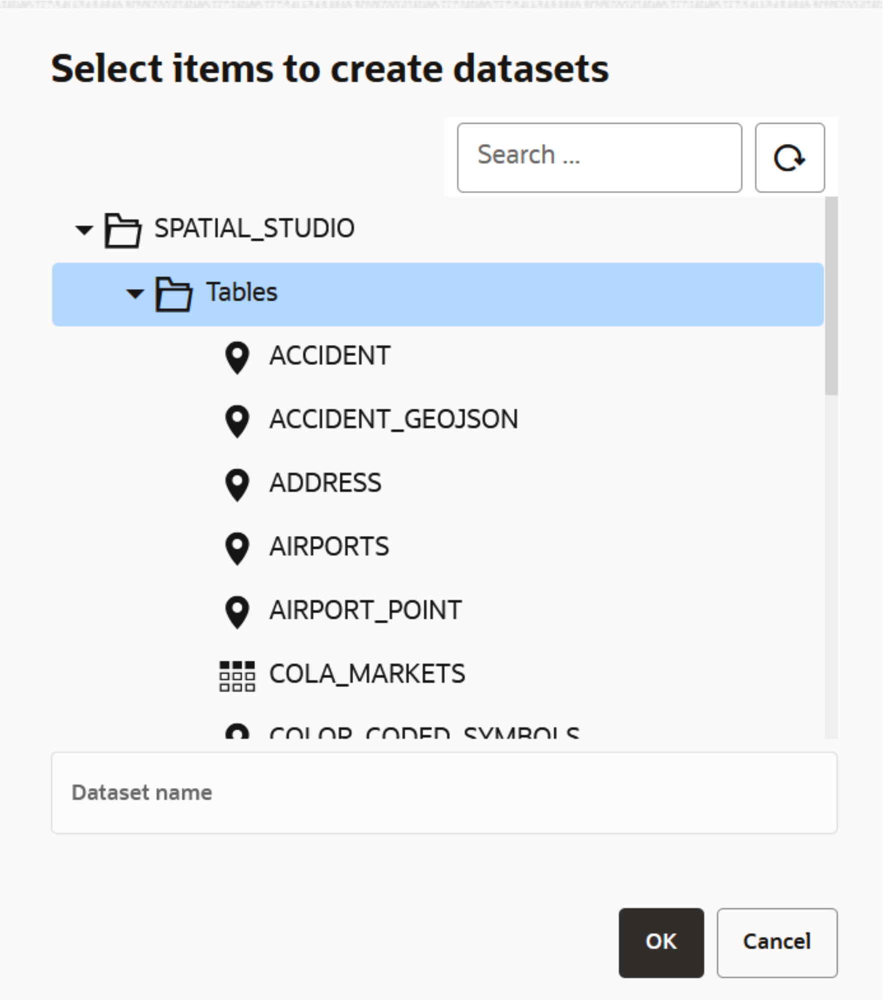
Perform the following steps to create a dataset using a database connection:

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

   The **Create Dataset** window opens.
3. Select the **Database table/view** option.
4. Select a connection from the **Select Connection** drop-down.
5. Click **Create**.

   The **Select items to create datasets** window opens listing all the tables, views and GeoRaster data present in the database.

Figure 3-12 Select the Data Source



6. Select a database item from the list and click **OK**.

> **Tip:**
>
> You can also use the **Search** box to quickly locate your table. This is especially useful or even necessary if your database connection has many tables, as the drop-down list only shows up to 500 tables or views.

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

3.6.1.2 Loading Raster Images into Oracle Spatial GeoRaster

You can upload raster data files, such as remote sensing images and digital elevation models, into Oracle Spatial GeoRaster database using Spatial Studio. Optionally, you can create a GeoRaster dataset using this uploaded data.

See Spatial GeoRaster Developer's Guide for more information on Oracle GeoRaster feature.

> **Note:**
>
> Loading raster images into Oracle Spatial GeoRaster is not supported for Spatial Studio deployed on macOS.

Spatial Studio provides a wizard based on an *Extract, Transform, and Load* (ETL) process for creating Oracle GeoRaster objects from geospatial imageries.

- Prerequisites for Uploading Raster Files Using Spatial Studio
  Learn the prerequisite tasks required for uploading raster data to Oracle Database.
- Using the GeoRaster Dataset Creation Wizard
  You can upload raster images into Oracle Spatial GeoRaster database using the **GeoRaster dataset creation** wizard.

3.6.1.2.1 Prerequisites for Uploading Raster Files Using Spatial Studio

Learn the prerequisite tasks required for uploading raster data to Oracle Database.

1. Verify that Oracle Instant Client and GDAL SDK are configured correctly in Spatial Studio deployed to Linux or Windows OS.

   Note that the GDAL SDK depends on the Oracle Instant Client when making connections to Oracle database.
   See Viewing GDAL Installation Info to review and verify GDAL SDK and Oracle Instant Client installations

   .

   > **Note:**
   >
   > The Oracle-tested GDAL library is installed automatically on Spatial Studio deployed to Linux or Windows OS in the file path `<USER_HOME>/.sgtech/tools/gdal`, where `<USER_HOME>` is the home directory of the operating system user.

   If you need to install Oracle Instant Client then:

   a. Go to the Oracle Instant Client Downloads page.
   b. Download the 64-bit Instant Client zip file (*Basic Package (ZIP)* or *Basic Light Package (ZIP)*).
   c. Unzip the downloaded file in `<USER_HOME>/.sgtech/tools` where `<USER_HOME>` is the home directory of the operating system user.

      The packages are downloaded in `instantclient_<version>` folder where `version` is the version of the Instant Client.
   d. Rename the folder name from `instantclient_<version>` to `instantclient`.
2. Verify the following connection requirements in Spatial Studio.

   a. Create a connection to Oracle Database or Oracle Autonomous Database (see Spatial Studio Connections Page).

      It is important to note that this must be a non-metadata repository connection. You can upload raster images only to a non-metadata repository schema.

   b. Enable GeoRaster for the database schema (see Enabling GeoRaster at the Schema Level).

3. Obtain the georeference information of the raster data to be uploaded.

   A raster data file's georeference information may fall into one of the following scenarios:

   - The georeference information is self-contained in the raster data file itself, and its spatial reference system (or SRID) is recognized and supported by Oracle database.
   - The raster data file has a companion world-file containing the required parameters, and SRID is known. You can then provide this SRID and the world-file's content.
   - The raster image is georectified, and the SRID and bounding box values are known. You can then provide the SRID, and the data file's upper-right and lower-left corners' coordinates.

4. Copy the raster files to the Spatial Studio server and ensure you have the required file reading privileges.
5. Obtain a fileset token from the Spatial Studio administrator.

   If you are a non-administrator user, then you can request the Spatial Studio administrator to provide the required fileset token. See Generating a Fileset Token for more information.

3.6.1.2.2 Using the GeoRaster Dataset Creation Wizard

You can upload raster images into Oracle Spatial GeoRaster database using the **GeoRaster dataset creation** wizard.

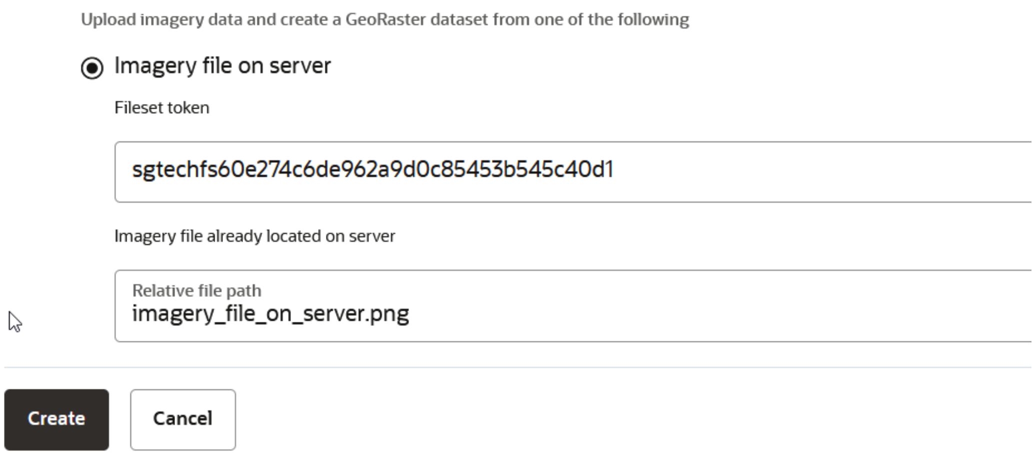
Before uploading a raster file, ensure you meet the prerequisites described in Prerequisites for Uploading Raster Files Using Spatial Studio.

Perform the following steps to access and use the **GeoRaster dataset creation** wizard:

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

   The **Create Dataset** window opens.
3. Select the **Imagery file on server** option.

Figure 3-13 Upload Imagery Data Configuration



Upload imagery data and create a GeoRaster dataset from one of the following

● Imagery file on server

Fileset token

sgtechfs60e274c6de962a9d0c85453b545c40d1

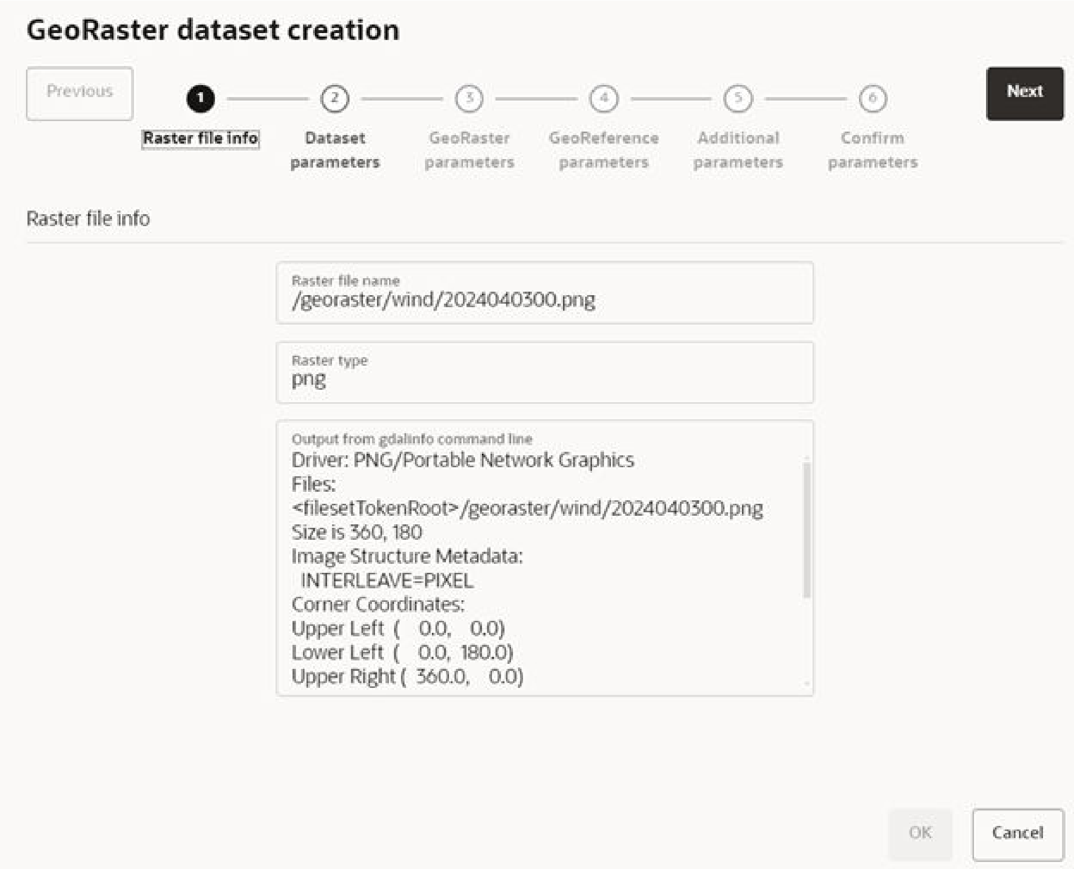
Imagery file already located on server

Relative file path
imagery_file_on_server.png

4. Enter the **Fileset token**.

5. Enter the **Relative file path** for the imagery files on the server.
6. Click **Create**.

   The **GeoRaster dataset creation** workflow opens and the **Raster file info** step is displayed as shown:



Raster file name
/georaster/wind/2024040300.png

Raster type
png

Output from gdalinfo command line

```
Driver: PNG/Portable Network Graphics
Files:
<filesetTokenRoot>/georaster/wind/2024040300.png
Size is 360, 180
Image Structure Metadata:
  INTERLEAVE=PIXEL
Corner Coordinates:
Upper Left (    0.0,    0.0)
Lower Left (    0.0,  180.0)
Upper Right (  360.0,    0.0)
```

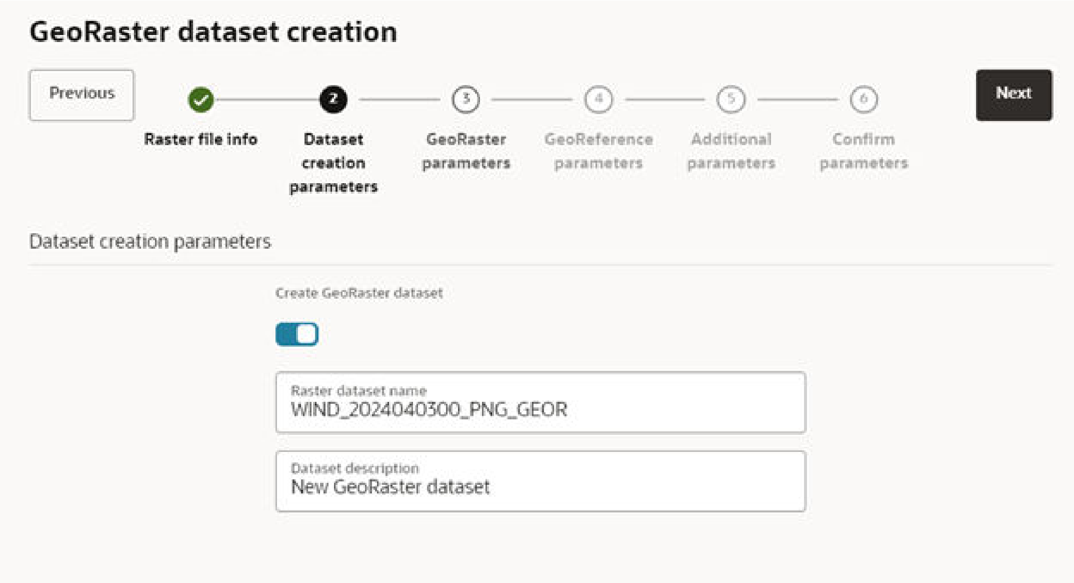
Spatial Studio runs the **gdalinfo** command (from GDAL package) at the backend and the command output is displayed in **Output from gdalinfo command line**. The command retrieves the basic metadata about the raster data file. You can check and view the imagery information at this step. This includes details such as the imagery dimensions, number of bands, image pixel storage structure, georeference information if applicable, and so on.

If errors are reported in **Output from gdalinfo command line**, then you need to exit the current uploading process and first resolve the reported issues. Issues are commonly related to improper configuration of GDAL SDK and Oracle Instant Client packages due to which Spatial Studio cannot find them from the expected file system folders.

7. Click **Next** only if no errors are reported in the **gdalinfo** command output.

   The **Dataset creation parameters** step is displayed as shown:

Figure 3-14 Dataset creation parameters



Raster dataset name: WIND_2024040300_PNG_GEOR

Dataset description: New GeoRaster dataset

8. Optionally, switch ON the **Create GeoRaster dataset** toggle.

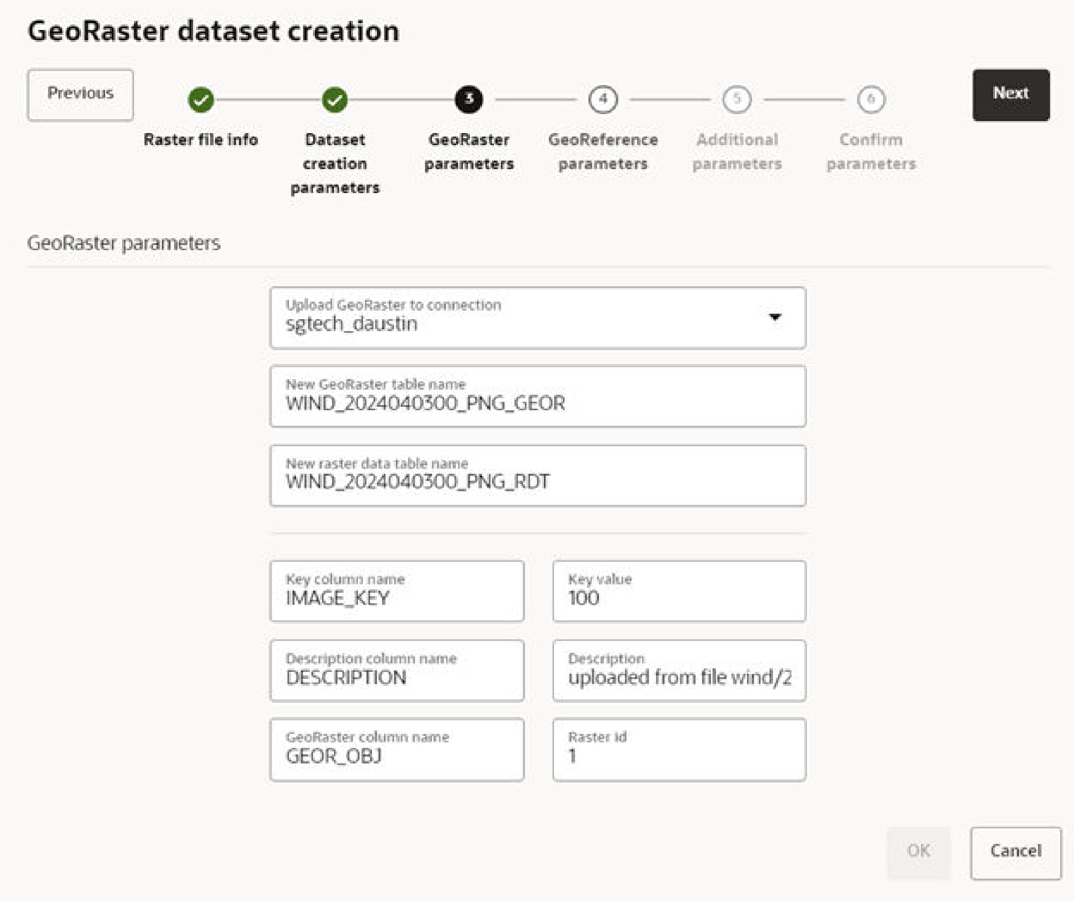
   When this option is switched OFF, only the raster file will be uploaded to the database, and the GeoRaster dataset will not be created in Spatial Studio. You can then later create the GeoRaster dataset from the database as more options are available for a database-based GeoRaster dataset. See Creating a GeoRaster Dataset for more information.

9. Enter the **Raster dataset name** and **Dataset description**.

10. Click **Next**.

    The **GeoRaster parameters** step is displayed as shown:

Figure 3-15 GeoRaster parameters



Upload GeoRaster to connection: sgtech_daustin
New GeoRaster table name: WIND_2024040300_PNG_GEOR
New raster data table name: WIND_2024040300_PNG_RDT
Key column name: IMAGE_KEY
Key value: 100
Description column name: DESCRIPTION
Description: uploaded from file wind/2
GeoRaster column name: GEOR_OBJ
Raster Id: 1

11. Select a connection object using the **Upload GeoRaster to connection** drop-down to store the raster data.
12. Enter the **New GeoRaster table name**.

    The GeoRaster table has the following hard-coded columns:

    a. **IMAGE_KEY**: The key column name of type `NUMBER`.

    b. **DESCRIPTION**: The description column name of type `VARCHAR2`.

    c. **GEOR_OBJ**: The GeoRaster column name of type `SDO_GEORASTER`.
13. Enter the **New raster data table name**.

    The raster data table has a **Raster Id** column of type `NUMBER`.
14. Enter **Key value** and **Description** for the GeoRaster table.
15. Enter **Raster Id** for the raster data table.
16. Click **Next**.

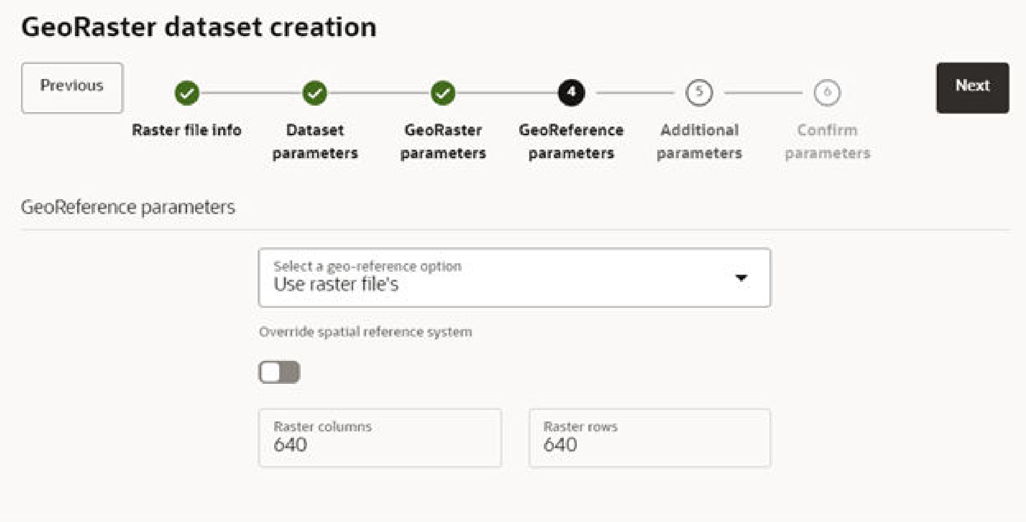
    The **GeoReference parameters** step is displayed.
    The uploaded raster must have known georeference information in order to be stored in Oracle database and then be displayed in Spatial Studio.
17. Select a value from the **Select a geo-reference option** drop-down.

    The options for this drop-down can vary depending on the spatial reference system (SRS) detected by Spatial Studio in the metadata of the raster file. The supported scenarios are:

- **Scenario 1: Self-contained Georeference information in the Raster Image File**
  If the raster image has self-contained georeference information (such as a geo-tiff image that contains the georeference details), then the **Use raster file's** option is automatically applied.

  You may directly accept and utilize this self-contained georeference information, and no other user inputs are needed as shown.

  Figure 3-16 Using Raster File's GeoReference Information

  Select a geo-reference option: Use raster file's

  Override spatial reference system

  Raster columns: 640

  Raster rows: 640

  It is also possible that a valid self-contained georeference information in the raster image happens to be a user-defined coordinate reference system and therefore not supported by Oracle Spatial. In such a case, the GDAL package may import the image into Oracle database but will assign it with an unsupported SRID (for example, a value of 999999 or 0). Although `gdal_translate` can upload it into Oracle database, Spatial Studio will not be able to generate the required metadata due to the absence of the required georeference information. As a result, this upload process will eventually fail for such a kind of data file.

  If you observe such an error (in the server logs) while uploading, then you must perform the following steps:

  a. Get a valid spatial reference identifier (SRID) that corresponds to the spatial reference system found in the imagery data.
     For this, you can raise a service request with My Oracle Support or refer to Oracle Spatial Developer's Guide for the steps to create a custom SRID.

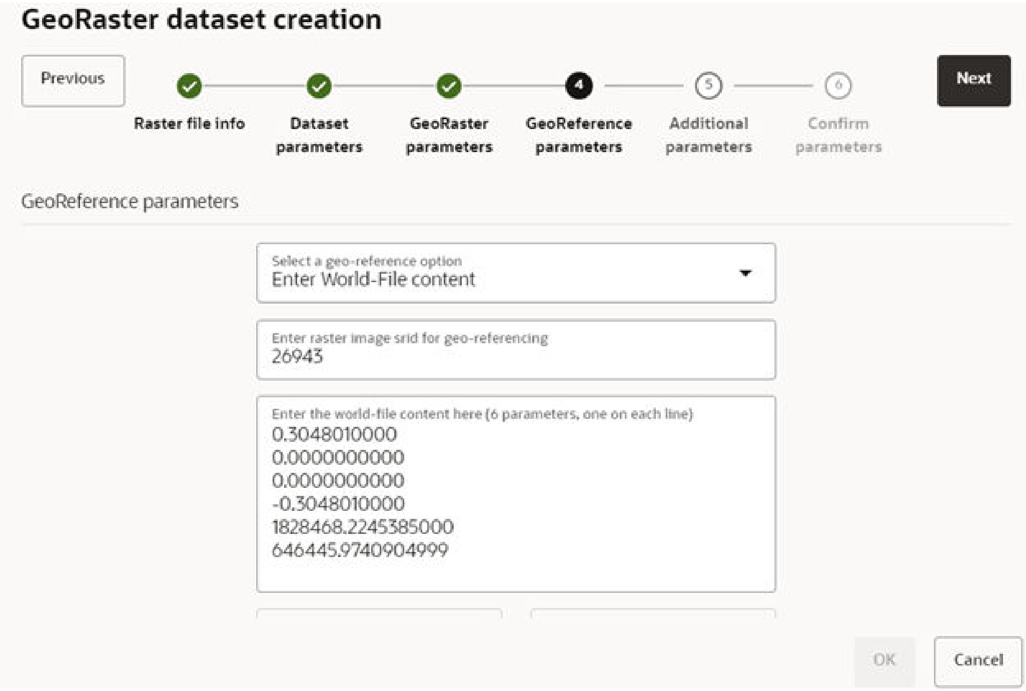
  b. Repeat all the previous steps (step 1 to step 16) to upload the raster image.

  c. Enable the **Override spatial reference system** switch in Figure 3-16 for the **GeoReference parameters** step.
     The raster data file is then treated as not containing georeference information and thus requires you to provide the details.

  d. Follow the steps for Scenario 2 or Scenario 3 as it applies to you.

- **Scenario 2: Georeference information Provided in a World-File**
  If the raster image has a companion world-file (for example, raster file `sf1.jps` has a companion `sf1.wld` file), and both are stored in the same folder, then select the **Enter World-File content** georeference option as shown.

Figure 3-17 Using GeoReference Information From a World-File



Select a geo-reference option
Enter World-File content

Enter raster image srid for geo-referencing
26943

Enter the world-file content here (6 parameters, one on each line)

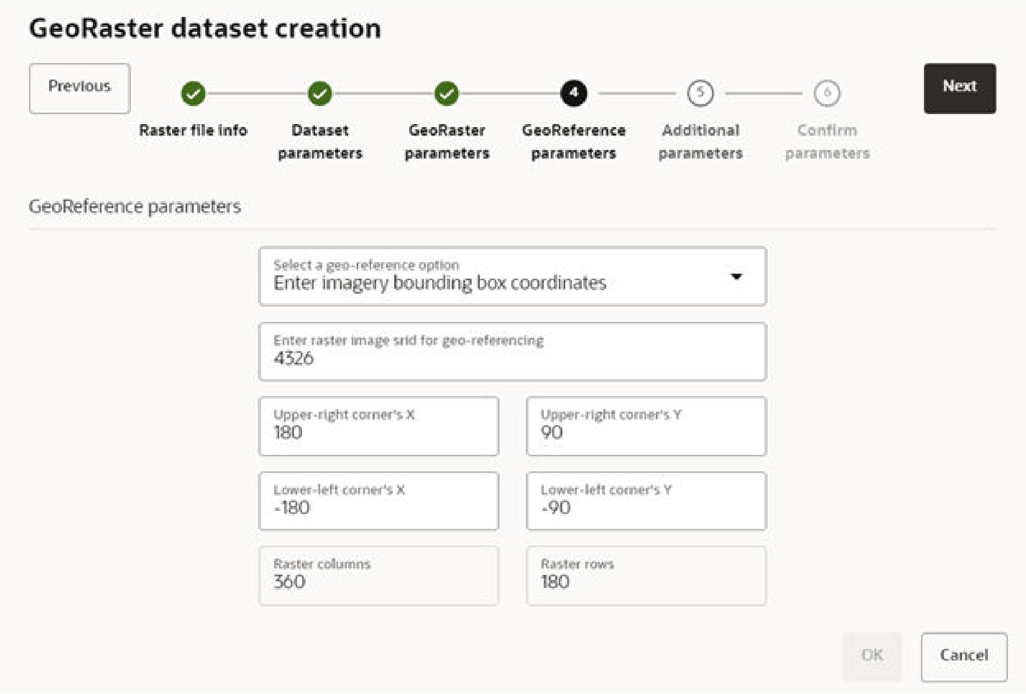
```
0.3048010000
0.0000000000
0.0000000000
-0.3048010000
1828468.2245385000
646445.9740904999
```

a. **Enter raster image srid for geo-referencing**: Enter the SRID for the spatial reference system.

b. **Enter the world-file content here**: Enter the world file's contents. Note that each parameter takes one line and six parameters occupy six consecutive lines.

- **Scenario 3: Georectified Raster Image with Known Bounding Box Values**
  If the raster image is already georectified and you know its SRID and bounding box values, then select the **Enter Imagery bounding box coordinates for a Valid SRID** georeference option as shown.

Figure 3-18 Using Georectified Raster Image with Bounding Box Coordinates



GeoRaster dataset creation

GeoReference parameters

Select a geo-reference option: Enter imagery bounding box coordinates

Enter raster image srid for geo-referencing: 4326

Upper-right corner's X: 180

Upper-right corner's Y: 90

Lower-left corner's X: -180

Lower-left corner's Y: -90

Raster columns: 360

Raster rows: 180

a. **Enter raster image srid for geo-referencing**: Enter the SRID for the spatial reference system.

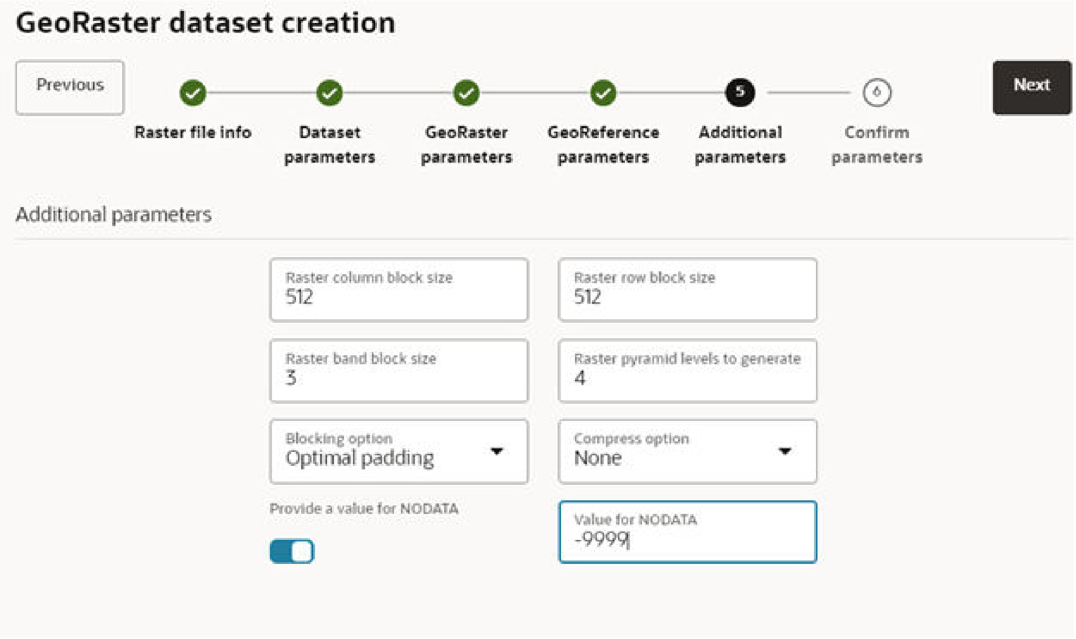
b. **Upper-right corner's X**, **Upper-right corner's Y**: Enter the upper-right corner's coordinates.

c. **Lower-left corner's X**, **Lower-left corner's Y**: Enter the lower-left corner's coordinates.

18. Click **Next** to provide additional GeoRaster parameters.

    The **Additional parameters** step is displayed as shown:

Figure 3-19 Georeference Parameters: Additional Parameters



Raster column block size: 512

Raster row block size: 512

Raster band block size: 3

Raster pyramid levels to generate: 4

Blocking option: Optimal padding

Compress option: None

Provide a value for NODATA

Value for NODATA: -9999

19. Optionally, modify the default parameters (if required) to fine tune the GeoRaster storage related parameters.

    If you are aware that there is a special value for raster cells indicating NODATA, then turn on the **Provide a value for NODATA** switch and provide its value.

20. Click **Next** to confirm the inputs.

    You may scroll down the text area and view all the parameters entered or selected in the previous steps. You may choose to go to any earlier steps to modify inputs.

21. Click **OK**.

    The server will initiate a backend process to upload the raster data files into the database, and then optionally create a dataset in Spatial Studio. The application displays a task completion notification and you can also verify the same in the Jobs page.

3.6.1.3 Creating a GeoRaster Dataset

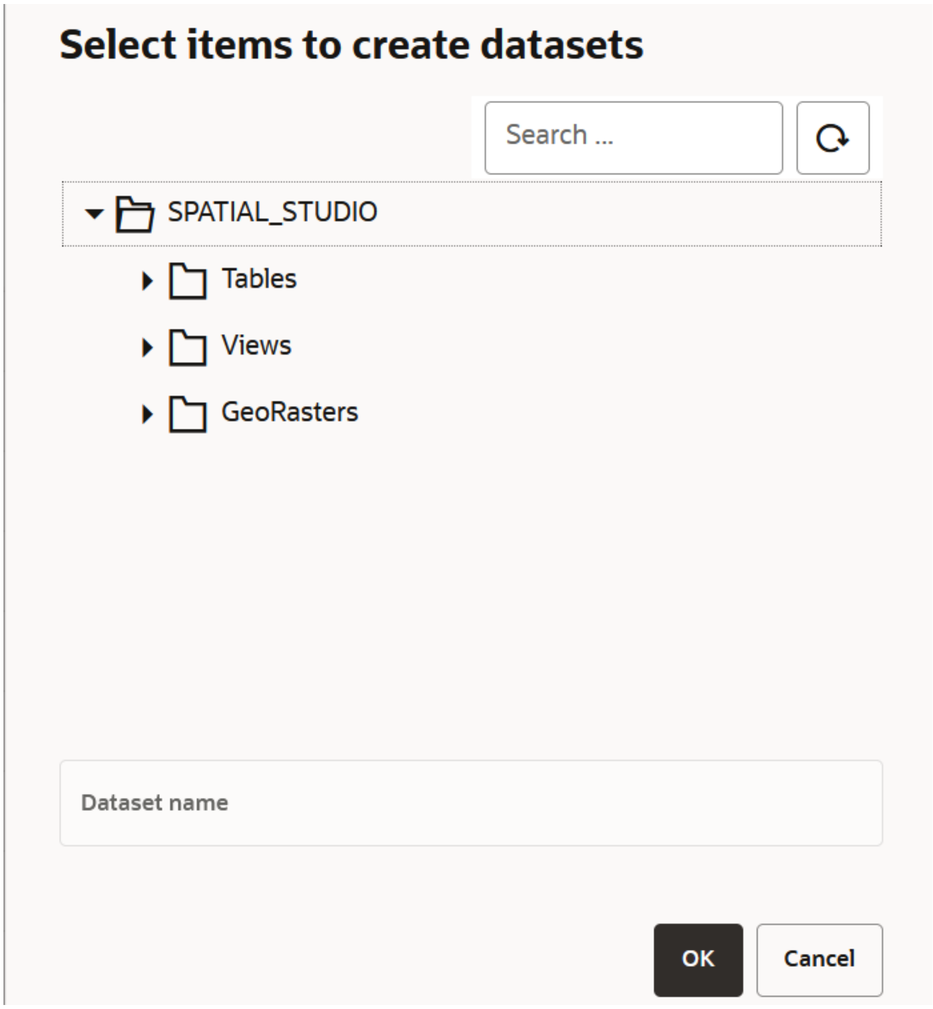
Spatial Studio allows you to create Georaster datasets.

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. Click **Database table/view**, select a **Connection** and click **Create**.
3. Click **GeoRasters**, select the required **GeoRaster** table and click **OK** as shown:

Figure 3-20   Creating a GeoRaster DataSet



Select items to create datasets

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

4. Choose a **Selection Mode**.

   The values for the selection mode are:

   - Single Raster
   - Virtual Mosaic

5. 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.

6. Optionally, enable **Wind Animation** if the raster image is encoded with velocities in the red (x-axis) and green (y-axis) channels, and you wish to visualize wind animation.

   See About Wind Animation for more information.

7. Provide the following **Data Range** values: **Min velocity in x axis**, **Max velocity in x axis**, **Min velocity in y axis**, and **Max velocity in y axis** only if you enabled **Wind Animation** in the preceding step.
8. Click **OK**.

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

3.6.1.4 Creating a GeoJSON URL Dataset

You can create a dataset by specifying a GeoJSON URL.

It is important to note the following prior to creating a GeoJSON URL dataset:

- A GeoJSON URL based dataset accesses its data directly from the source URL. There is no database table managed in Spatial Studio for this dataset.
- A GeoJSON URL based dataset does not support Spatial Analysis.
- A GeoJSON URL based dataset is subject to the same upload size limit, or 100MB, whichever is smaller.
- If a GeoJSON URL does not support CORS (Cross-Origin Resource Sharing), then Spatial Studio will act as a proxy to the browser requesting the GeoJSON URL data.

Perform the following steps to create a GeoJSON URL dataset:

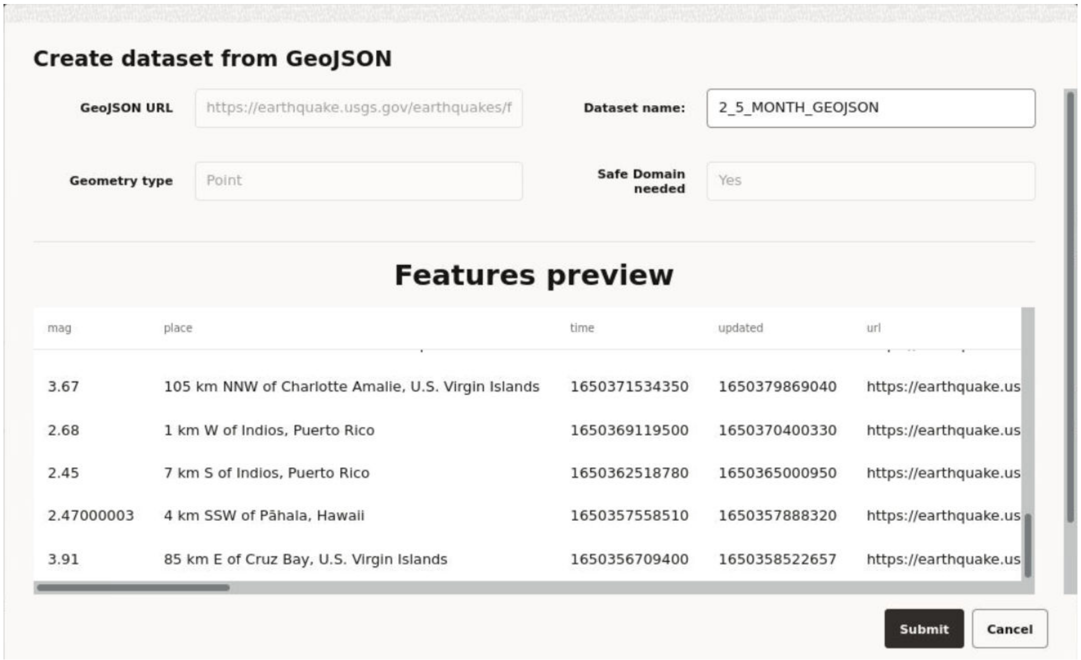
1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.

   The **Create Dataset** window opens.
3. Select the **GeoJSON URL** option.
4. Specify the **GeoJSON URL** to access GeoJSON data from an external domain for map visualization.

   > **Note:**
   >
   > Ensure you add the external domain used for accessing GeoJSON data to the list of entries in the Safe Domains list.
5. Click **Create**.

   Create dataset from GeoJSON window opens as shown:

Figure 3-21   Creating a Dataset from GeoJSON



Create dataset from GeoJSON

GeoJSON URL: https://earthquake.usgs.gov/earthquakes/f
Dataset name: 2_5_MONTH_GEOJSON
Geometry type: Point
Safe Domain needed: Yes

Features preview

mag	place	time	updated	url
3.67	105 km NNW of Charlotte Amalie, U.S. Virgin Islands	1650371534350	1650379869040	https://earthquake.us
2.68	1 km W of Indios, Puerto Rico	1650369119500	1650370400330	https://earthquake.us
2.45	7 km S of Indios, Puerto Rico	1650362518780	1650365000950	https://earthquake.us
2.47000003	4 km SSW of Pāhala, Hawaii	1650357558510	1650357888320	https://earthquake.us
3.91	85 km E of Cruz Bay, U.S. Virgin Islands	1650356709400	1650358522657	https://earthquake.us

6. Optionally, enter a **Dataset name**.
7. Click **Submit**.

   The GeoJSON URL dataset gets created with the warning, `No key column was found`. You must resolve the warning in order to use the dataset as a map layer for visualization. See Datasets with Issues for more details to resolve the warning.

3.6.1.5 Creating an OGC WMS Dataset

Starting with Spatial Studio release 22.3, you can define datasets that are based on the `GetMap` responses from any external OGC (Open Geospatial Consortium) WMS (Web Map Service) services.

Prior to creating a WMS dataset, ensure that the required OGC WMS connection is created in Spatial Studio.

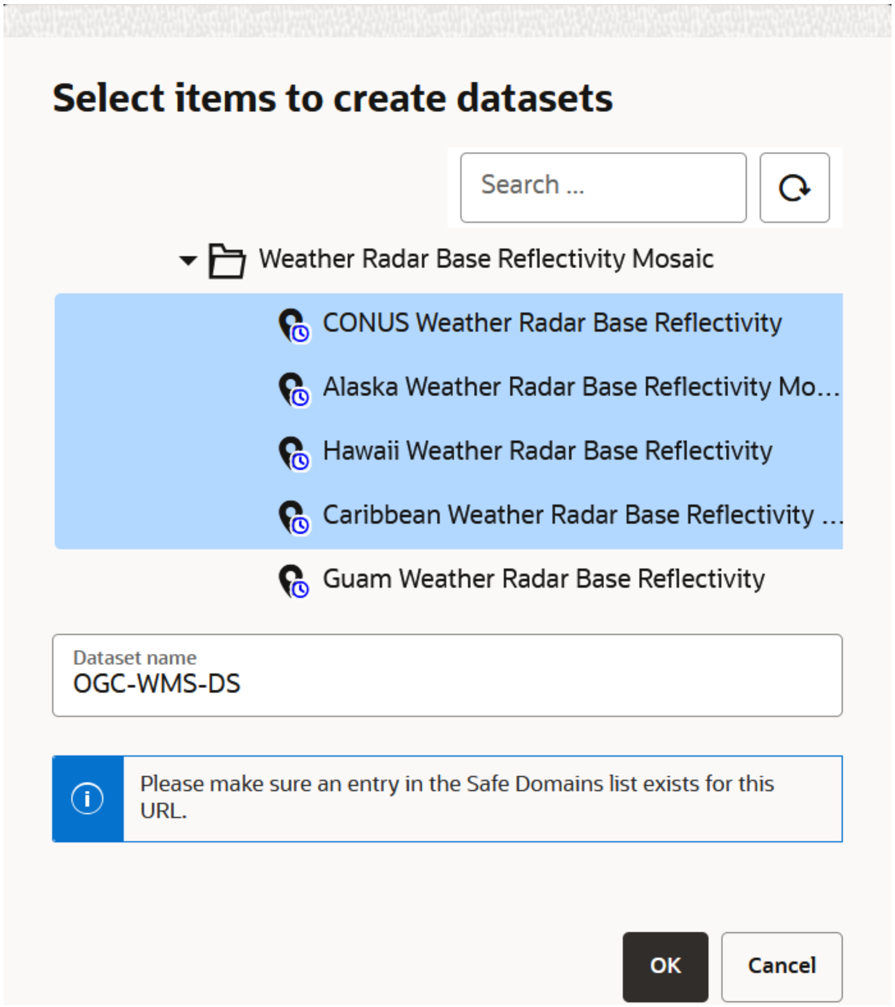
Perform the following steps to create an OGC WMS dataset:

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

   The **Create Dataset** window opens.
3. Select **OGC Web Map Service**.
4. Select the **WMS Connection** to be used from the drop-down list.
5. Explore all the available WMS map layers from the external WMS server and select the required one.

   You can `Shift+Click` to select more than one layer. The external WMS server combines multiple layers into a single image as a response to Spatial Studio’s requests for the new WMS dataset.

Figure 3-22 Selecting the WMS Layer to Create a WMS Dataset



Select items to create datasets

Search ...
Weather Radar Base Reflectivity Mosaic
CONUS Weather Radar Base Reflectivity
Alaska Weather Radar Base Reflectivity Mo...
Hawaii Weather Radar Base Reflectivity
Caribbean Weather Radar Base Reflectivity ...
Guam Weather Radar Base Reflectivity

Dataset name
OGC-WMS-DS

Please make sure an entry in the Safe Domains list exists for this URL.

6. Enter the **Dataset name**.
7. Click **OK**.

   The OGC WMS dataset gets created and is displayed on the **Datasets** page.
   When this WMS dataset is displayed on a map visualization, Spatial Studio will obtain and display the images for both the selected layers.

Related Topics

- Creating an OGC WMS Connection
  You can create a new connection to an external OGC (Open Geospatial Consortium) WMS (Web Map Service) service.
- Visualizing OGC WMS Maps as a Dataset
  You can visualize an OGC (Open Geospatial Consortium) WMS (Web Map Service) dataset on a map.

3.6.1.6 Creating a Dataset by Uploading a File

You can create a dataset by uploading a file in a format supported by Spatial Studio.

The supported file formats are as follows:

- Excel file

- Shapefile
- GeoJSON file
- CSV file
- KML file

Also, note the following:

- WKT or GeoJSON geometry text values in Excel or CSV files are supported.
  If you are uploading a file with WKT text values, then only WKT strings representing geodetic coordinates (longitude and latitude) are supported.
- Three dimensional coordinates are supported in GeoJSON files.

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

   The **Create Dataset** window opens.
3. Select the **Local File** option.
4. Upload any one of the supported file types.
5. Click **Create**.

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

- Uploading a Shapefile
  You can create a dataset by uploading a shapefile.

3.6.1.6.1 Uploading a Shapefile

You can create a dataset by uploading a shapefile.

A shapefile contains the geospatial data which can be referenced in multiple files with specific file extensions. The following lists a few selected files that contribute to shapefile format:

- **`.shp`** - Stores the geometry data
- **`.shx`** - Stores the index of the geometry
- **`.dbf`** - Stores the attribute information of geometry features
- **`.prj`** - Stores the coordinate system information
- **`.cpg`** - Specifies the character set to be used

1. Navigate to the **Datasets** page and click **Create Dataset**.

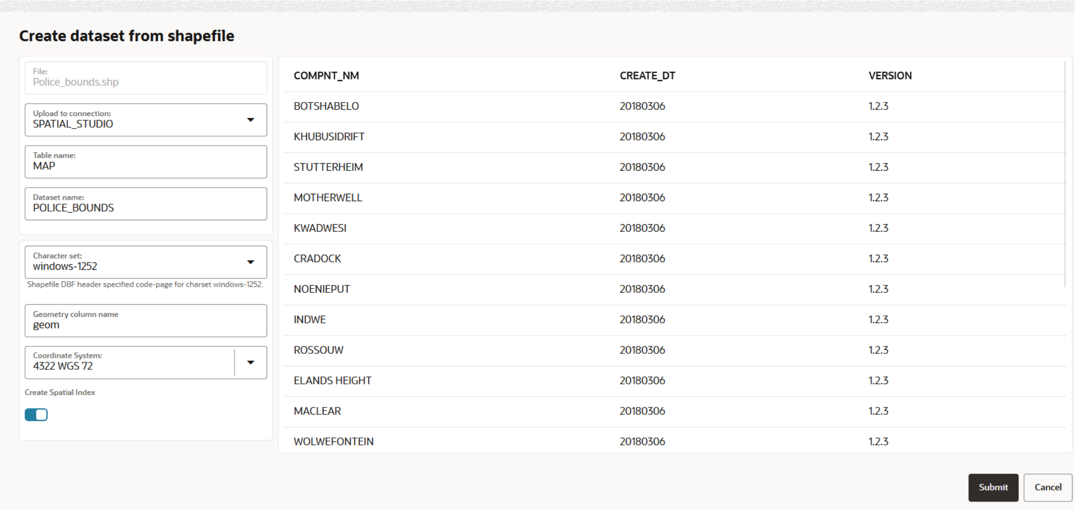
   Create Dataset window opens as shown in Figure 3-11.
2. Select **Local File**.
3. Click ⤒ to upload the shape file.

   The **File Upload** window opens.
4. Select all the required files from your system.

> **Note:**
>
> It is mandatory to upload `.shp`, `.shx`, and `.dbf` files.

The **Create dataset from shapefile** dialog opens as shown:

Figure 3-23   Create dataset from shapefile



Create dataset from shapefile

File: Police_bounds.shp

Upload to connection: SPATIAL_STUDIO

Table name: MAP

Dataset name: POLICE_BOUNDS

Character set: windows-1252

Shapefile DBF header specified code-page for charset windows-1252.

Geometry column name geom

Coordinate System: 4322 WGS 72

Create Spatial Index

COMPNT_NM	CREATE_DT	VERSION
BOTSHABELO	20180306	1.2.3
KHUBUSIDRIFT	20180306	1.2.3
STUTTERHEIM	20180306	1.2.3
MOTHERWELL	20180306	1.2.3
KWADWESI	20180306	1.2.3
CRADOCK	20180306	1.2.3
NOENIEPUT	20180306	1.2.3
INDWE	20180306	1.2.3
ROSSOUW	20180306	1.2.3
ELANDS HEIGHT	20180306	1.2.3
MACLEAR	20180306	1.2.3
WOLWEFONTEIN	20180306	1.2.3

5. Select the connection to upload the shapefile from the **Upload to connection** drop-down list.
6. Optionally, change the **Table name**.
7. Optionally, change the destination **Dataset name**.
8. Optionally, select the **Coordinate System** to be used.
   - If your shapefile includes a `.prj` file referencing a custom Geographic Coordinate System (GEOGCS), then Spatial Studio will assign a best-matched geodetic SRID from the target Spatial database, as shown in the preceding figure.
   - If your shapefile does not contain a `.prj` file, then the system uses the default `EPSG:4326` GEOGCS.
9. Optionally, select the required **Character set**.

   Spatial Studio automatically detects the character set to be used in the following order of priority:

   - Extracts the `charset-name` from a `.cpg` file, if present.
   - Uses the character set specified in the `.dbf` file header.
   - Otherwise, uses the default ISO-8859-1.

   You can preview the file attributes using the detected character set. However, you can still choose to switch to a different **Character set** and preview the refreshed contents.
10. Click **Submit**.

    The dataset gets created from a shapefile.

3.6.1.7 Creating a Dataset Using a File URL

You can create a dataset by specifying the URL of an external server which hosts the geospatial file.

Perform the following steps to create a dataset using an external file URL:

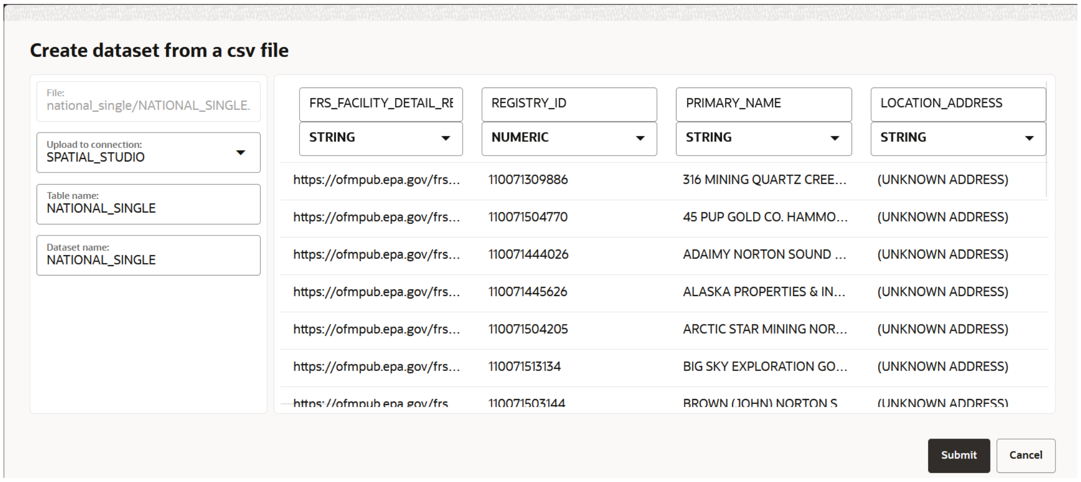
1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.

   The **Create Dataset** window opens.
3. Select the **File URL** option.
4. Specify the **File URL** to access the geospatial data from an external domain.

   The following file types are supported:
   - Excel spreadsheet
   - CSV file
   - KML file
   - Shape files contained in one zip file
5. Click **Create**.

   For instance, if you are accessing a CSV file using the file URL, then **Create dataset from a csv file** dialog opens as shown:

Figure 3-24 Creating a Dataset from a File URL



Create dataset from a csv file

File: national_single/NATIONAL_SINGLE.
Upload to connection: SPATIAL_STUDIO
Table name: NATIONAL_SINGLE
Dataset name: NATIONAL_SINGLE

FRS_FACILITY_DETAIL_RE	REGISTRY_ID	PRIMARY_NAME	LOCATION_ADDRESS
STRING	NUMERIC	STRING	STRING
https://ofmpub.epa.gov/frs...	110071309886	316 MINING QUARTZ CREE...	(UNKNOWN ADDRESS)
https://ofmpub.epa.gov/frs...	110071504770	45 PUP GOLD CO. HAMMO...	(UNKNOWN ADDRESS)
https://ofmpub.epa.gov/frs...	110071444026	ADAIMY NORTON SOUND ...	(UNKNOWN ADDRESS)
https://ofmpub.epa.gov/frs...	110071445626	ALASKA PROPERTIES & IN...	(UNKNOWN ADDRESS)
https://ofmpub.epa.gov/frs...	110071504205	ARCTIC STAR MINING NOR...	(UNKNOWN ADDRESS)
https://ofmpub.epa.gov/frs...	110071513134	BIG SKY EXPLORATION GO...	(UNKNOWN ADDRESS)
https://ofmpub.epa.gov/frs	110071503144	BROWN (JOHN) NORTON S	(UNKNOWN ADDRESS)

   a. Select the connection to upload the shapefile from the **Upload to connection** drop-down list.
   b. Optionally, change the **Table name**.
   c. Optionally, change the destination **Dataset name**.
   d. Click **Submit** to create the dataset.

3.6.1.8 Creating a Dataset from Cesium Datasets

Spatial Studio supports Cesium map visualization by allowing you to create a dataset from a 3D dataset or a CZML file.

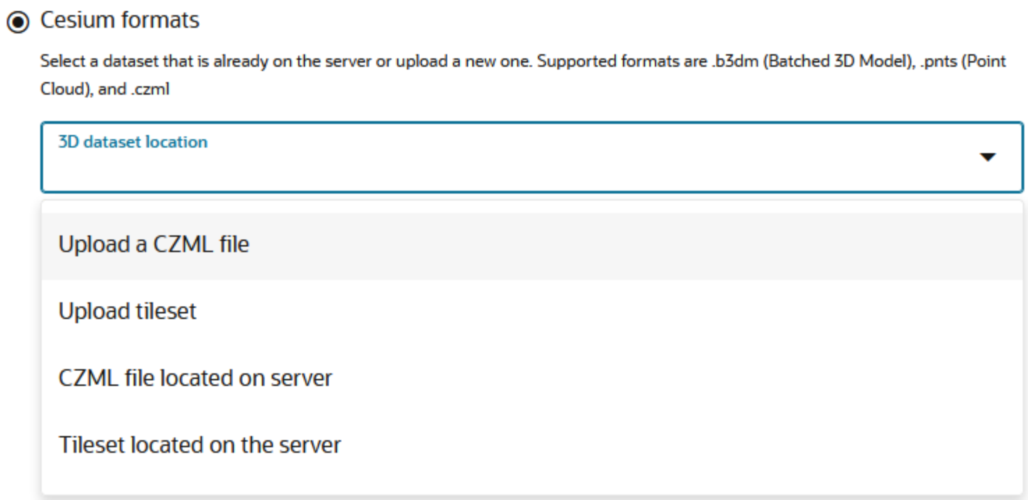
Perform the following steps to create a dataset from Cesium datasets:

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

The **Create Dataset** window opens.

3. Select the **Cesium formats** option.

Figure 3-25 Options for Creating a Cesium Dataset



● Cesium formats

Select a dataset that is already on the server or upload a new one. Supported formats are .b3dm (Batched 3D Model), .pnts (Point Cloud), and .czml

4. Select a **3D dataset location** option.
   - **Upload czml file:** Upload a `.czml` file.
   - **Upload tileset:** Upload a tileset zip file. The supported formats are:
     - `.b3dm`: Batched
     - `.pnts`: Point Cloud

   > **Tip:**
   >
   > You can increase the default size limit for zip files larger than 50 MB by updating the `dataset_max_size` attribute for the `upload` property defined in `<user_home_folder>/.sgtech/sgtech_config.json` file.

   - **Czml file located on server:** Specify the czml file to be uploaded from the server by entering the **Name** of the `.czml` file and the **Directory** path.
   - **Tileset located on the server:** Specify the tileset file to be uploaded from the server by entering the **Name** of the `tileset.json` file and the **Directory** path.

> **Note:**
>
> When uploading a CZML file or a tileset file from the server:
>
> - If the file is not under `<SGTECH_HOME>/cesiumdata` or `<SGTECH_HOME>/3d-tilesets` as it may apply, then you must manually migrate the datasets when migrating Spatial Studio.
> - You can update the unzipped file limits in the General tab in the Console page. The following two advanced settings parameters need to be modified:
>   - Maximum unzipped item
>   - Maximum unzipped total

5. Click **Create**.

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

3.6.1.9 Creating a Wind Animation Dataset

You can create a wind animation dataset which can be used for visualizing wind speeds and dynamic flow on a map.

As a prerequisite for creating a wind animation dataset, ensure that:

- The base wind image is generated. See Generating a Base Wind Image From a NOAA Dataset for an example.
- The generated base wind image is loaded as a GeoRaster to Oracle Database. See Using the GeoRaster Dataset Creation Wizard for more information.

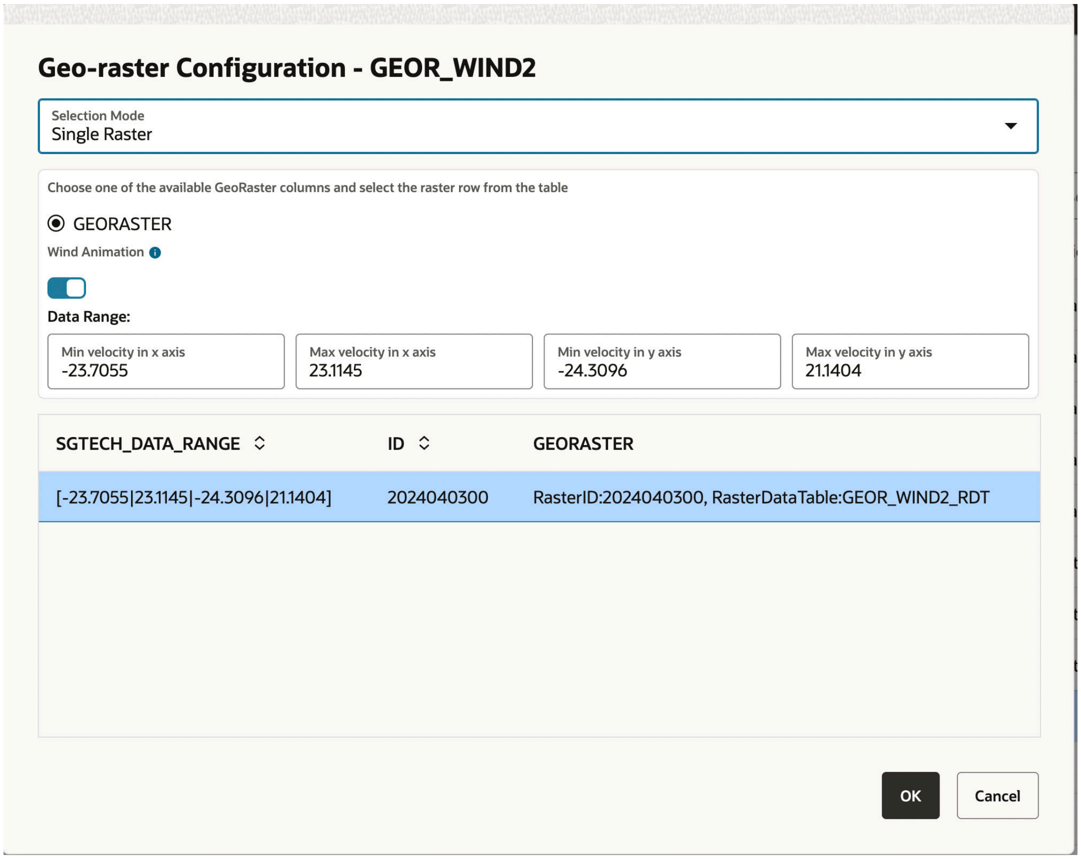
Perform the following steps to create a wind animation dataset:

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

   The **Create Dataset** window opens.
3. Click **Database table/view**, select a **Connection** and click **Create**.
4. Click **GeoRasters**, select the **GeoRaster** table containing the base image, and click **OK**.

   The **Geo-raster Configuration** dialog opens as shown:

Figure 3-26 GeoRaster Configuration for Creating a Wind Animation Dataset



Geo-raster Configuration - GEOR_WIND2

Selection Mode: Single Raster

Choose one of the available GeoRaster columns and select the raster row from the table

● GEORASTER

Wind Animation: ON

Data Range:

Min velocity in x axis: -23.7055

Max velocity in x axis: 23.1145

Min velocity in y axis: -24.3096

Max velocity in y axis: 21.1404

SGTECH_DATA_RANGE	ID	GEORASTER
[-23.7055|23.1145|-24.3096|21.1404]	2024040300	RasterID:2024040300, RasterDataTable:GEOR_WIND2_RDT

5. Set the **Selection Mode** to *Single Raster*.
6. Switch ON the **Wind Animation** toggle.
7. Enter the following **Data Range** values: **Min velocity in x axis**, **Max velocity in x axis**, **Min velocity in y axis** and **Max velocity in y axis**.

   Note the following:

   - These values are obtained at the time of generating the base wind image. See Generating a Base Wind Image From a NOAA Dataset for an example.
   - These values need to be set only the first time you create a wind animation dataset from this GeoRaster table. Once saved, these parameters will be stored in the GeoRaster table. Hence, the future datasets will not require manual input of the **Data Range** values, unless you choose to update them.
8. Click **OK**.

   The wind animation dataset gets created and is displayed on the **Datasets** page.

Related Topics

- About Wind Animation
  Starting from Oracle Spatial Studio Release 24.2.0, you can create and visualize wind animations that depict the direction of flow between various locations.

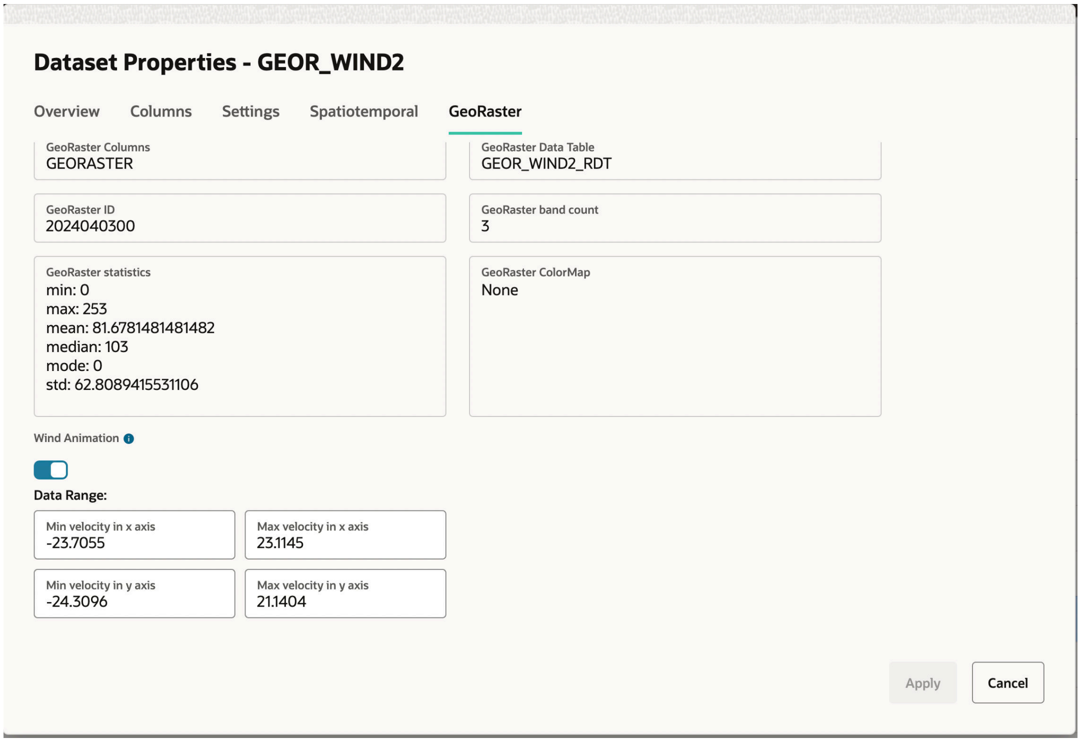
3.6.1.10 Enabling Wind Animation For an Existing GeoRaster Dataset

You can enable wind animation for an existing GeoRaster dataset only if the raster image is encoded with the red (R) and green (G) channels representing the x and y velocities, respectively.

1. Navigate to the **Datasets** page.
2. Right-click on the required GeoRaster dataset and click **Properties**.

   The **Dataset Properties** dialog opens as shown.

Figure 3-27 Enabling Wind Animation



Dataset Properties - GEOR_WIND2

GeoRaster Columns: GEORASTER

GeoRaster Data Table: GEOR_WIND2_RDT

GeoRaster ID: 2024040300

GeoRaster band count: 3

GeoRaster statistics:
min: 0
max: 253
mean: 81.6781481481482
median: 103
mode: 0
std: 62.8089415531106

GeoRaster ColorMap: None

Wind Animation

Data Range:

Min velocity in x axis: -23.7055

Max velocity in x axis: 23.1145

Min velocity in y axis: -24.3096

Max velocity in y axis: 21.1404

3. Click the **GeoRaster** tab.
4. Switch `ON` the **Wind Animation** toggle.
5. Optionally, modify the following **Data Range** values: **Min velocity in x axis**, **Max velocity in x axis**, **Min velocity in y axis**, and **Max velocity in y axis**.
6. Click **Apply**.

Related Topics

- About Wind Animation
  Starting from Oracle Spatial Studio Release 24.2.0, you can create and visualize wind animations that depict the direction of flow between various locations.

3.6.2 About Spatial Analysis Datasets

Spatial Studio stores the results of a spatial analysis operation in a spatial analysis dataset. Also, storing selected geographic features or pins on a map layer gets saved as a new spatial analysis dataset.

When you perform any new spatial analysis operation (such as filtering, combining, transforming existing datasets, and so on) against a data source in map visualization, the results of the analysis are generated into a spatial analysis dataset. Similarly, when you store selected geographic locations or pins on a map layer, the spatial data gets stored as spatial analysis datasets. These datasets get instantly added to the map visualization project and appear under **Analysis** in the Active Project page. You can also view these datasets on the **Datasets** page.

- Saving Selected Features on a Map Into a Dataset
  You can save selected features on a map layer into a new spatial analysis dataset.
- Saving Pins on a Map Into a Dataset
  You can save all the pins that you dropped on a map layer into a spatial analysis dataset.

Related Topics

- Performing Analyses in Spatial Studio
  You can perform various spatial analyses (such as filtering by proximity, nearest neighbor analysis and so on) and visualize the results in Spatial Studio.

3.6.2.1 Saving Selected Features on a Map Into a Dataset

You can save selected features on a map layer into a new spatial analysis dataset.

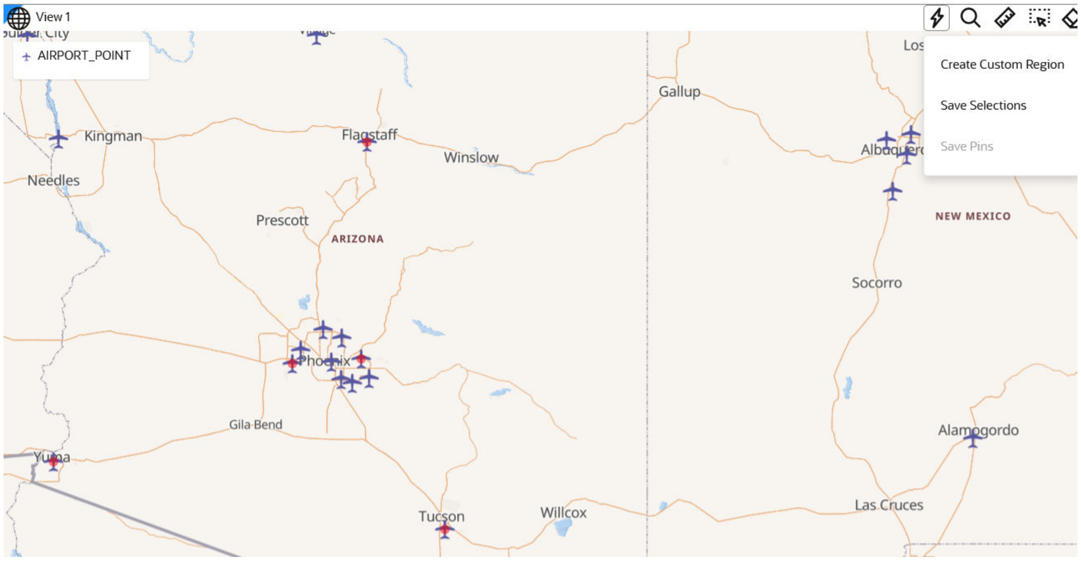
The following steps enable you to save selected features on a map layer into a dataset.

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

1. Select the required features to be saved to the dataset.

   If you are using a Windows system, you can select multiple features using the keyboard shortcut `Ctrl+Click`.
2. Click the **Actions** icon on the map tool bar.
3. Select **Save Selections** from the drop-down menu.

Figure 3-28 Saving Selections



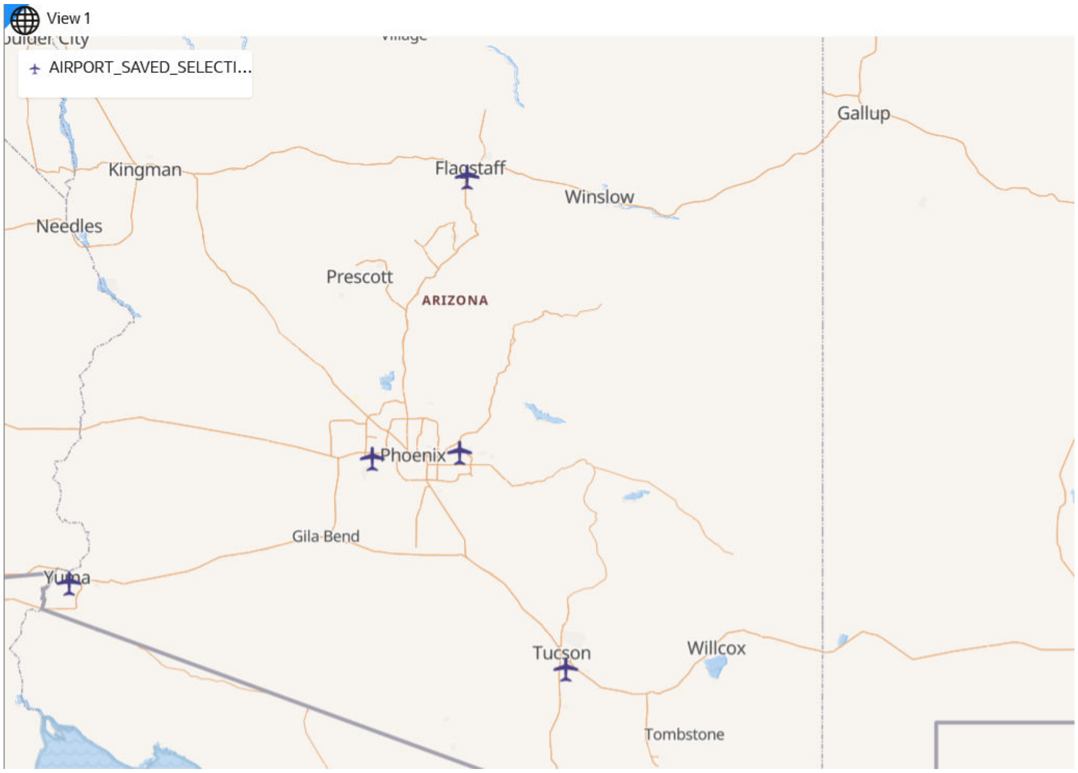
The **Save selections** dialog opens.

4. Enter the **Analysis name**.
5. Select the required columns from the **Save Selections From** drop-down list.
6. Click **Run**.

   The new (analysis) dataset containing the saved selections is created and gets listed under **Analyses** on the left pane in the **Active Project** page. It also appears on the table in the **Datasets** page.
7. Verify the selection, by dragging and dropping the analysis dataset on the map view.

   You can now view only selected features on the map layer:

Figure 3-29 Visualizing Saved Selections



3.6.2.2 Saving Pins on a Map Into a Dataset

You can save all the pins that you dropped on a map layer into a spatial analysis dataset.

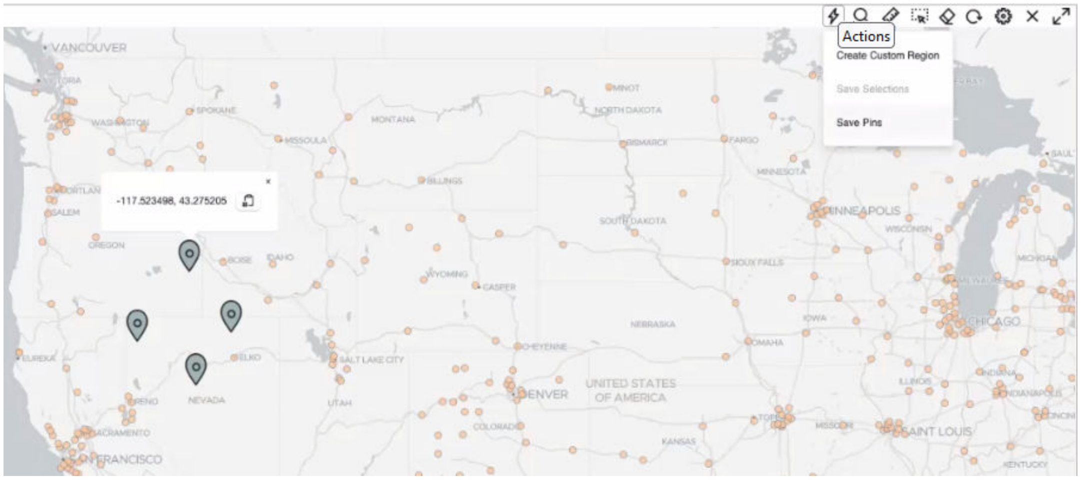
This dataset containing the stored pins can later be used in various spatial analyses.

The following steps enable you to save multiple pins on a map layer into a dataset.

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

1. Click the **Actions** icon on the map tool bar.
2. Select **Save Pins** from the drop-down menu.

Figure 3-30   Saving Pins on a Map Layer



The **Save pinned places** dialog opens.

3. Enter the **Analysis name**.
4. Select the required **Connection** for saving the dataset.
5. Click **Run**.

   The new dataset containing the pins is created and gets listed under **Analyses** on the left pane in the **Active Project** page. It also appears on the table in the **Datasets** page.
6. Verify the saved pins, by dragging and dropping the analysis dataset on the map view.

   The saved pins are displayed as points and not as a pin location on the map layer. This is because the pins get saved to a regular point type dataset. You can now perform various spatial analyses on the map using this dataset layer.

Related Topics

- Adding a Pin on a Map

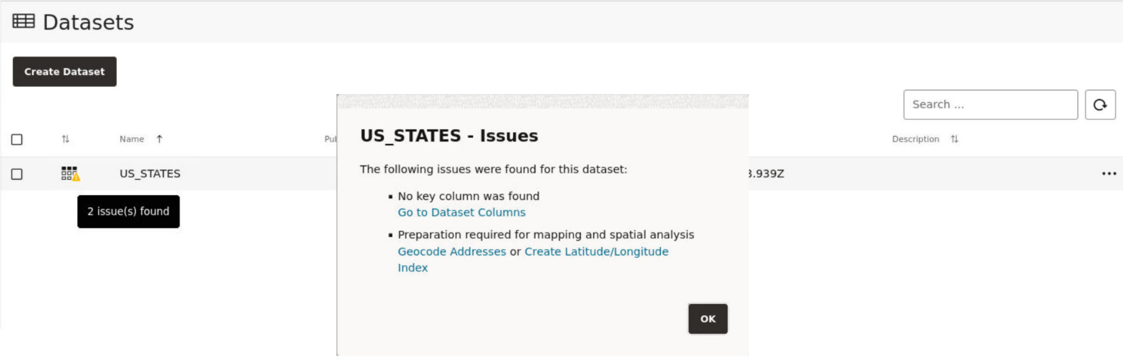
3.6.3 Datasets with Issues

All datasets in Spatial Studio must meet certain data requirements in order to be used for map visualization and 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 3-31 Warnings on a Dataset



US_STATES - Issues

The following issues were found for this dataset:

- No key column was found
  Go to Dataset Columns
- Preparation required for mapping and spatial analysis
  Geocode Addresses or Create Latitude/Longitude Index

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

Table 3-2 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. The **Dataset Properties** configuration window opens. • Select a column containing unique values and switch ON **Use as Key**. • Click **Validate key**. • Click **Apply**.
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: • 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: • Click **Geocode Addresses** • Click **Create Latitude/Longitude Index**

- Enabling Spatial on a View-Based Dataset with Latitude and Longitude Columns

3.6.3.1 Enabling Spatial on a View-Based Dataset with Latitude and Longitude Columns

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 analyze views.

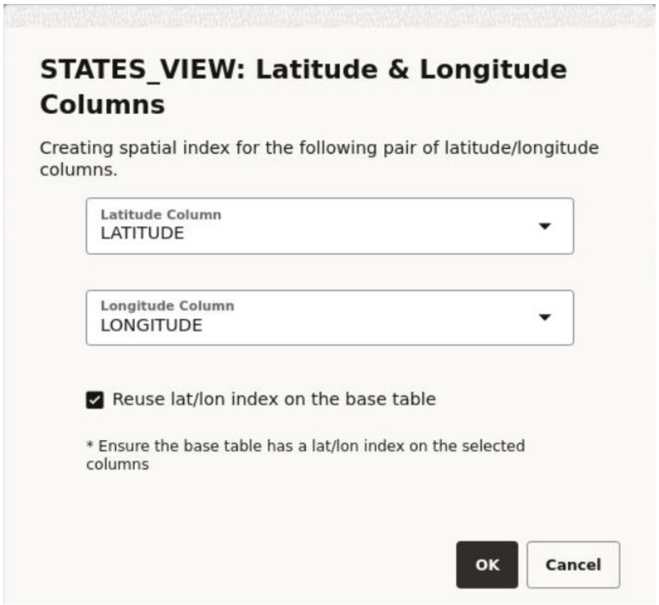
The following steps enable you to create latitude/longitude index on a view-based dataset. The instructions assume:

- You have created a dataset from a view having latitude and longitude columns. See Creating a Dataset from Database Tables or Views 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 3-32 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

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

   Note that irrespective of whether the spatial index on the latitude and longitude columns exists in the underlying base table (or view) or not, you must always select this checkbox. If there is no spatial index in the underlying base table (or view), Spatial Studio will simply update the dataset's metadata and mark it as ready for spatial visualization. This enables you to perform map visualizations, although it may not be as performant as when there is a spatial index in place.
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.

3.6.4 Geocoding a Dataset

Geocoding is the process of deriving the latitude and longitude coordinates from location details that are geo address types.

You can geocode a dataset in Spatial Studio to store the resulting latitude and longitude information as a `SDO_GEOMETRY` column. Optionally, you can also store them in latitude and longitude numeric columns in the underlying database table referenced by the dataset.

Prior to geocoding a dataset, if the Spatial Studio server is running behind a firewall, then ensure you have the correct **Web Proxy** information configured in the Console page. This is because the Spatial Studio application uses an external Oracle hosted geocoding service which is on the public internet.

You can perform the following steps to geocode a dataset.

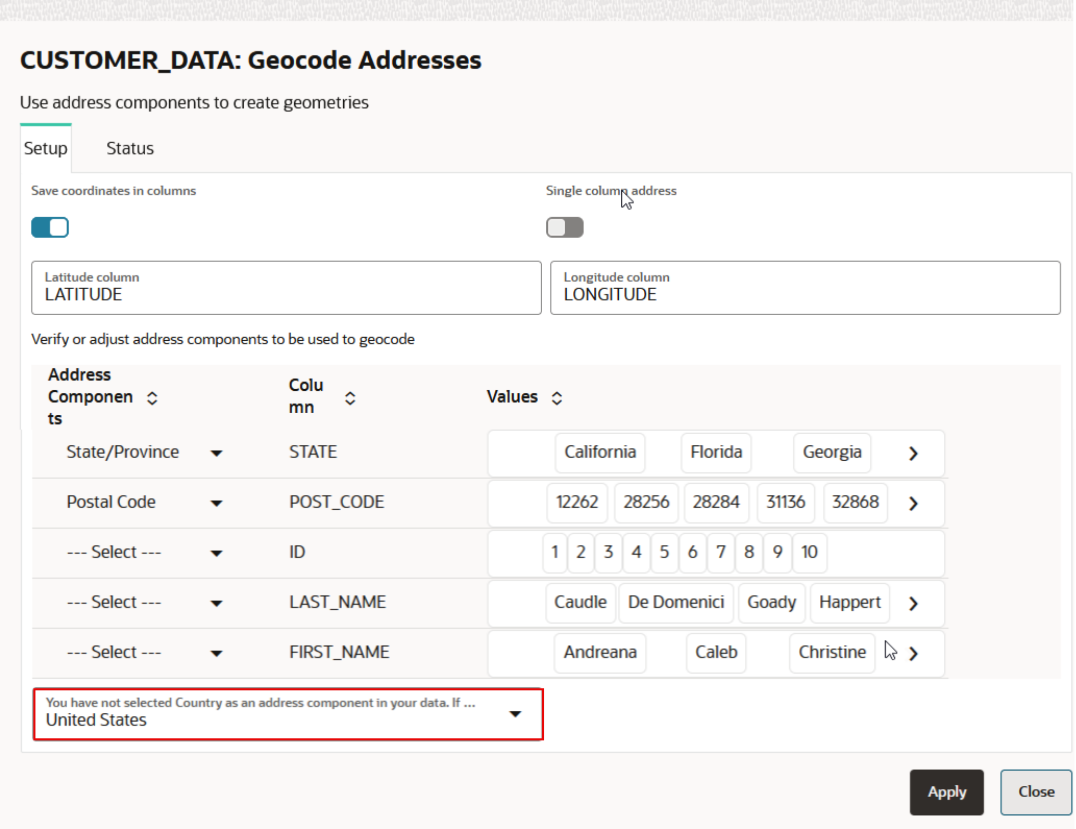
The instructions assume that a dataset containing location columns such as address details is already existing in Spatial Studio.

1. Navigate to the **Datasets** page.
2. Right-click on the **dataset name** on which you want to apply geocoding.

   Ensure that the dataset has a valid key column defined.
3. Select **Geocode Addresses** from the **Prepare** context menu.

   Geocode Addresses dialog opens as shown:

Figure 3-33 Geocode Addresses



CUSTOMER_DATA: Geocode Addresses

Use address components to create geometries

Save coordinates in columns: on

Single column address: off

Latitude column: LATITUDE

Longitude column: LONGITUDE

Verify or adjust address components to be used to geocode

Address Components	Column	Values
State/Province	STATE	California, Florida, Georgia
Postal Code	POST_CODE	12262, 28256, 28284, 31136, 32868
--- Select ---	ID	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
--- Select ---	LAST_NAME	Caudle, De Domenici, Goady, Happert
--- Select ---	FIRST_NAME	Andreana, Caleb, Christine

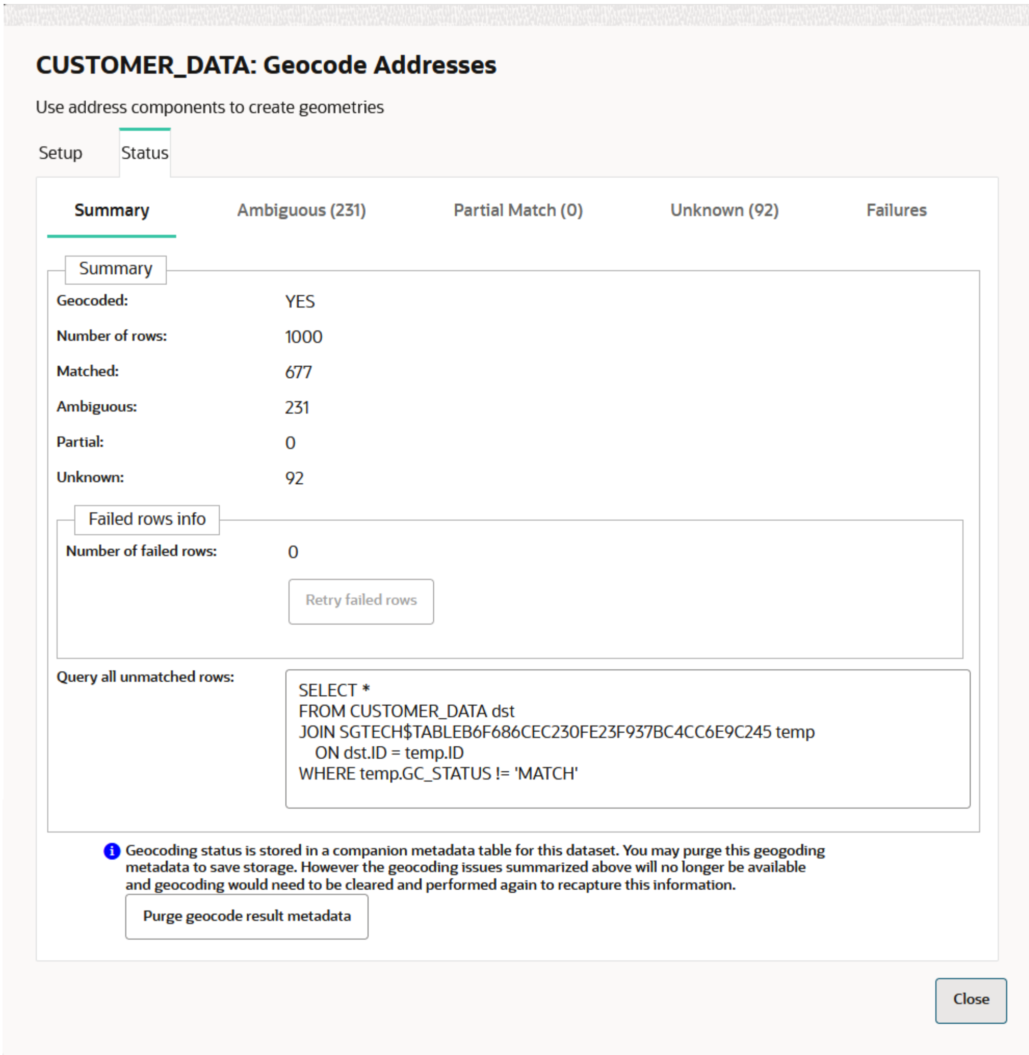
You have not selected Country as an address component in your data. If ...
United States

4. Click the **Setup** tab.
5. Perform one of the following depending on whether the address attributes are stored in a single column or multiple columns:
   - **Single Column Address**
     a. Switch ON the **Single column address** toggle.
     b. Verify or select the required address **Column**.
   - **Address Stored in Multiple Columns**
     a. Select the **Address Components** for the geo-attributes to be used for geocoding. You must provide sufficient geographic data for successful geocoding. If the address components do not include the country or state attributes, then you must explicitly select either the country or the state in the respective drop-down list shown highlighted in the preceding figure.
6. Optionally, switch ON **Save coordinates in columns** to save the geocoordinates to the dataset and to the underlying database table.
7. Optionally, enter **Latitude column** name and **Longitude column** name, if you switched ON **Save coordinates in columns** in the preceding step.
8. Click **Apply**.

   The geocoding process gets initiated and can be monitored on the **Jobs** page. Also, note the following:

   - The geocoding process is performed in batches and the default batch size is `50`. At any time, you can change the default geocoding batch size under the **General** settings in the Console page.
   - If any batch fails, the overall geocoding job will not fail. You will be notified on the failed batch at the end of job completion.
   - At the end of the geocoding process, you can view the results in the **Status** tab as shown:

Figure 3-34 Geocoding Status



CUSTOMER_DATA: Geocode Addresses

Use address components to create geometries

Geocoded: YES
Number of rows: 1000
Matched: 677
Ambiguous: 231
Partial: 0
Unknown: 92

Number of failed rows: 0

Query all unmatched rows:

```
SELECT *
FROM CUSTOMER_DATA dst
JOIN SGTECH$TABLEB6F686CEC230FE23F937BC4CC6E9C245 temp
   ON dst.ID = temp.ID
WHERE temp.GC_STATUS != 'MATCH'
```

Geocoding status is stored in a companion metadata table for this dataset. You may purge this geogoding metadata to save storage. However the geocoding issues summarized above will no longer be available and geocoding would need to be cleared and performed again to recapture this information.

- On successful completion of a geocoding job, you can verify that geocoding has been applied by viewing the latitude and longitude columns in the dataset properties and in the input source database table along with the `GC_GEOMETRY` column of data type `SDO_GEOMETRY`.

3.6.5 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 3-35.

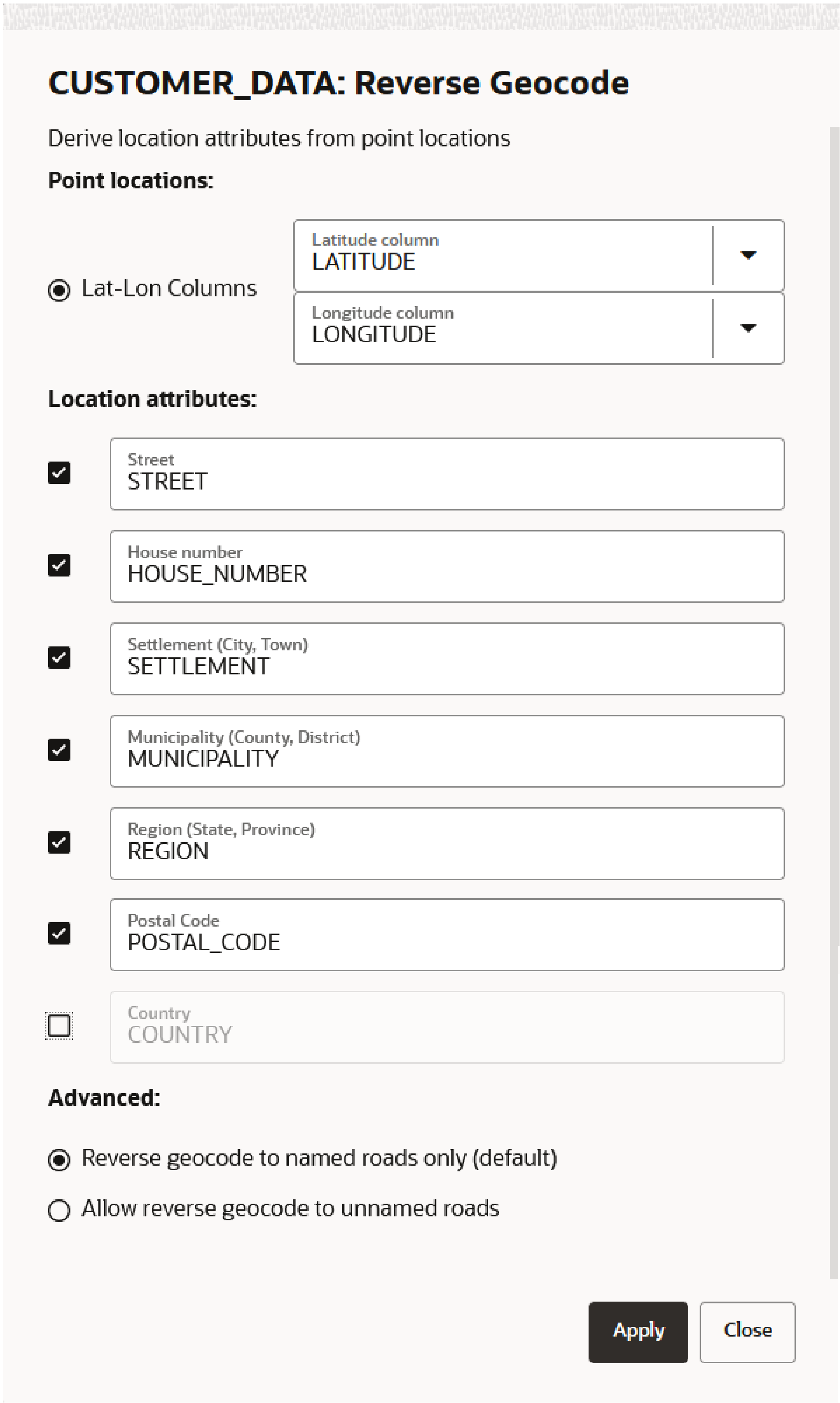
   The Input text fields for Location attributes are the column names to be created in the underlying database table for the target dataset.
5. Select the **Advanced** option as required.

   The default **Reverse geocode to named roads only** option ensures that for all latitude and longitude coordinates that do not match a named road, the closest street or road name will be obtained while geocoding.
6. 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.

   You can verify that reverse geocoding has been applied to your dataset by viewing the additional address related columns in the dataset properties.

Figure 3-35 Reverse Geocoding



CUSTOMER_DATA: Reverse Geocode

Derive location attributes from point locations

Point locations:

● Lat-Lon Columns

Latitude column: LATITUDE

Longitude column: LONGITUDE

Location attributes:

☑ Street: STREET

☑ House number: HOUSE_NUMBER

☑ Settlement (City, Town): SETTLEMENT

☑ Municipality (County, District): MUNICIPALITY

☑ Region (State, Province): REGION

☑ Postal Code: POSTAL_CODE

☐ Country: COUNTRY

Advanced:

● Reverse geocode to named roads only (default)

○ Allow reverse geocode to unnamed roads

3.6.6 Enabling Spatiotemporal for a Dataset

In order to visualize and animate spatiotemporal data, you must enable **Spatiotemporal** for the dataset on the Datasets page.

Spatial Studio supports visualization and animation of spatiotemporal map layers using a Cesium Timeline widget (see Overview of the Cesium Timeline Widget). These map layers can listen to the timeline only if you enable **Spatiotemporal** on the underlying datasets.

Characteristics of a Spatiotemporal Dataset

Spatial Studio considers a dataset to contain spatiotemporal data if it belongs to any one of the following types.

- **Live Spatiotemporal Dataset:** A dataset which meets the following characteristics is known as a **Live** dataset:
  - The dataset is based on a geometry table or view with a geometry column or pair of latitude/longitude columns.
  - The dataset has one or more entities (that represent an object in the dataset) which are uniquely identified by one of the columns.
  - The dataset's underlying table or view contains a column of the type `TIMESTAMP` or `DATE` (or a qualifying field in the GeoJSON response), that stores the UTC datetime of the entities as they are being observed and recorded.
  - The dataset's underlying table or view must have ongoing inserts with recently obtained location data of entities being observed or monitored.

  Spatial Studio considers all the different dataset rows of the same *entity id* as entries representing the entity with different `TIMESTAMP` values. However, they may or may not have varying location coordinates or geometries. Hence, these live spatiotemporal datasets can again be classified as shown:

  - **Moving Objects:** For each entity, if the location or geometry change with changing `TIMESTAMP` values, then these datasets are called moving objects datasets. In this case, a trail layer (if it is a qualifying geometry) gets added, which shows the trajectory of the moving object as a line string by fetching data for last `N` seconds (or higher time unit).
  - **Non-Moving Objects:** For each entity, if only certain properties change (and not the location or geometry) with changing `TIMESTAMP`, then these are called non-moving objects datasets. In this case, no trail layer gets added as only the properties change with time.
- **Non-Live Spatiotemporal Dataset:** A dataset with the following characteristics is known as a **Non-Live** dataset:
  - The dataset is based on a geometry table or view with a geometry column or pair of latitude/longitude columns.
  - The dataset's underlying table or view contains a `TIMESTAMP` or `DATE` type column that contains historic time values.

  These datasets can again be classified as shown:

  - **Moving Objects:** Similar to a **Live** dataset, if this dataset contains entities (that uniquely represent an object in the dataset) with varying `TIMESTAMP` values, then a trail layer gets added. The trail layer shows the trajectory of the moving object as a line string by fetching data for last `N` seconds (or higher time unit).

  - **Non-Moving Objects:** In this configuration, the dataset is just treated to have various rows with different `TIMESTAMP` values (not grouped by any entity id).
- **Time-enabled WMS Dataset:** If a WMS Service offers a time dimension for an image layer selected in a WMS dataset, then that WMS Dataset can be configured as spatiotemporal.
- **GeoJSON URL (external) Dataset:** These types of datasets can be configured to refresh periodically based on an interval value.

- Configuring Spatiotemporal for Live Moving Objects Dataset
- Configuring Spatiotemporal for Live and Non-Moving Objects Dataset
- Configuring Spatiotemporal for Non-Live Moving Objects Dataset
- Configuring Spatiotemporal for Non-Live and Non-Moving Objects Dataset
- Configuring Spatiotemporal for OGC WMS Datasets
- Configuring Spatiotemporal for GeoJSON URL Datasets

3.6.6.1 Configuring Spatiotemporal for Live Moving Objects Dataset

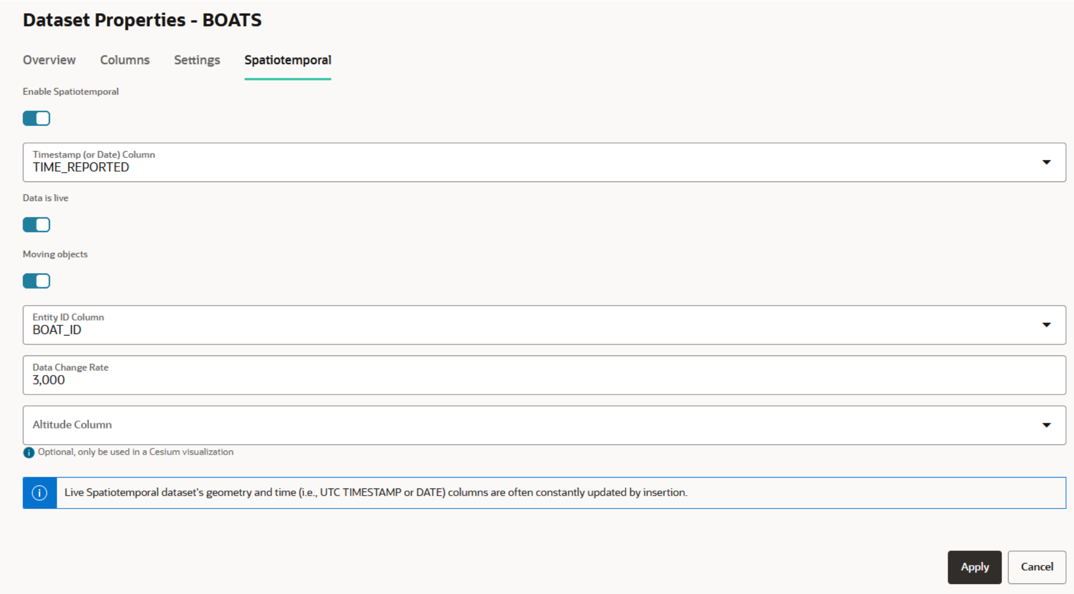
Perform the following steps to configure spatiotemporal for a live dataset with moving objects. The instructions assume that such a dataset is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the required spatiotemporal dataset and click **Properties**.

   The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.

   The following dialog is displayed:

   Figure 3-36 Enabling Spatiotemporal for a Dataset

   Dataset Properties - BOATS

   Enable Spatiotemporal

   Timestamp (or Date) Column: TIME_REPORTED

   Data is live

   Moving objects

   Entity ID Column: BOAT_ID

   Data Change Rate: 3,000

   Altitude Column

   Optional, only be used in a Cesium visualization

   Live Spatiotemporal dataset's geometry and time (i.e., UTC TIMESTAMP or DATE) columns are often constantly updated by insertion.

4. Switch `ON` **Enable Spatiotemporal**.
5. Select the **Timestamp (or Date) Column**.
   - Both date-type and timestamp-type columns are supported.

    - If using a timestamp-type column, then note that Spatial Studio supports only UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time) time zone for visualizing moving objects.

6. Switch `ON` **Data is live**.
7. Switch `ON` **Moving objects**.
8. Select the **Entity ID Column** that identifies a set of unique entities.

   The **Entity ID Column** is not a unique column as each entity can have many recordings of its locations in the same table.
9. Specify **Data Change Rate** to indicate the approximate frequency of the live feed updates in the table.
10. Optionally, select the **Altitude Column** for Cesium Map Visualization only.
11. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

Related Topics

- Visualizing Live Moving Objects Dataset
  You can visualize live moving objects on a map in Spatial Studio.

3.6.6.2 Configuring Spatiotemporal for Live and Non-Moving Objects Dataset

Perform the following steps to configure spatiotemporal for a dataset containing live real-time data on non-moving objects. Although the data attributes of the different entities can vary with time, the entity locations do not change. The instructions assume that such a dataset is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the required spatiotemporal dataset and click **Properties**.

   The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.
4. Switch `ON` **Enable Spatiotemporal**.
5. Select the **Timestamp (or Date) Column**.
    - Both date-type and timestamp-type columns are supported.
    - If using a timestamp-type column, then note that Spatial Studio supports only UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time) time zone for visualizing moving objects.
6. Switch `ON` **Data is live**.
7. Switch `OFF` **Moving objects**.
8. Select the **Entity ID Column** that identifies a set of unique entities.

   The **Entity ID Column** is not a unique column as each entity can have many recordings of its locations in the same table.
9. Specify **Data Change Rate** to indicate the approximate frequency of the live feed updates in the table.
10. Optionally, select the **Altitude Column** for Cesium Map Visualization only.
11. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

Related Topics

- Visualizing Live and Non-Moving Objects Dataset
  You can visualize a spatiotemporal dataset having ongoing inserts of real-time data, but the locations of the data entities do not change.

3.6.6.3 Configuring Spatiotemporal for Non-Live Moving Objects Dataset

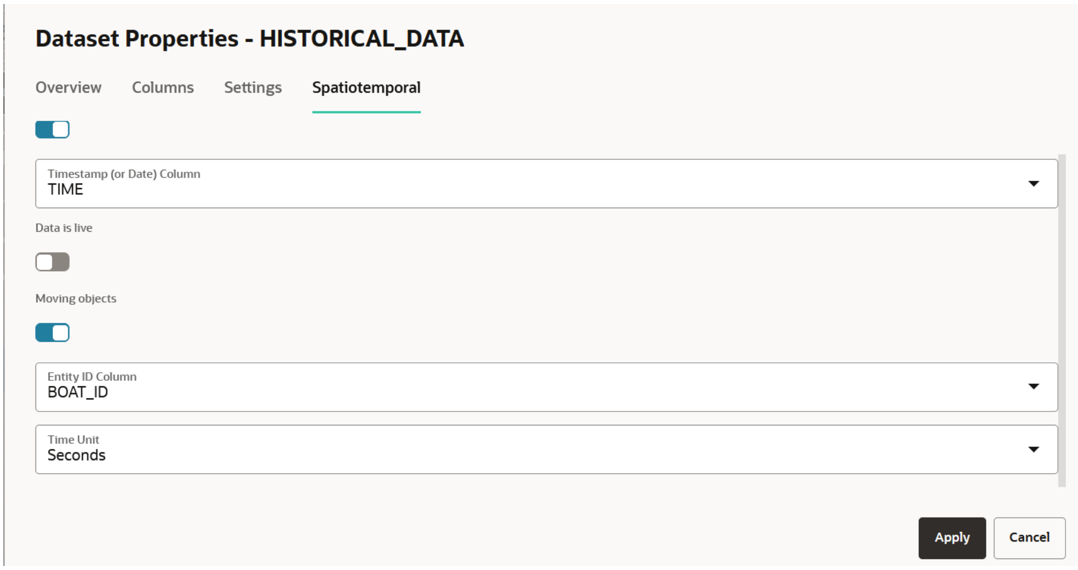
Perform the following steps to configure spatiotemporal for a dataset containing non-live data on moving objects. The instructions assume that such a dataset is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the required spatiotemporal dataset and click **Properties**.

   The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.

   The following dialog is displayed:

   Figure 3-37 Enabling Spatiotemporal for Historical Data

   Dataset Properties - HISTORICAL_DATA

   Timestamp (or Date) Column: TIME

   Data is live: off

   Moving objects: on

   Entity ID Column: BOAT_ID

   Time Unit: Seconds

4. Switch `ON` **Enable Spatiotemporal**.
5. Select the **Timestamp (or Date) Column**.
   - Both date-type and timestamp-type columns are supported.
   - If using a timestamp-type column, then note that Spatial Studio supports only UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time) time zone for visualizing moving objects.
6. Switch `OFF` **Data is live**.
7. Switch `ON` **Moving objects**.
8. Select the **Entity ID Column** that identifies a set of unique entities.

   The **Entity ID Column** is not a unique column as each entity can have many recordings of its locations in the same table.

9. Select the **Time Unit**.
10. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

Related Topics

- Visualizing Non-Live Moving Objects Dataset
  You can visualize moving objects with historic timestamp values on a map in Spatial Studio.

3.6.6.4 Configuring Spatiotemporal for Non-Live and Non-Moving Objects Dataset

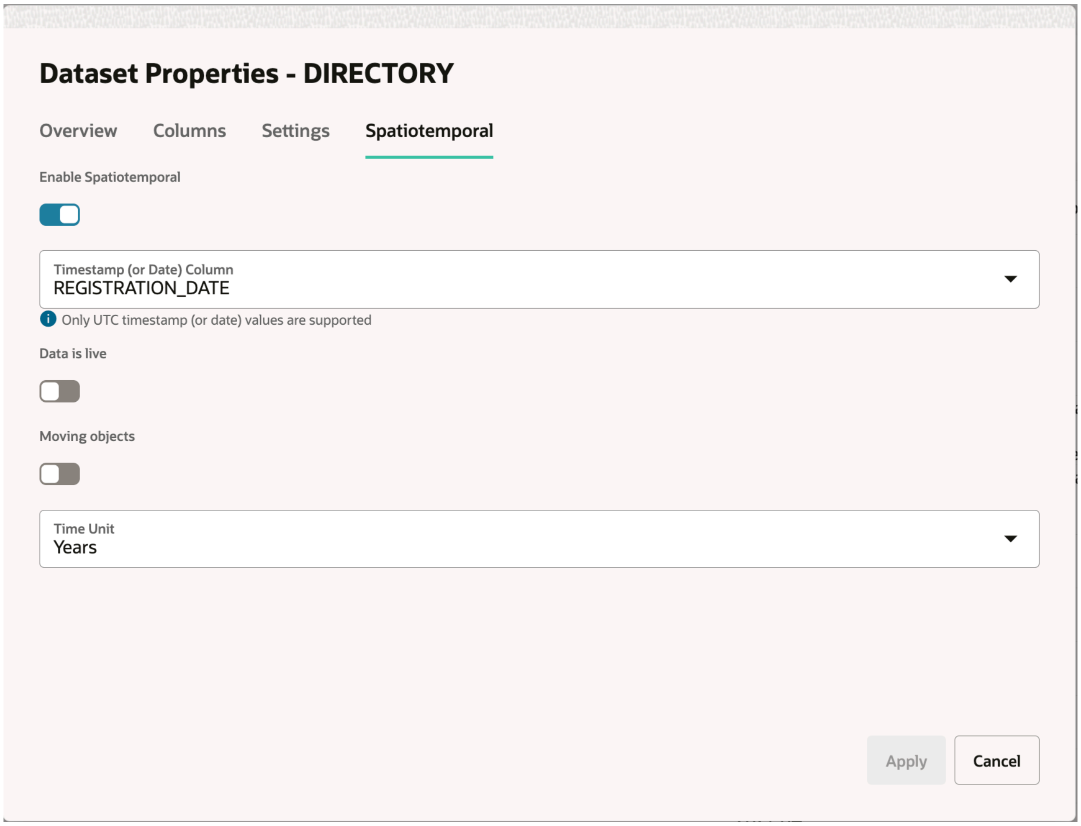
Perform the following steps to configure spatiotemporal for a dataset containing non-moving objects with different timestamp values. The instructions assume that such a dataset is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the required spatiotemporal dataset and click **Properties**.

   The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.

   The following dialog is displayed:

Figure 3-38 Enabling Spatiotemporal for Standard Filtering Datasets



Enable Spatiotemporal: ON

Timestamp (or Date) Column: REGISTRATION_DATE

Only UTC timestamp (or date) values are supported

Data is live: OFF

Moving objects: OFF

Time Unit: Years

4. Switch `ON` **Enable Spatiotemporal**.
5. Select the **Timestamp (or Date) Column**.

  - Both date-type and timestamp-type columns are supported.
  - If using a timestamp-type column, then note that Spatial Studio supports only UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time) time zone for visualizing moving objects.

6. Switch `OFF` **Data is live**.
7. Switch `OFF` **Moving objects**.
8. Select the **Time Unit**.

   The data will be filtered as per the selected time unit.
   Also, note that the filtering is applied at the dataset level. This implies that all the layers created out of this dataset will have the same filtering when added to the timeline.
9. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

Related Topics

- Visualizing Non-Live and Non-Moving Objects Dataset
  You can visualize a spatiotemporal dataset that simply contains different timestamp values in each row which are not grouped by any entity ids.

3.6.6.5 Configuring Spatiotemporal for OGC WMS Datasets

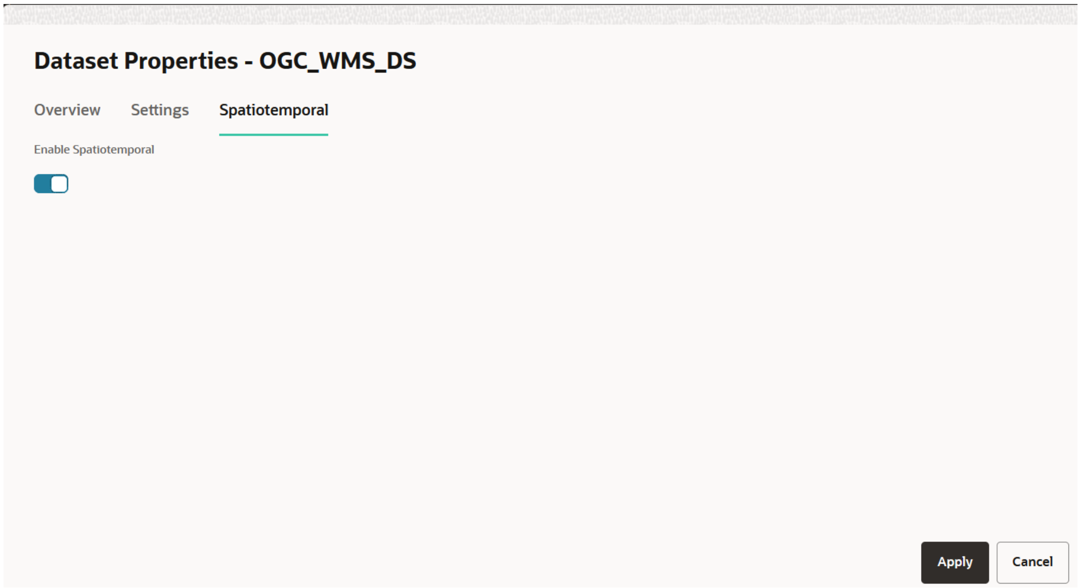
Perform the following steps to configure spatiotemporal for an OGC WMS dataset.

1. Navigate to the **Datasets** page.
2. Right-click on the required OGC WMS dataset and click **Properties**.

   The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.

   The following dialog is displayed:

Figure 3-39 Enabling Spatiotemporal for OGC WMS Dataset



Dataset Properties - OGC_WMS_DS

Enable Spatiotemporal

4. Switch `ON` **Enable Spatiotemporal**.
5. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

Related Topics

- Visualizing Spatiotemporal Data in OGC WMS Datasets
  You can visualize OGC WMS datasets that contain spatiotemporal data.

3.6.6.6 Configuring Spatiotemporal for GeoJSON URL Datasets

Perform the following steps to configure spatiotemporal for a GeoJSON URL based dataset.

1. Navigate to the **Datasets** page.
2. Right-click on the required GeoJSON URL dataset and click **Properties**.

   The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.
4. Switch `ON` **Enable Spatiotemporal**.
5. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization. Also, note that the dataset will be considered **Live** by default.

Related Topics

- Visualizing GeoJSON URL Datasets with Spatiotemporal Data
  You can visualize GeoJSON URL based datasets that contain spatiotemporal data.

3.6.7 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.

Note the following highlights about joining two datasets:

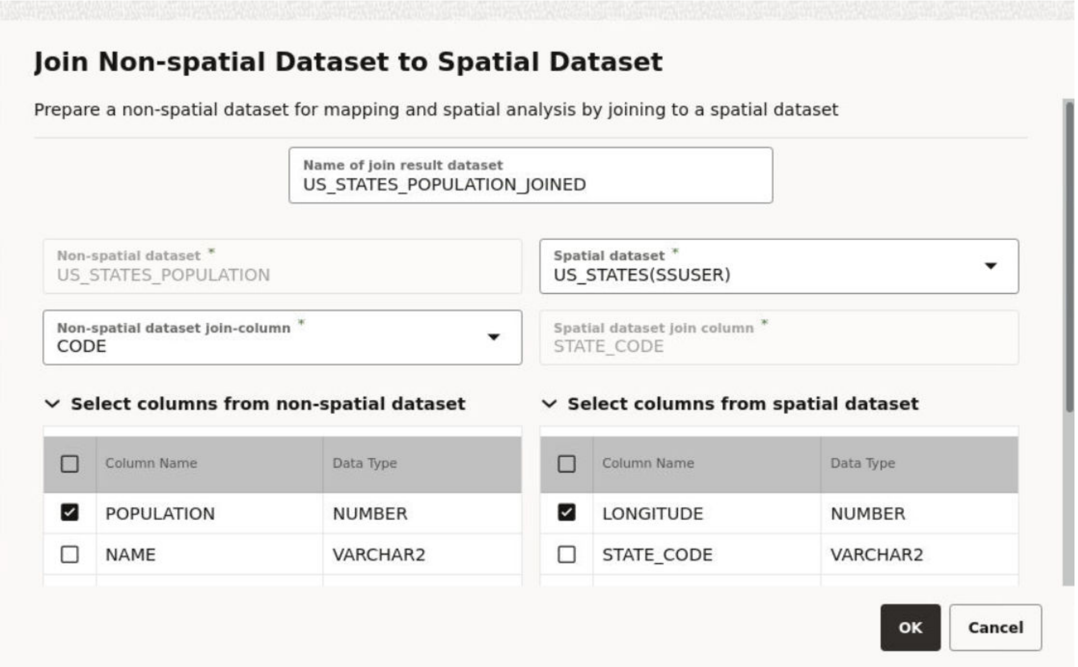
- You can only join a non-spatial dataset to a spatial dataset and not conversely.
- It is essential that the non-spatial data in one dataset is linked to the spatial data in the other dataset through a common primary key column.
- You can choose the columns for the newly created joined dataset from 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 3-40   Joining to a Spatial Dataset



Join Non-spatial Dataset to 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

Spatial dataset *: US_STATES(SSUSER)

Non-spatial dataset join-column *: CODE

Spatial dataset join column *: STATE_CODE

Select columns from non-spatial dataset

☐	Column Name	Data Type
☑	POPULATION	NUMBER
☐	NAME	VARCHAR2

Select columns from spatial dataset

☐	Column Name	Data Type
☑	LONGITUDE	NUMBER
☐	STATE_CODE	VARCHAR2

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

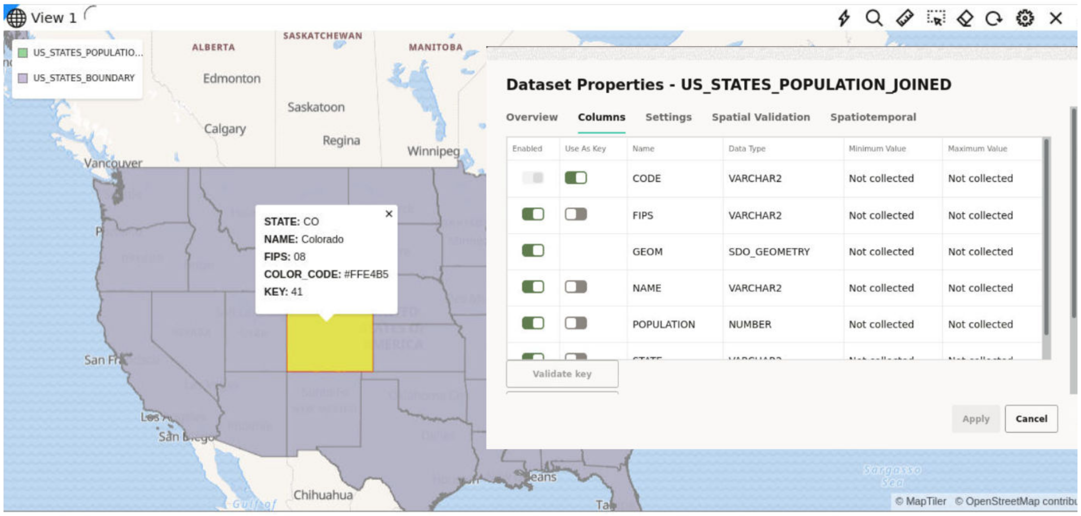
   On selection, the primary key associated with the spatial dataset is validated against the non-spatial dataset key. If the datasets key values are not suitable for a join operation, then the following error is displayed:

   ```
   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 3-41 Appended Non-spatial and Spatial Properties



STATE: CO
NAME: Colorado
FIPS: 08
COLOR_CODE: #FFE4B5
KEY: 41

Dataset Properties - US_STATES_POPULATION_JOINED

Overview | **Columns** | Settings | Spatial Validation | Spatiotemporal

Enabled	Use As Key	Name	Data Type	Minimum Value	Maximum Value
☐	☑	CODE	VARCHAR2	Not collected	Not collected
☑	☐	FIPS	VARCHAR2	Not collected	Not collected
☑		GEOM	SDO_GEOMETRY	Not collected	Not collected
☑	☐	NAME	VARCHAR2	Not collected	Not collected
☑	☐	POPULATION	NUMBER	Not collected	Not collected

3.6.8 Exporting a Dataset to GeoJSON

You can export a dataset from Spatial Studio to GeoJSON.

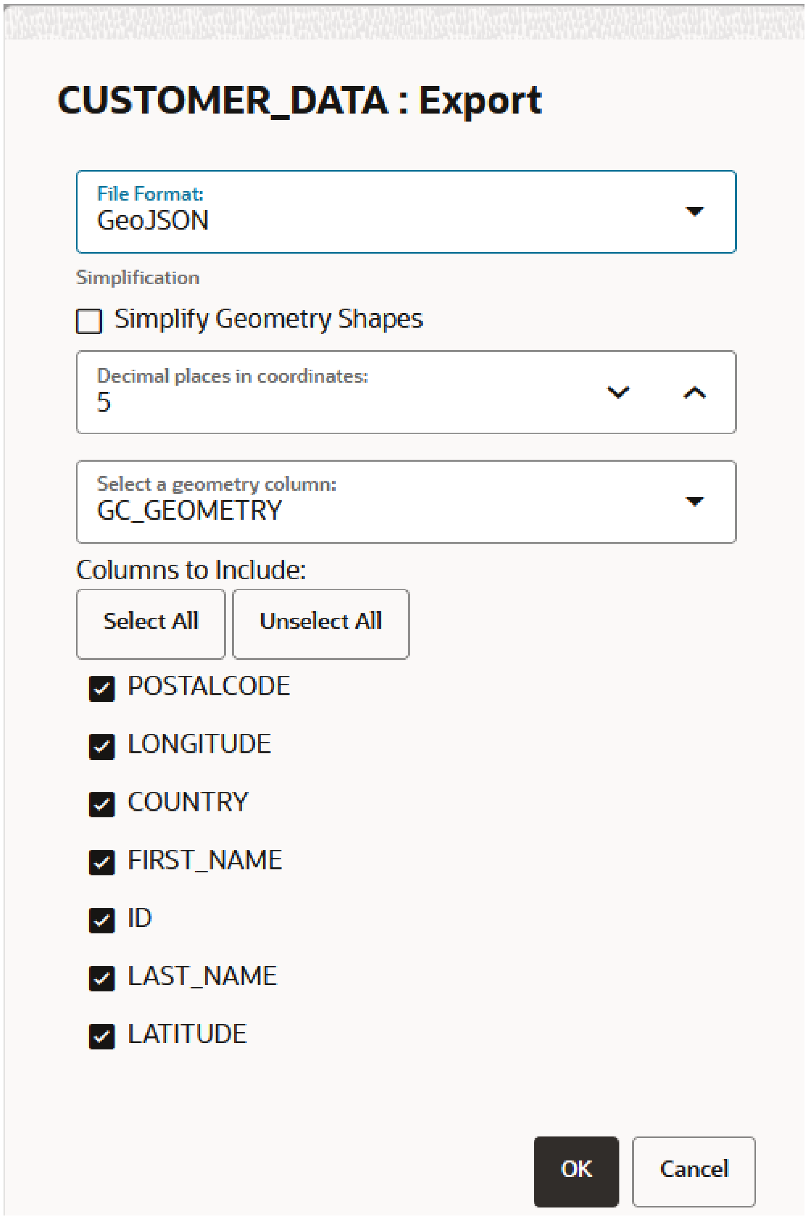
It is possible that your dataset can contain multiple geometry columns. In such a case, Spatial Studio allows you to select a specific geometry column for the export operation.

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** which you want to export.
3. Select **Export**.

   The dataset **Export** dialog opens as shown:

Figure 3-42   Exporting to GeoJSON



CUSTOMER_DATA : Export

File Format: GeoJSON

Simplification

☐ Simplify Geometry Shapes

Decimal places in coordinates: 5

Select a geometry column: GC_GEOMETRY

Columns to Include:

☑ POSTALCODE
☑ LONGITUDE
☑ COUNTRY
☑ FIRST_NAME
☑ ID
☑ LAST_NAME
☑ LATITUDE

4. Select **GeoJSON** from the **File Format** drop-down list.
5. Optionally, increase or decrease the **Decimal places in coordinates** as required.
6. **Select a geometry column** as required.
7. Select the required columns for the export.
8. Click **OK**.
9. Save the `.zip` file containing the GeoJSON data on your system.

3.6.9 Updating Statistics for Datasets

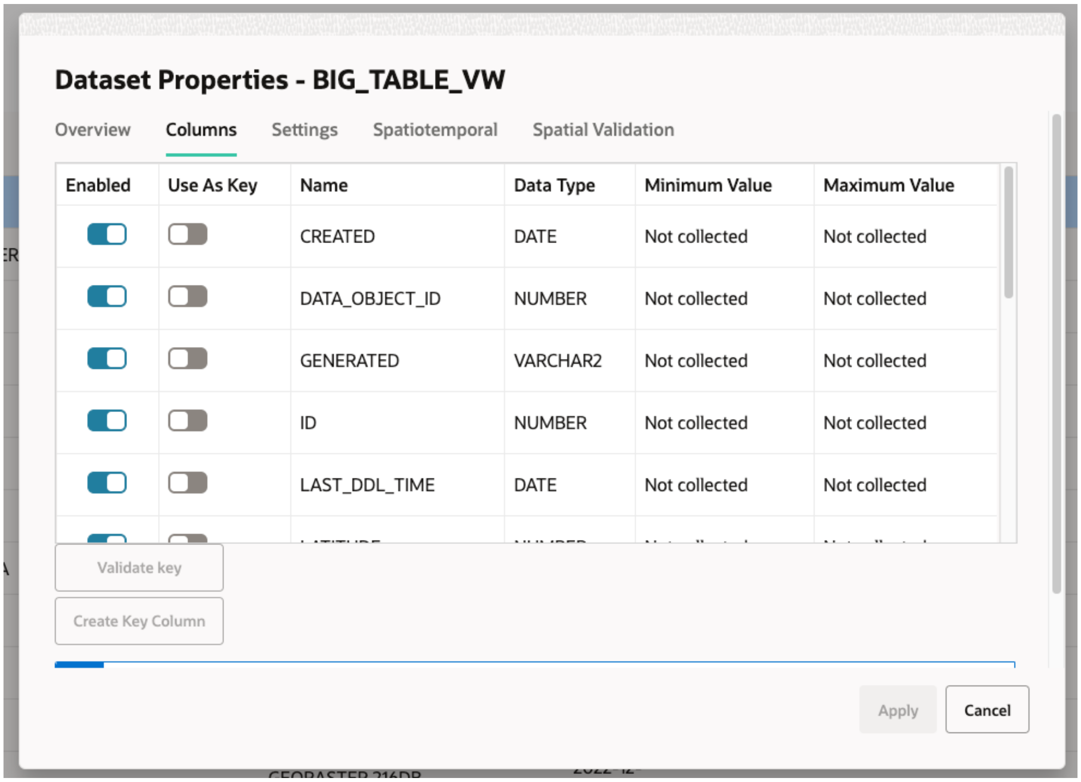
The **Update statistics** feature in Spatial Studio gathers statistics of the dataset columns.

To gather the dataset statistics, right-click on the dataset and select **Update statistics**. For all datasets (except view-based and spatial analysis datasets), this action triggers a single background job which collects the relevant statistical data. Once the job completes successfully on the Jobs page, you can verify the updated statistical data by viewing the **Dataset Properties**.

However, for view-based and spatial analysis datasets, gathering statistics is a two-step process. It implies that two background jobs are triggered:

1. **Gather dataset statistics [basic]**: This job collects the basic statistics such as **Name** and **DataType** of columns in a dataset. When this job completes successfully, the job in step-2 is triggered.
2. **Gather dataset statistics [full]**: This job collects more detailed statistics such as **Minimum Value**, **Maximum Value**, **Bounding Box**, and unique column values. As long as this job is in the `Processing` status, the view-based dataset may show incomplete information for the **Minimum Value** and **Maximum Value** columns in the **Dataset Properties** dialog:

Figure 3-43 Gathering Statistics In Progress

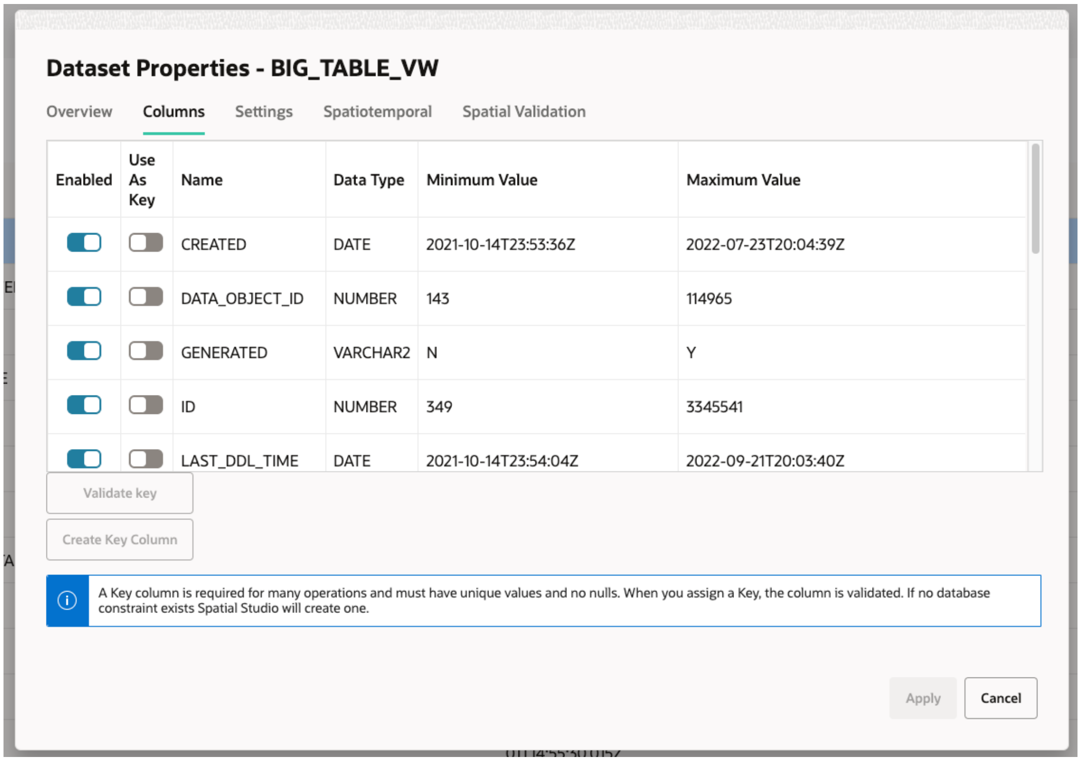


Dataset Properties - BIG_TABLE_VW

Enabled	Use As Key	Name	Data Type	Minimum Value	Maximum Value
☑	☐	CREATED	DATE	Not collected	Not collected
☑	☐	DATA_OBJECT_ID	NUMBER	Not collected	Not collected
☑	☐	GENERATED	VARCHAR2	Not collected	Not collected
☑	☐	ID	NUMBER	Not collected	Not collected
☑	☐	LAST_DDL_TIME	DATE	Not collected	Not collected

Once the job status is `Done`, the **Dataset Properties** reflects the gathered statistics.

Figure 3-44 Displaying Gathered Statistics



Dataset Properties - BIG_TABLE_VW

Enabled	Use As Key	Name	Data Type	Minimum Value	Maximum Value
●	○	CREATED	DATE	2021-10-14T23:53:36Z	2022-07-23T20:04:39Z
●	○	DATA_OBJECT_ID	NUMBER	143	114965
●	○	GENERATED	VARCHAR2	N	Y
●	○	ID	NUMBER	349	3345541
●	○	LAST_DDL_TIME	DATE	2021-10-14T23:54:04Z	2022-09-21T20:03:40Z

A Key column is required for many operations and must have unique values and no nulls. When you assign a Key, the column is validated. If no database constraint exists Spatial Studio will create one.

Note that for any type of dataset, you must always ensure that this background job completes successfully before performing advanced styling or visualization of a dataset.

3.6.10 About Cache in Spatial Studio

Starting with Spatial Studio release 22.3, all vector tiles generated for all datasets are cached to the file system by default.

This cache process automatically begins when the you first load a dataset for map visualization and start panning the map or zoom in and out on the map. Therefore, the next time the same dataset is visualized, all the corresponding map layers load faster as the relevant tiles have been already generated and are ready to be loaded. All these generated vector tiles will be saved under:

```
<user_home_folder>/.sgtech/cache/CACHE_<cache_id>
```

The *<cache_id>* which is part of the folder name is an integer value, calculated based on the dataset `id` and the geometry column being encoded in the vector tiles. A metadata file will be saved inside each `cache` folder to provide human-readable information about where the tiles belong to in a `tiles.json` file. A sample structure of the metadata file is as shown:

```
{
  "DatasetName" : "DATASET NAME",
  "DatasetId" : "8da55629d3ca71aa37d859422a847257",
  "GeometryColumn" : "GEOM_COL_NAME"
}
```

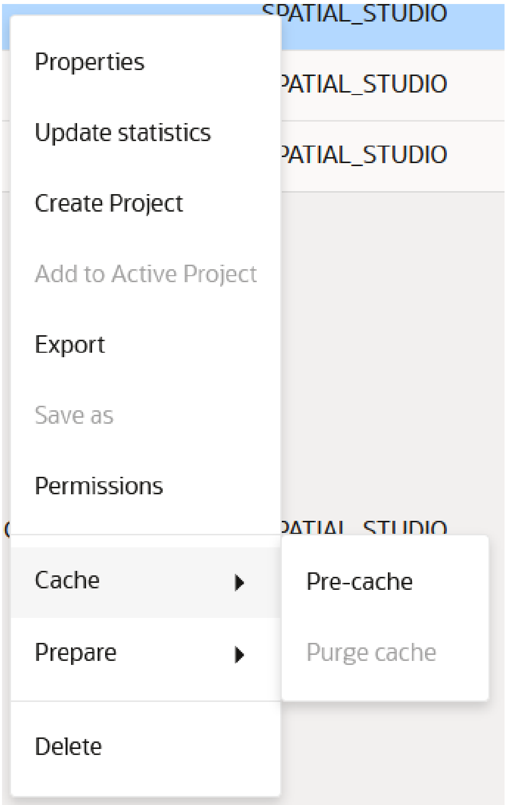
Each vector tile will be encoded and saved to a file that follows a name pattern as shown:

```
<zoom_level>_<x_axis>_<y_axis>.dat
```

All the variables in the preceding name pattern are replaced by an integer and denote the world position where the tile needs to be loaded when looking at a certain viewport of the world map.

The cache options (**Pre-cache** and **Purge cache**) for a dataset can be accessed from the **Datasets** page as shown:

Figure 3-45 Dataset Cache Options



- Pre-Cache
  You can trigger a pre-caching task to start generating vector tiles even before a map is loaded with the dataset for visualization.
- Purge Cache
  You can wipe the cached tiles by calling the **Purge cache** option.

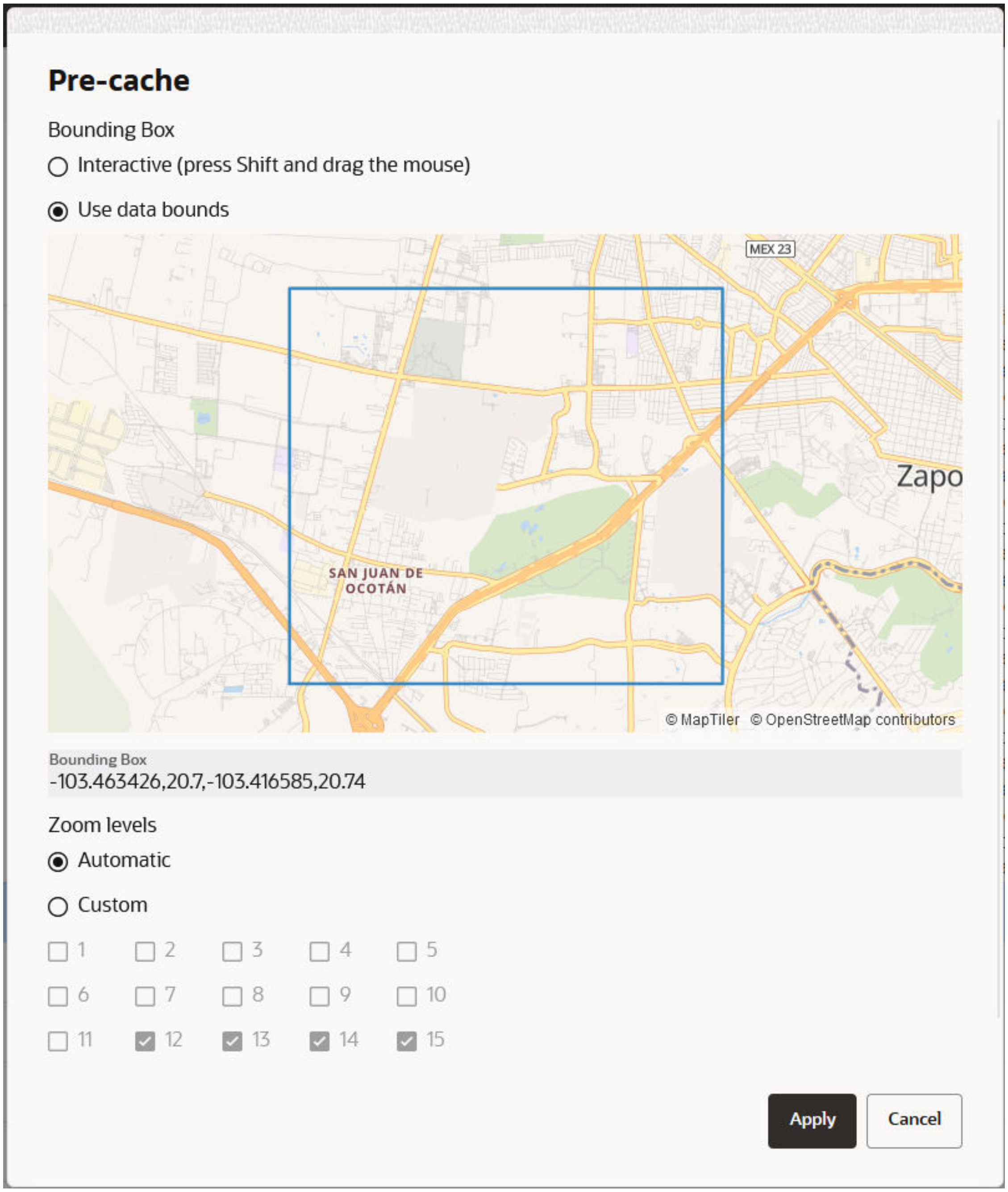
3.6.10.1 Pre-Cache

You can trigger a pre-caching task to start generating vector tiles even before a map is loaded with the dataset for visualization.

See Figure 3-45 to access the **Pre-cache** option.

Pre-caching can infer where the data is located and suggest the data bounds for caching. In case if the information is not available, then you can interactively select the part of the world that needs to be included in the pre-caching task. Spatial Studio also suggests the zoom levels that are best suited for the data. However, you can always override this and configure your own choice for the **Zoom levels**.

Figure 3-46   Configuring Zoom Levels for Pre-Caching Task



Pre-cache

Bounding Box

○ Interactive (press Shift and drag the mouse)

● Use data bounds

Bounding Box
-103.463426,20.7,-103.416585,20.74

Zoom levels

● Automatic

○ Custom

☐ 1   ☐ 2   ☐ 3   ☐ 4   ☐ 5
☐ 6   ☐ 7   ☐ 8   ☐ 9   ☐ 10
☐ 11   ☑ 12   ☑ 13   ☑ 14   ☑ 15

Note:

Based on the complexity of the data and the number of zoom levels to pre-cache, this task could take from a couple of minutes to several hours. Therefore, be cautious on what you opt to include in this process as the database connections and CPU usage could heavily be impacted by this task.

The pre-cached tiles are saved in the file system, following the name pattern discussed in the earlier section. Extra information about the bounding rectangle and zoom levels that were pre-cached are included in the `tiles.json` file as shown:

```
{
  "DatasetName" : "DATASET NAME",
  "DatasetId" : "8da55629d3ca71aa37d859422a847257",
  "GeometryColumn" : "GEOM_COL_NAME",
  "ZoomLevels" : [ 13, 14, 15 ],
  "BoundingBox" : [ -103.455841, 20.708551, -103.421479, 20.73044 ]
}
```

3.6.10.2 Purge Cache

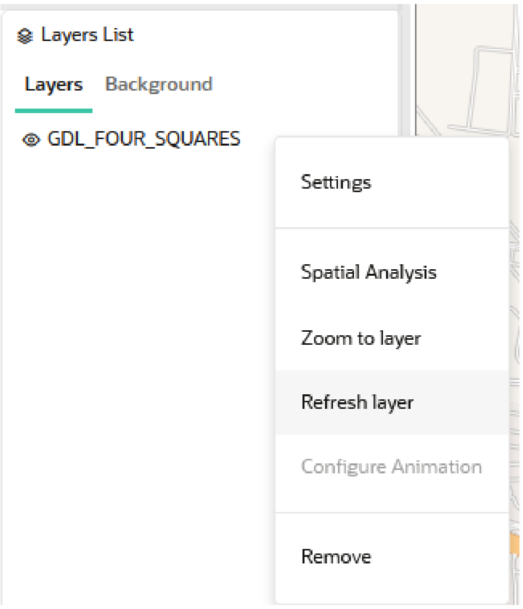
You can wipe the cached tiles by calling the **Purge cache** option.

See Figure 3-45 to access the **Purge cache** option.

This option is helpful whenever the database data changes causing the already generated vector tiles to become stale.

Alternatively, you can also select the **Refresh layer** option for each dataset layer that is added to the map visualization in the **Active Project** page as shown:

Figure 3-47 Refresh Map Data Layer



This indirectly triggers a **Purge cache** operation, before generating the vector tiles again.

You must perform a cache purge or layer refresh whenever you apply any of the following changes to a dataset:

- Change the key column of a dataset
- Enable or disable columns of a dataset

- Change the contents of your dataset's source table

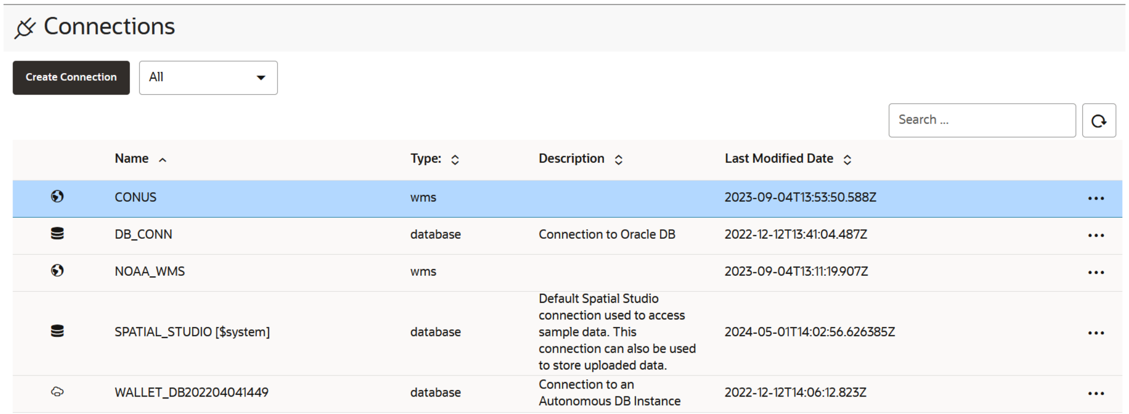
Otherwise, you will be viewing stale data on the map and interacting with this data may also result in errors.

3.7 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 3-48 Connections Page

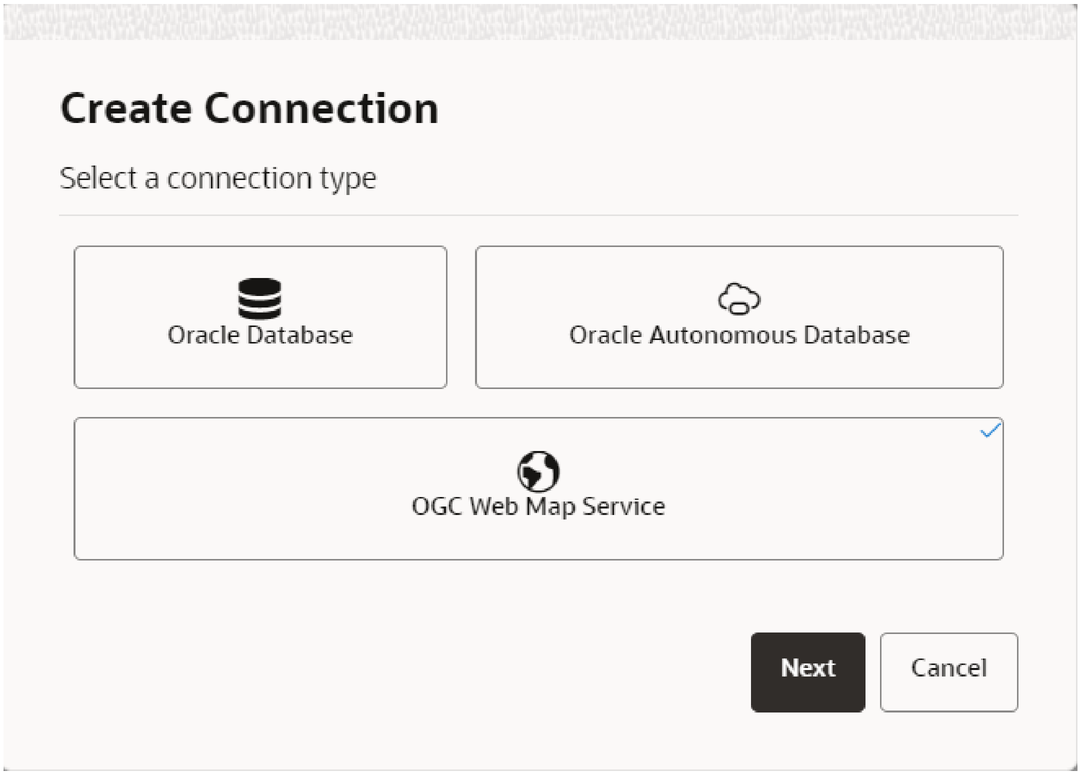


	Name	Type:	Description	Last Modified Date	
	CONUS	wms		2023-09-04T13:53:50.588Z	...
	DB_CONN	database	Connection to Oracle DB	2022-12-12T13:41:04.487Z	...
	NOAA_WMS	wms		2023-09-04T13:11:19.907Z	...
	SPATIAL_STUDIO [$system]	database	Default Spatial Studio connection used to access sample data. This connection can also be used to store uploaded data.	2024-05-01T14:02:56.626385Z	...
	WALLET_DB202204041449	database	Connection to an Autonomous DB Instance	2022-12-12T14:06:12.823Z	...

You can perform the following actions on the Connections page:

- You can create a new connection, by clicking **Create Connection**.

Figure 3-49 Create Connection



As seen in the preceding figure, you can create a connection to the following sources:

- **Oracle Database:** You must provide the host, port, schema, and other database authentication details.
- **Oracle Autonomous Database:** You must provide the wallet and the connection details.
- **OGC Web Map Service:** You must provide the URL to connect to the WMS service.

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

  - **Migrate:** To migrate the connection from one environment to another
  - **Replace Cloud Wallet:** To replace the cloud wallet for your Autonomous Database Connection
  - **Test Connection:** To validate the connection
  - **Delete:** To delete the connection along with all its datasets

> **Note:**
>
> You cannot delete the SPATIAL_STUDIO connection.

- Creating an Oracle Database Connection
  You can create a Spatial Studio connection to any Oracle Database schema.
- Creating a Cloud Connection to an Autonomous Database Instance
  You can create a Spatial Studio connection to an Autonomous Database instance.
- Creating an OGC WMS Connection
  You can create a new connection to an external OGC (Open Geospatial Consortium) WMS (Web Map Service) service.
- Migrating Database Connections
  You can migrate your connections in Spatial Studio between on-premises and cloud database environments.

3.7.1 Creating an Oracle Database Connection

You can create a Spatial Studio connection to any Oracle Database schema.

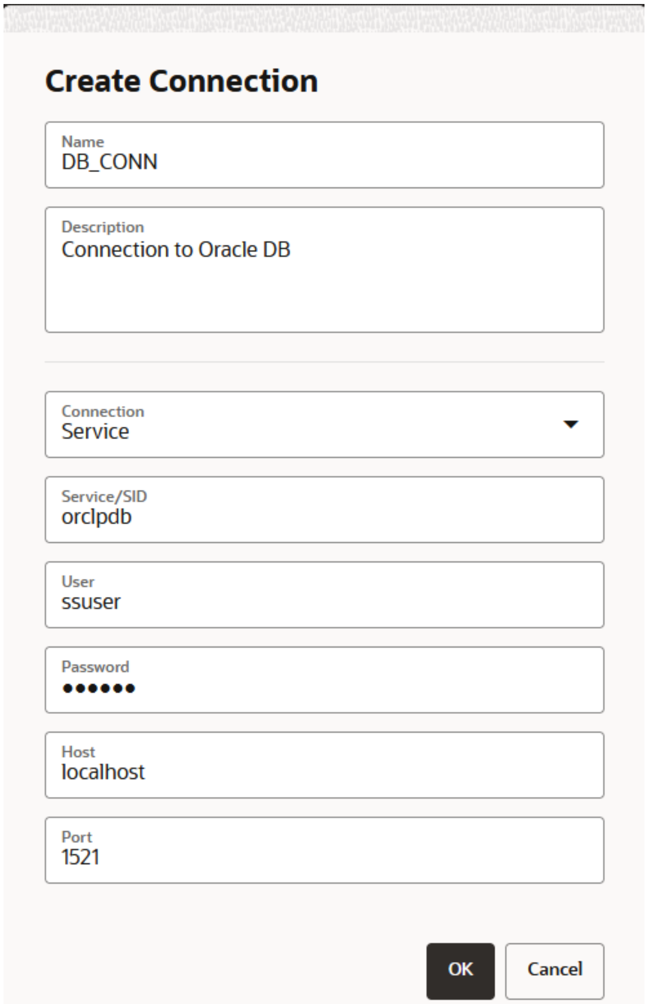
You can perform the following steps to setup a connection to the database:

1. Navigate to the **Connections** page.
2. Click **Create Connection**.

   The **Create Connection** dialog opens as shown in Figure 3-49.
3. Select **Oracle Database** as the connection type and click **Next**.

   The **Create Connection** dialog open as shown:

Figure 3-50 Creating a Connection to the Oracle Database



Create Connection

Name: DB_CONN

Description: Connection to Oracle DB

Connection: Service

Service/SID: orclpdb

User: ssuser

Password: ●●●●●●

Host: localhost

Port: 1521

4. Enter the Spatial Studio connection **Name**.
5. Optionally, enter a **Description**.
6. Select the database **Connection** type.

   The supported types are:

   - **Service**
   - **SID**
7. Enter the **Service/SID** value depending on your connection type.
8. Enter the database **User** name and the **Password** for the user.

   Note that when the database user password expires, Spatial Studio will prompt you to reestablish the schema connection. Then the **Create Connection** dialog is displayed with prefilled metadata schema details.
9. Enter the **Host** and **Port** details.
10. Click **OK**.

    The Oracle Database connection gets created. This **database** type connection is displayed on the **Connections** page.

3.7.2 Creating a Cloud Connection to an Autonomous Database Instance

You can create a Spatial Studio connection to an Autonomous Database instance.

As a prerequisite, you must download and save the wallet for your Autonomous Database instance from the Oracle Cloud Infrastructure (OCI) console. See Download Client Credentials (Wallets) for more information.

You can perform the following steps to setup a cloud connection to your Autonomous Database instance:

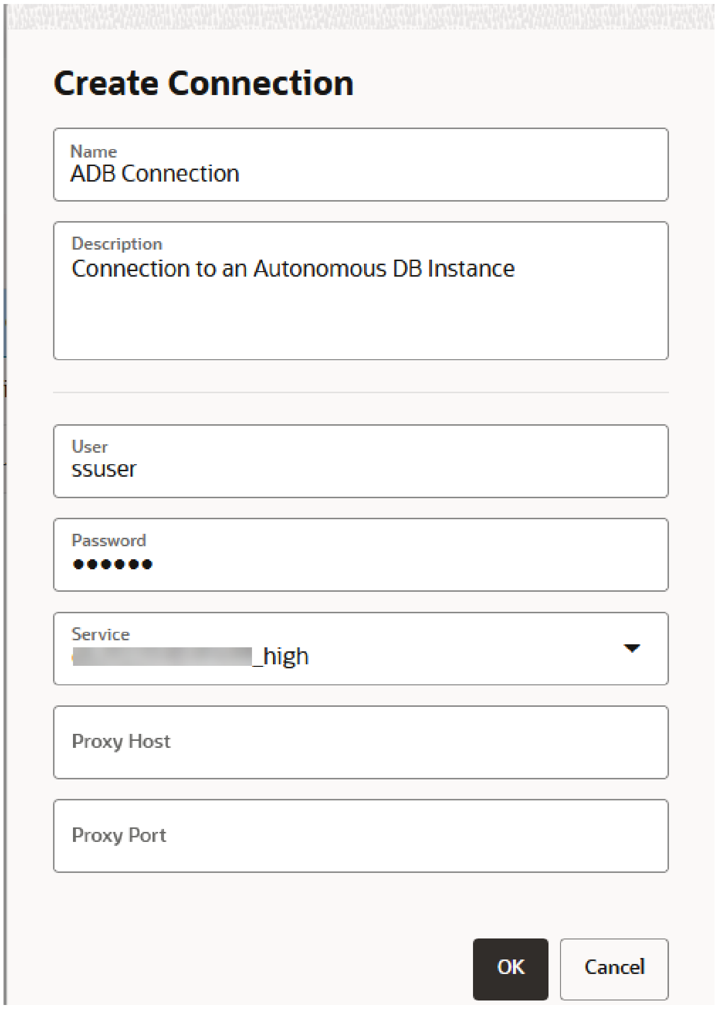
1. Navigate to the **Connections** page.
2. Click **Create Connection**.

   The **Create Connection** dialog opens as shown in Figure 3-49.
3. Select **Oracle Autonomous Database** as the connection type and click **Next**.

   The **Upload wallet** dialog opens.
4. Drag and drop your saved wallet file or click to upload the wallet from your system.
5. Click **OK**.

   The **Create Connection** dialog opens as shown:

Figure 3-51 Creating a Connection to an Autonomous Database Instance



Create Connection

Name
ADB Connection

Description
Connection to an Autonomous DB Instance

User
ssuser

Password
●●●●●●

Service
[redacted]_high

6. Optionally, change the default Spatial Studio connection **Name**.
7. Optionally, enter a **Description**.
8. Enter the Autonomous Database **User** name and the **Password** for the user.
9. Select the appropriate **Service** from the drop-down list.
10. Optionally, enter the **Proxy Host** and **Proxy Port** details.
11. Click **OK**.

    The connection to the Autonomous Database instance gets created. This **database** type connection is displayed on the **Connections** page.

3.7.3 Creating an OGC WMS Connection

You can create a new connection to an external OGC (Open Geospatial Consortium) WMS (Web Map Service) service.

This enables you to create an OGC WMS dataset which can be used in map visualizations. Note that a WMS service or server typically offers many individual map layers that can be combined in different orders. The full list of available map layers, as well as many other important supported functionalities are all advertised by the WMS server through a standard WMS `GetCapabilities` response.

When you create a new WMS connection, Spatial Studio will be querying such capabilities against the external WMS server using the standard `GetCapabilities` call. Based on the result of such a query, you will later be able to choose the required WMS map layers that must be included when creating a new Spatial Studio WMS dataset.

Prior to creating a WMS connection, if the Spatial Studio server is running behind a fire wall, then you must configure the Web Proxy using the **General** panel in the Console page. This is to enable Spatial Studio to access the WMS server (which can either be running on the same data center or remotely) from the server side.

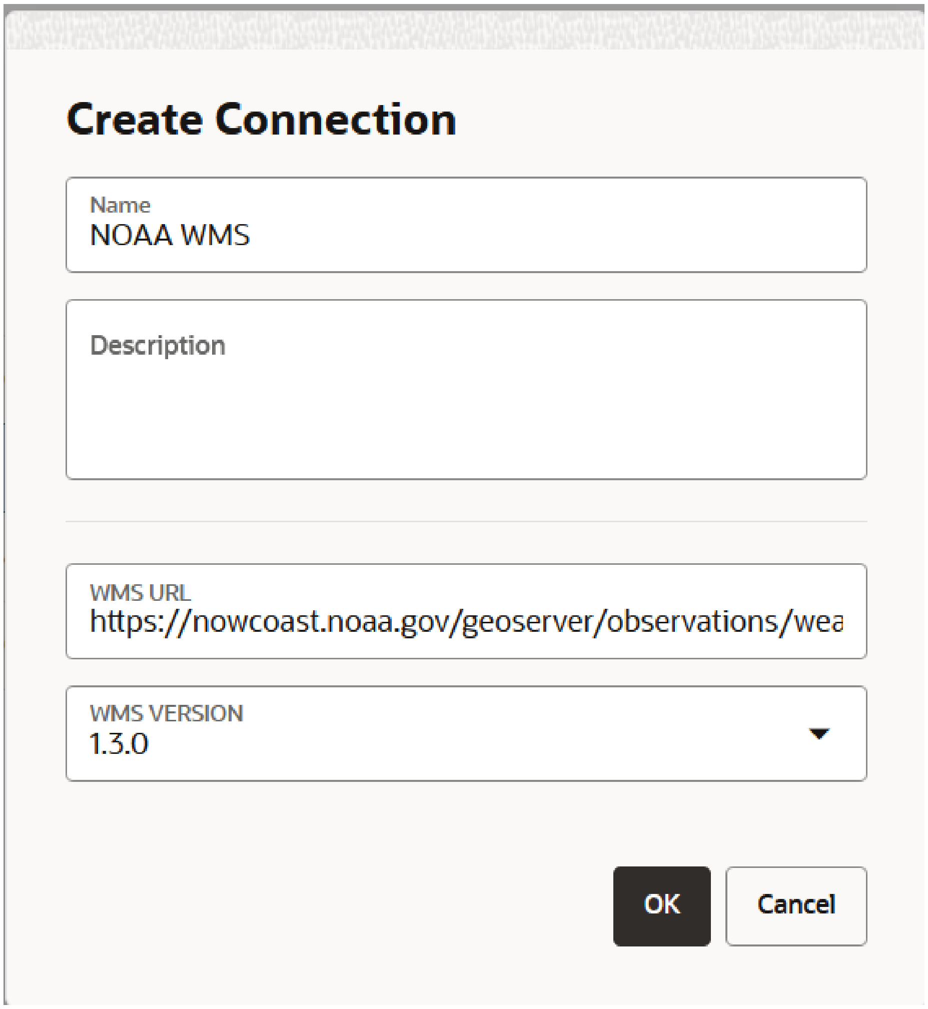
You can perform the following steps to create an OGC WMS connection:

1. Navigate to the **Connections** page.
2. Click **Create Connection**.

   The **Create Connection** dialog opens as shown in Figure 3-49.
3. Select **OGC Web Map Service** as the connection type and click **Next**.

   The **Create Connection** dialog open as shown:

Figure 3-52 Creating an OGC WMS Connection



Create Connection

Name
NOAA WMS

Description

WMS URL
https://nowcoast.noaa.gov/geoserver/observations/wea

WMS VERSION
1.3.0

4. Enter the connection **Name**.

5. Optionally, enter a **Description**.
6. Enter the **WMS URL** to connect to the WMS service.

   Also, note the following:

   - Ensure that the **WMS URL** is added to the **Safe Domains** list.
   - You can use one of the following two formats for the WMS URL:
     - A complete `GetCapabilities` request, including the version of the WMS specification (1.3.0 is recommended). For instance: `https://nowcoast.noaa.gov/geoserver/observations/weather_radar/ows?SERVICE=WMS&VERSION=1.3.0&REQUEST=GetCapabilities`
     - The base URL of the WMS server. For instance: `https://nowcoast.noaa.gov/geoserver/observations/weather_radar/ows`
7. Optionally, select the **WMS VERSION**.
8. Click **OK**.

   The OGC WMS connection gets created. This **wms** type connection is displayed on the **Connections** page.
   Also, the new WMS connection stores the names of all the available map layers (hosted by the WMS service) and a host of other information based on the **GetCapabilities** response as a part of its metadata.
9. Right-click on the newly created connection, select **Test connection**, and verify that the connection tests successfully.

Related Topics

- Creating an OGC WMS Dataset
  Starting with Spatial Studio release 22.3, you can define datasets that are based on the `GetMap` responses from any external OGC (Open Geospatial Consortium) WMS (Web Map Service) services.
- Visualizing OGC WMS Maps as a Dataset
  You can visualize an OGC (Open Geospatial Consortium) WMS (Web Map Service) dataset on a map.

3.7.4 Migrating Database Connections

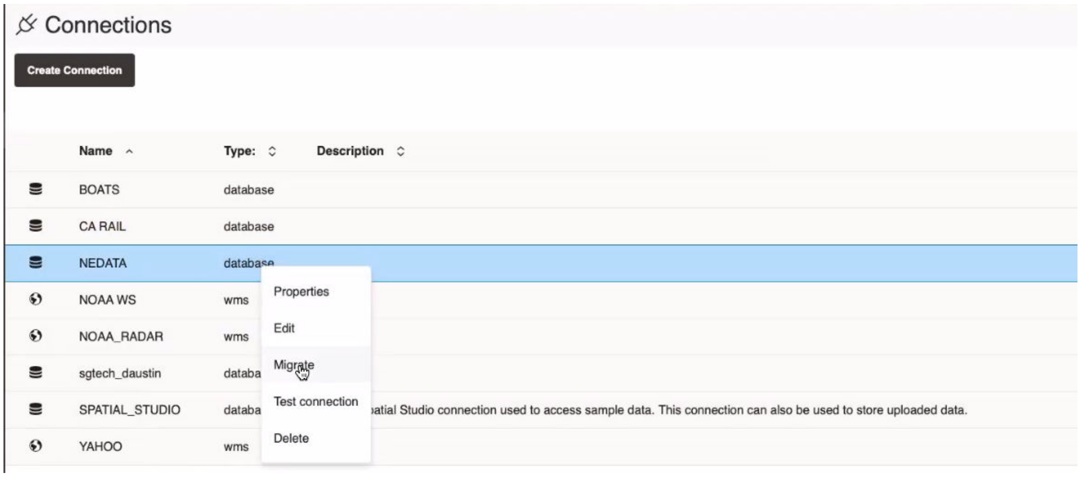
You can migrate your connections in Spatial Studio between on-premises and cloud database environments.

It is possible that you may want to migrate data from your on-premises database to an Autonomous Database instance or the other way around. In such scenarios, you can also migrate the Spatial Studio connection related to the data to the new target data source. Thus, Spatial Studio allows you to continue working with the datasets that were created using the earlier connection properties, without rendering them invalid.
You can perform the following steps to migrate a database connection.

1. Navigate to the **Connections** page.
2. Right-click on the required connection **Name**.

   The context menu for the database connection appears as shown:

Figure 3-53   Migrate Option for a Database Connection

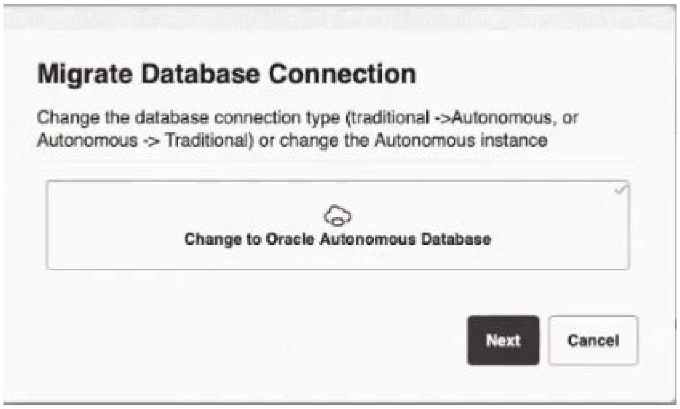


Name	Type:	Description
BOATS	database	
CA RAIL	database	
NEDATA	database	
NOAA WS	wms	
NOAA_RADAR	wms	
sgtech_daustin	databa	
SPATIAL_STUDIO	databa	patial Studio connection used to access sample data. This connection can also be used to store uploaded data.
YAHOO	wms	

3. Click **Migrate**.

   Migrate Database Connection is displayed as shown:

Figure 3-54   Migrate Database Connection



Migrate Database Connection

Change the database connection type (traditional ->Autonomous, or Autonomous -> Traditional) or change the Autonomous instance

Note that in the preceding image, the target environment for migration may vary depending on the current source of the database connection. You can perform the following steps to configure the target environment that applies to you:

- **Migrating from On-Premises Database to Oracle Autonomous Database**:
  a. Click **Next** and provide the **Upload Wallet** details.
  b. Click **OK** and provide the database connection details.
- **Migrating from Oracle Autonomous Database to On-Premises Database**:
  a. Click **Next** and provide the database connection details.
  b. Click **OK**.

The connection gets updated to the new data source.

3.8 Spatial Studio Console Page

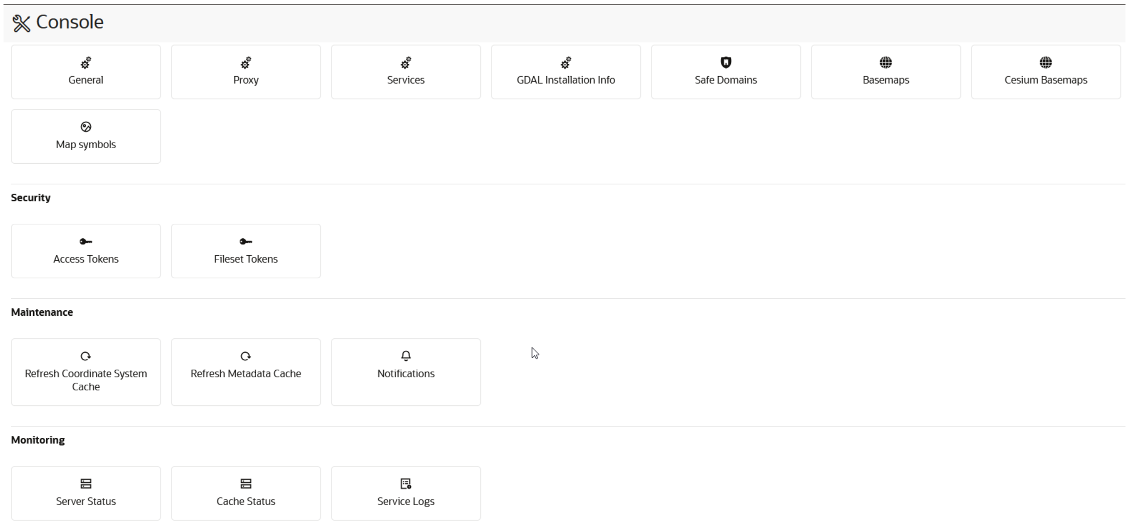
You can monitor the status and activity of Spatial Studio in the Console Page. You can also view server logs, change global system configurations, manage custom basemaps, and configure safe domains.

The Console menu link directs you to the Console page.

> **Note:**
>
> If you are logged in as an administrator of Spatial Studio, then you can access all the supported Console menu options. Otherwise, you can access only the **Map symbols** and **Access Tokens** options under **Settings** and **Security** sections respectively.

The layout of the Console page is as shown:

Figure 3-55 Console Page



The Spatial Studio console page comprises of the following sections:

Settings

- **General**: This slider allows changing the GeoCoding service URL, the geocoding batch size, and the web proxy used by the Studio server. It also allows you to customize the frontend branding area of the application.
- **GDAL Installation Info**: This slider allows you to verify the GDAL SDK and Oracle Instant Client installations and to view the location path on the server for these installations.
- **Safe Domains**: This slider 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. See Managing Safe Domains for more information.
- **Basemaps**: This slider allows a quick view of the existing custom basemaps, and in adding or editing 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 slider 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.
- **Map symbols**: This slider allows you to upload custom map symbols in Spatial Studio. This option is available for both Spatial Studio administrators and regular users.

> **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.

Security

- **Access Tokens**: This slider allows you to create different types of access tokens. This option is available for both Spatial Studio administrators and regular users.
  See About Tokens in Spatial Studio for more information.
- **Fileset Tokens**: This slider allows you to view the existing fileset tokens and also to create a new fileset token.
  See Generating a Fileset Token for more information.

Maintenance

- **Refresh Coordinate System cache**: Use this only when needed to rebuild the text index of the repository database schema’s supported Spatial Reference Well Known Text (WKText) definitions. For the shapefile upload, this WKText 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.
- **Notifications**: You can use this option to set up one or more system notifications. These notifications are displayed across the top of the Spatial Studio application once a user logs in.

Monitoring

- **Server Status**: This section provides read-only information about the general health and system status of the Spatial Studio server.
- **Cache Status**: This section provides the details of the cache maintained by Spatial Studio.
- **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. It also allows the administrator to change the logging level. See Viewing and Managing Server Logs for more information.

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.

- Configuring Custom Branding

- Configuring Zip Upload Settings
- Configuring Web Proxy
- Configuring Service URLs
- Uploading a Map Symbol
- Managing Safe Domains
- Adding a Custom Basemap
- Editing a Custom Basemap
- Managing System Notifications
- Viewing and Managing Server Logs
- Viewing GDAL Installation Info

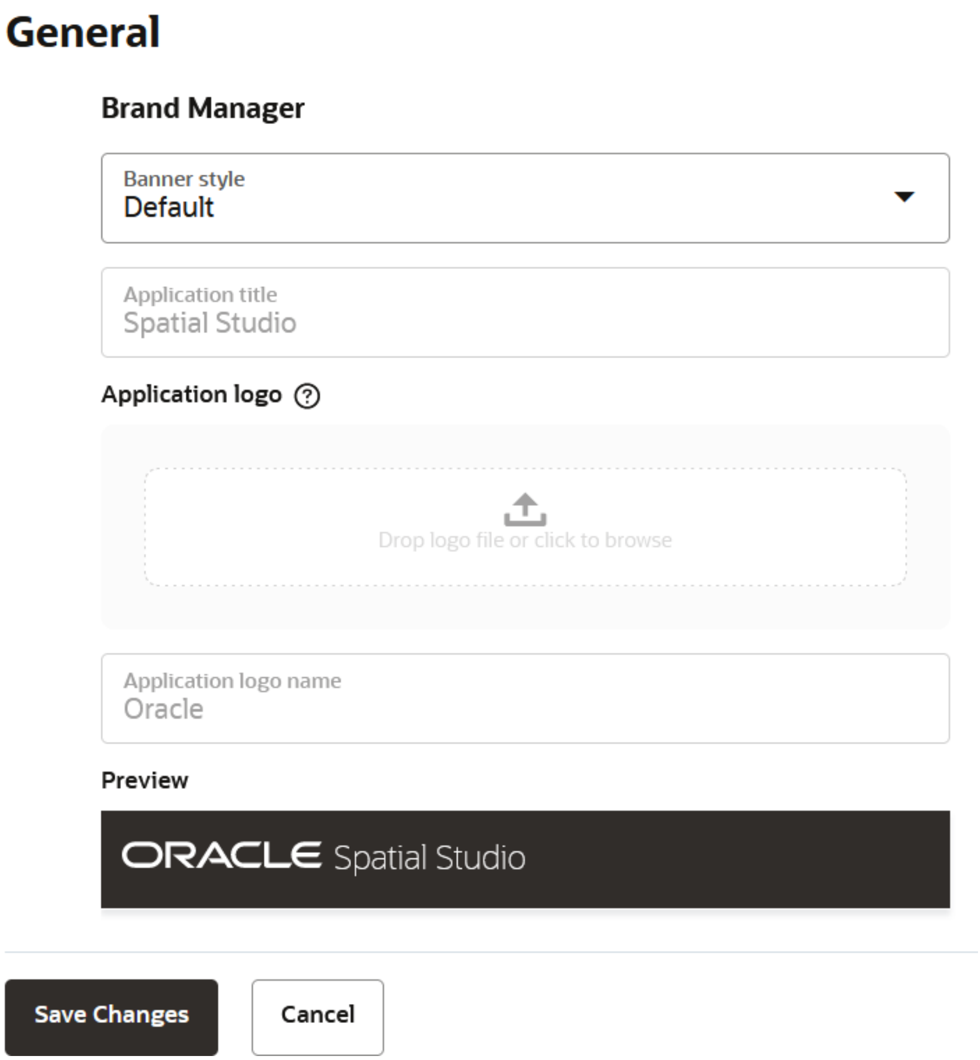
3.8.1 Configuring Custom Branding

As a Spatial Studio administrator, you can use the **Brand Manager** feature in Spatial Studio to upload your brand logo and change the application title as desired.
The following steps enable you to configure custom branding.

1. Navigate to the **Console** page.
2. Click **General** under **Settings**.

   The **Brand Manager** slider opens as shown.

Figure 3-56 Custom Brand Configuration



General

Brand Manager

Banner style: Default

Application title: Spatial Studio

Application logo

Application logo name: Oracle

Preview

3. Select **Custom** from the **Banner style** drop-down list.

   The following two banner styles are supported:

   - **Default:** This is the default configuration which uses **Oracle** branding.
   - **Custom:** Custom configuration allows you to apply your organization's branding.

4. Change the **Application title** as desired.

   The default value is **Spatial Studio**.

5. Upload your own **Application logo**.
6. Enter your **Application logo name**.
7. Preview your changes and click **Save Changes**.

   Note that you need to refresh your page to see the custom brand changes.

3.8.2 Configuring Zip Upload Settings

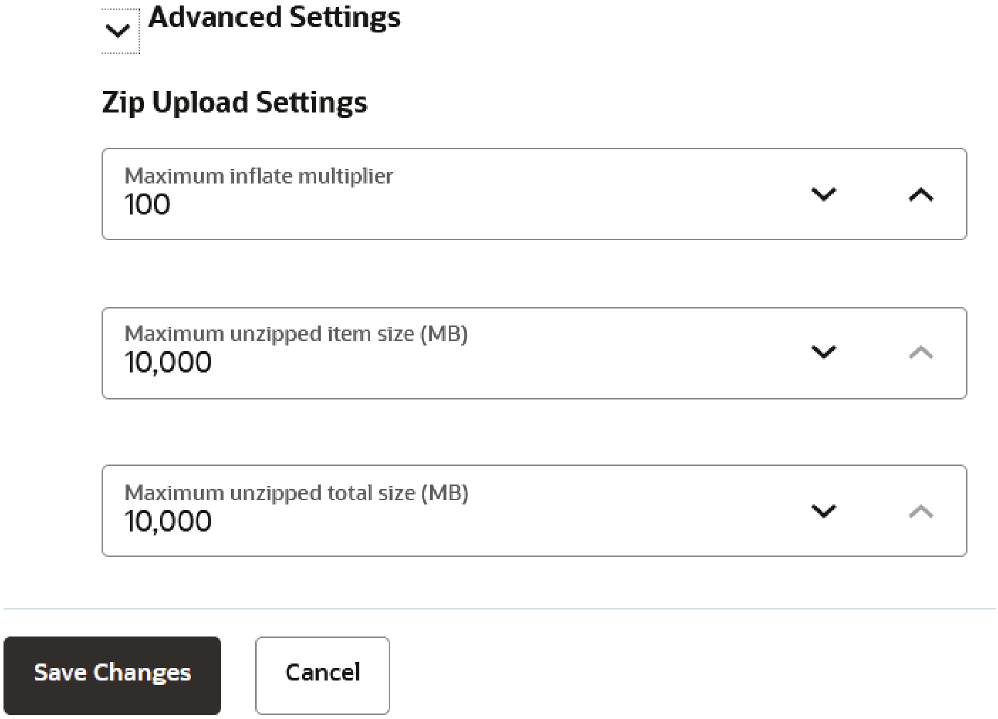
Spatial Studio allows you to create datasets by uploading zip files. As a Spatial Studio administrator, you can set the size limits for these zip files.

Perform the following steps, to change the zip upload settings.

1. Navigate to the **Console** page.
2. Click **General** under **Settings**.

   The **General** slider opens.
3. Click the **Advanced Settings** collapse icon to open the **Zip Upload Settings** as shown:

Figure 3-57 Zip Upload Settings



Advanced Settings

Zip Upload Settings

Maximum inflate multiplier
100

Maximum unzipped item size (MB)
10,000

Maximum unzipped total size (MB)
10,000

4. Change any of the following default configuration options as required.
   - **Maximum inflate multiplier:** Maximum allowed multiplier when inflating files.
   - **Maximum unzipped item size (MB):** Maximum size for an item in the zip file.
   - **Maximum unzipped total size (MB):** Maximum size of the zip file (with all the entries unzipped to the disk).
5. Click **Save Changes**.

3.8.3 Configuring Web Proxy

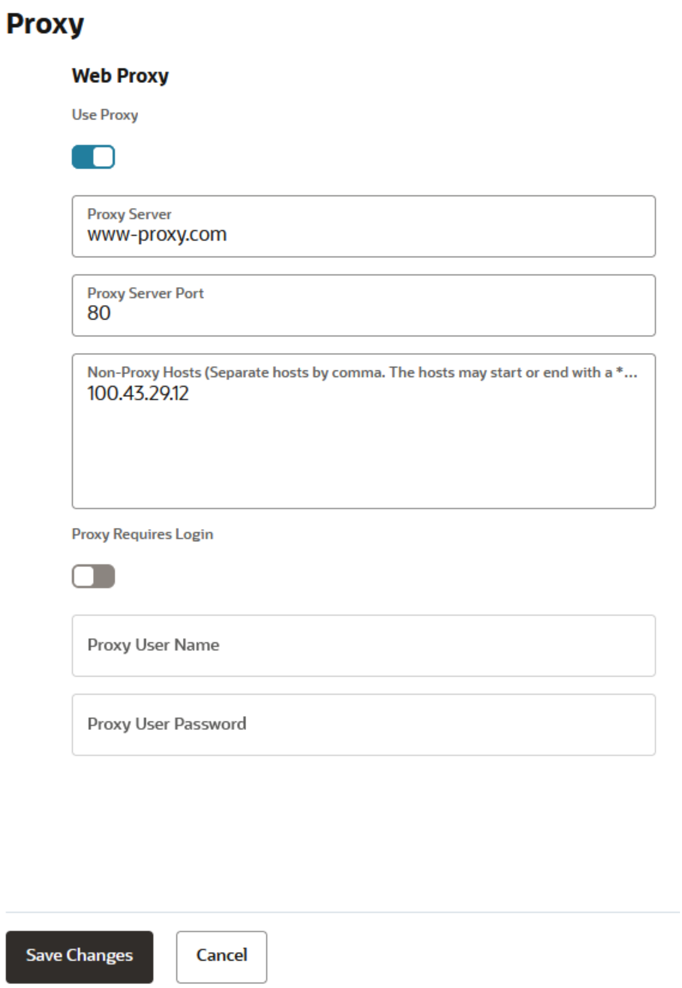
If the Spatial Studio server is running behind a fire wall, then you can configure a web proxy server in your web application.
Note that the web proxy settings only affect the backend Java server when it needs to access an external service or data source through HTTP. One such example is the Oracle Maps cloud services used to geocode the addresses in a dataset. If Spatial Studio is running behind a firewall then the web proxy settings will be used to access the Oracle Maps services which run on the public internet.

Perform the following steps to configure a web proxy server.

1. Navigate to the **Console** page.
2. Click **Proxy** under **Settings**.

   The **Proxy** slider opens as shown:

Figure 3-58 Web Proxy Configuration



Proxy Server
www-proxy.com

Proxy Server Port
80

Non-Proxy Hosts (Separate hosts by comma. The hosts may start or end with a *...
100.43.29.12

3. Switch ON the **Use Proxy** slider.
4. Enter the **Proxy Server** details.
5. Enter the **Proxy Server Port**.
6. Optionally, enter the **Non-Proxy Hosts**.
7. Optionally, switch ON the **Proxy Requires Login** toggle if it applies and provide the **Proxy User Name**/**Proxy User Password** credentials.
8. Click **Save Changes**.

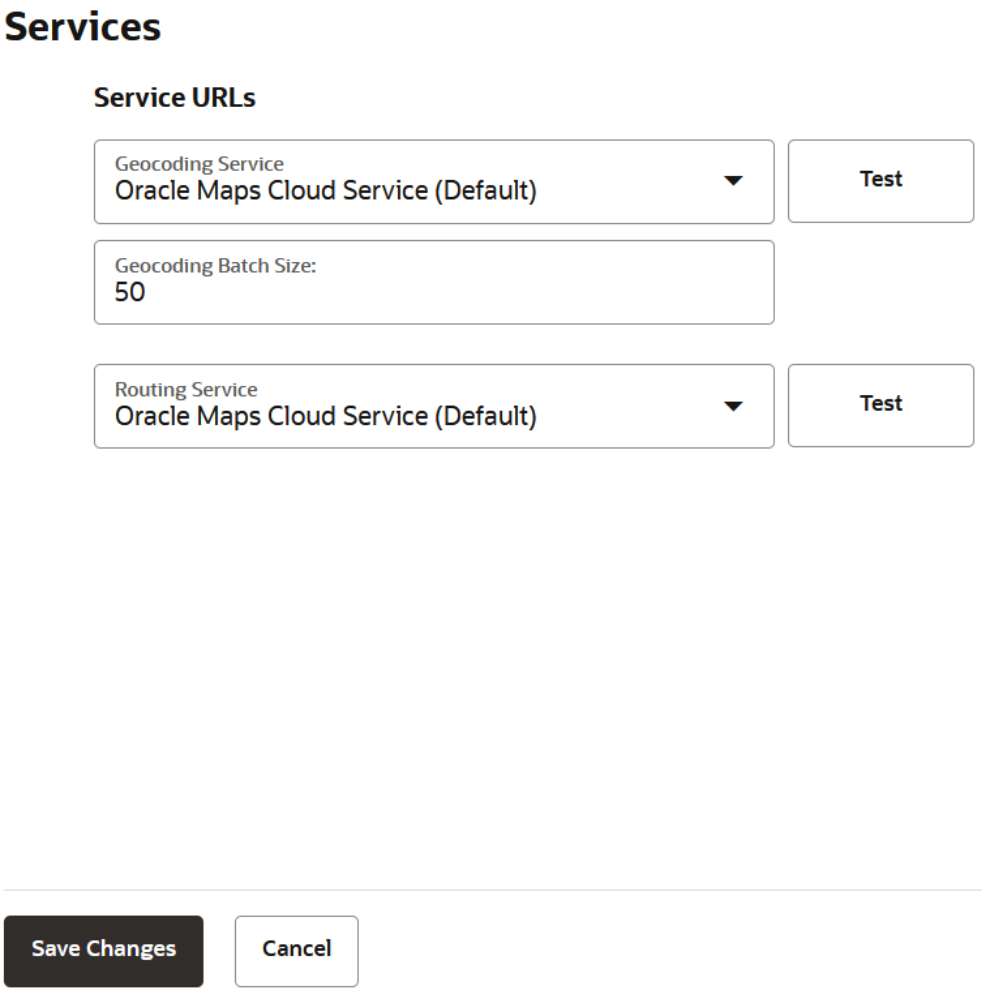
3.8.4 Configuring Service URLs

In order to perform geocoding and routing tasks, you can configure the URL for these services in Spatial Studio if you are an administrator user. You can choose to replace the default URLs with your own service URLs.

1. Navigate to the **Console** page.
2. Click **Services** under **Settings**.

   The **Services** slider opens as shown:

   Figure 3-59   Service URLs Configuration

   Services

   Service URLs

   Geocoding Service: Oracle Maps Cloud Service (Default)

   Geocoding Batch Size: 50

   Routing Service: Oracle Maps Cloud Service (Default)

   The default geocoding and routing service URLs are as shown in the preceding figure.
3. Optionally, change the default URLs for any of the following services as required.

   Geocoding Service

   a. Click the **Geocoding Service** drop-down and select **Custom**.
   b. Enter your own **Geocoding Service URL**.
   c. Change **Geocoding Batch Size** if required.
   d. Click **Test** to verify your connection.

   Routing Service

   a. Click the **Routing Service** drop-down and select **Custom**.
   b. Enter your own **Routing Service URL**.

   c. Click **Test** to verify your connection.

4. Click **Save Changes**.

3.8.5 Uploading a Map Symbol

You can upload custom map symbols (or icons) and also 3D models (in .glb format), which you can use in a Map or Cesium-Map visualization. Starting from Spatial Studio Release 24.1, in addition to administrators, all valid Spatial Studio users can also upload and manage their own custom map symbols.

Also, note the following:

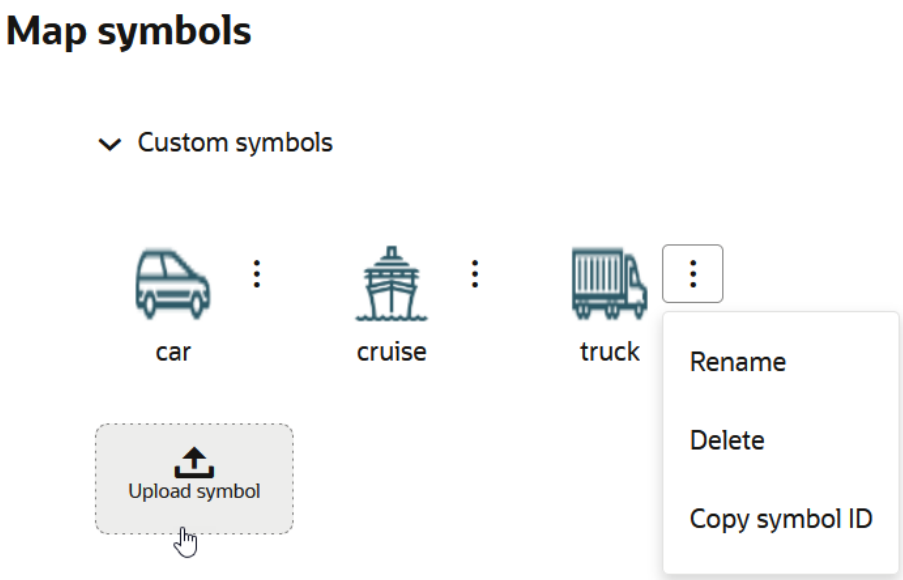
- All uploaded symbols are assigned a globally unique ID. The application always references the symbol using its unique ID, and not by its name. The name of the symbol is used only for display purposes in the application.
- When a regular user (non-administrator) uploads a map symbol, the symbol is visible and accessible only for that specific user and does not become public.
- When an administrator uploads a map symbol, the symbol is accessible in a read-only manner to everyone in the organization. The symbol will show up in the symbol list of any regular Spatial Studio user along with their own symbols.
- Regular users can **Rename** and **Delete** only their own custom map symbols.
- If two different users upload an image file with the same name, then the symbols do not get overwritten as each symbol is referenced by its unique ID.
- When an owner attempts to delete a custom map symbol, Spatial Studio performs a referential check to ensure that the particular symbol is not used in any map visualization.
- The **Copy symbol ID** option can be used when the user wants to explicitly assign and apply different custom symbols to different groups of data, in which case the symbol ID needs to be stored in the source data table in its own column.

The following steps enable you to add a custom map symbol in Spatial Studio.

1. Navigate to the **Console** page.
2. Click **Map symbols** under **Settings**.

   The **Map symbols** slider opens as shown.

Figure 3-60 Uploading a Map Symbol



3. Click the **Custom symbols** collapse icon and click **Upload symbol**.
4. Select the required image file in your system for the upload.

   It is important to note the following:

   - Only `.png`, `.gif`, `.jpg`, and `.glb` file formats are supported.
   - Each file cannot exceed 2 MB in size.
5. Optionally, change the **Symbol name**.
6. Click ✓ to add the custom map symbol.

   Once it is uploaded, you can style your data points on a map visualization using the new symbol. See Applying Custom Map Symbols to a Map Layer for more information.

3.8.6 Managing Safe Domains

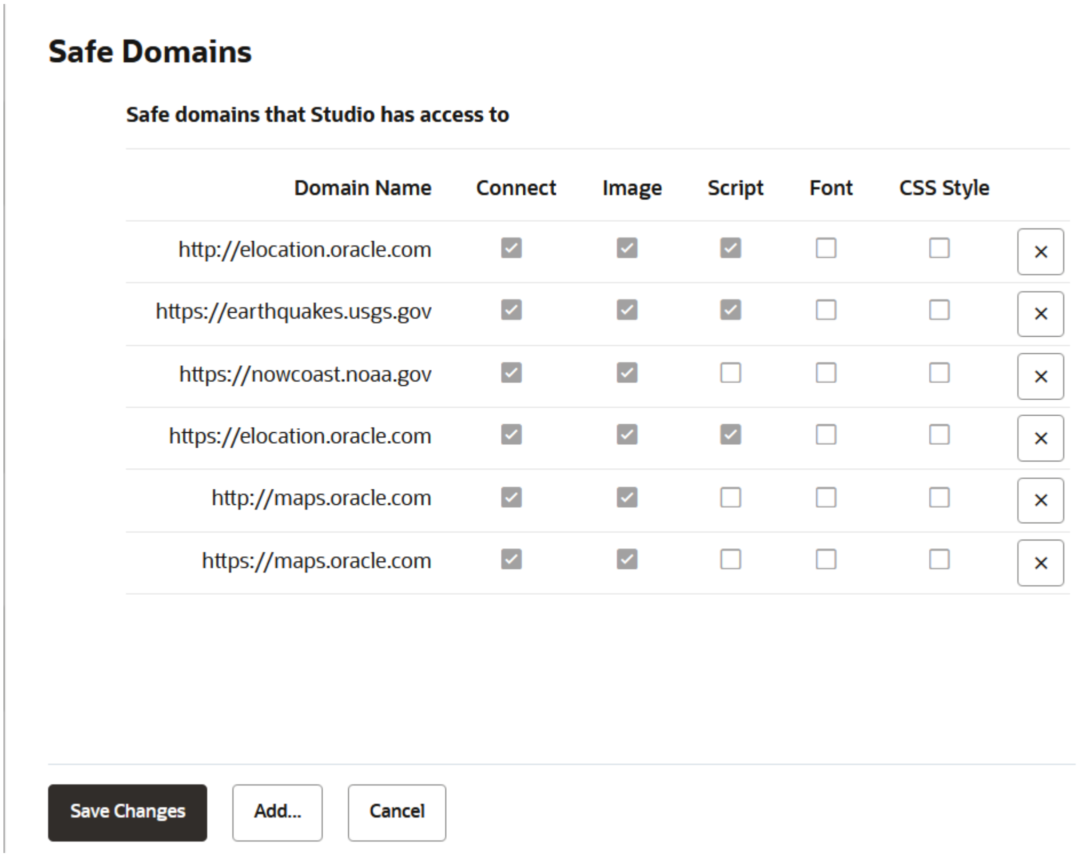
As an administrator, you can add a domain of a custom basemap or a WMS service to the Content Security Policy directives of your Spatial Studio application.
Alternatively, you can edit or delete an existing safe domain.

> **Note:**
>
> If you make any changes to the safe domains list, then it is important that you refresh or reload the browser page to reload the new Content Security Policy.

1. Navigate to the **Console** page.
2. Click **Safe Domains** under Settings.

   The list of safe domains to which Spatial Studio has access is displayed as shown:

Figure 3-61   Safe Domains



Safe Domains

Safe domains that Studio has access to

Domain Name	Connect	Image	Script	Font	CSS Style	
http://elocation.oracle.com	☑	☑	☑	☐	☐	×
https://earthquakes.usgs.gov	☑	☑	☑	☐	☐	×
https://nowcoast.noaa.gov	☑	☑	☐	☐	☐	×
https://elocation.oracle.com	☑	☑	☑	☐	☐	×
http://maps.oracle.com	☑	☑	☐	☐	☐	×
https://maps.oracle.com	☑	☑	☐	☐	☐	×

You can choose to perform one of the following actions:

- **Adding a safe domain**
    a. Click **Add**.
    A new row gets added to the end of the safe domains table list.
    b. Double-click the **Domain Name** cell of the empty new row to enter the new domain.
    Ensure that you enter only the domain part of an external URL (that is, the protocol, host name or IP address, and port) from which you will be fetching the resources. For instance, `https://wms.mycompany.com:8080` or `https://wms.mycompany.com`.

    Note that the protocol is a part of the domain and should be based on the URL of the remote service. For instance, if you defined a WMS data source or a custom base map in Spatial Studio, and the URL to the WMS server or the custom base map's tile server starts with `https://`, then you must use `https://`. If it starts with `http://`, then use `http://`. In case if both the protocols are used (maybe one is used to fetch some resources while the other is used for a different type of resource), then you need to add the domain twice, one with the `http://` protocol and another with the `https://` protocol. Spatial Studio performs safe domain validation strictly based on the value you added to the list.
    c. Select the appropriate check boxes.
    The check boxes represent Content Security Policy fetch directives.

        - **Connect:** This corresponds to the CSP `connect-src` directive, and indicates whether Spatial Studio is allowed to interact with the domain via script interface (such as AJAX calls).
        - **Image:** this corresponds to the CSP `img-src` directive, and indicates whether Spatial Studio is allowed to fetch images from the domain.
        - **Script:** this corresponds to the CSP `script-src` directive, and indicates whether Spatial Studio is allowed to import or load scripts hosted by the specified domain.
        - **Font:** this corresponds to the CSP `font-src` directive, and indicates whether Spatial Studio is allowed to load font data from the specified domain.
        - **CSS Style:** this corresponds to the CSP `style-src` directive, and indicates whether Spatial Studio is allowed to load stylesheet from the specified domain.

        It is important to understand what type of resources you will be fetching from the specific domain. For instance, if you select the check box **Script**, then it implies that you are enabling your browser to fetch Java Script type resources from the domain.

        In case if you are adding a safe domain for a WMS data source, then you likely need to enable the following check boxes:

        - **Connect:** This is required because Spatial Studio needs to interact with a remote WMS data source to check its capabilities using AJAX calls.
        - **Image:** This is needed because eventually Spatial Studio needs to fetch individual WMS map images from the remote WMS server.

        Note that when a check box is selected, the domain URL gets added to a list of all the allowed URLs for the corresponding CSP directive. For instance, consider that the domain `https://www.mycompany.com` is added as a safe domain with the **Connect** check box selected. Then, when you reload Spatial Studio, the CSP header loaded by the browser will now include `https://www.mycompany.com` in its `connect-src` directive's list of domain values.

    d. Click **Save Changes**.

    e. Ensure to refresh or reload the browser page.

- **Editing a safe domain**
    - Double-click the required safe domain table row and edit the required details.
    - Click **Save Changes**.
    - Ensure to refresh or reload the browser page.
- **Deleting a safe domain**
    - Double-click the required safe domain row in the table.
    - Click ✕ and confirm delete by clicking **OK**.
    - Click **Save Changes**.
    - Ensure to refresh or reload the browser page.

3.8.7 Adding a Custom Basemap

The following steps enable you to add a custom basemap.

1. Navigate to the **Console** page.

2. Click **Basemaps** under Settings.

   The **Basemaps** window listing all the available basemaps opens.

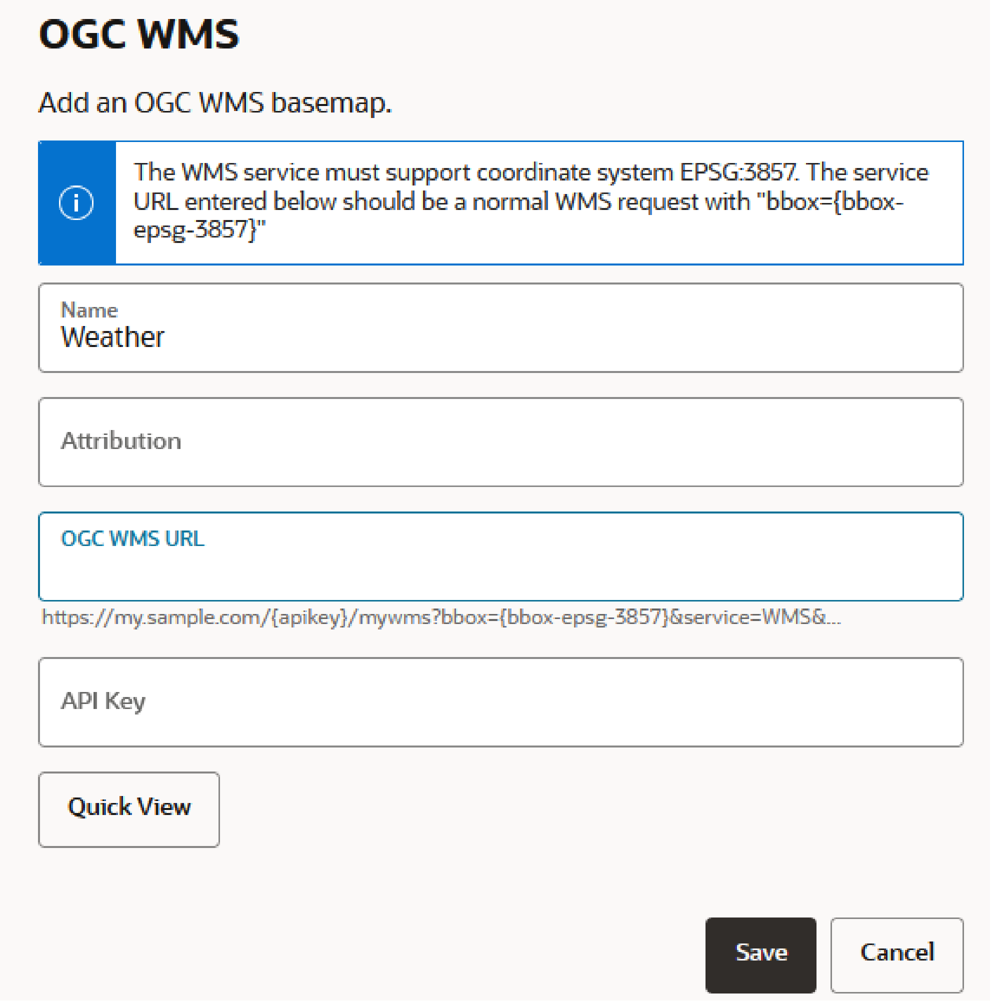
3. Click **Add Basemap** and click on one of the following basemap types:
   - XYZ Raster tiles
   - OGC WMS
   - Vector tiles
4. Enter **Name** and **URL** for the selected basemap type.
5. Optionally enter **Attribution** and **API Key**.

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

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

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

Figure 3-62 Adding a OGC WMS Map



OGC WMS

Add an OGC WMS basemap.

The WMS service must support coordinate system EPSG:3857. The service URL entered below should be a normal WMS request with "bbox={bbox-epsg-3857}"

Name
Weather

https://my.sample.com/{apikey}/mywms?bbox={bbox-epsg-3857}&service=WMS&...

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.

3.8.8 Editing a Custom Basemap

The following steps enable you to edit a custom basemap.

1. Navigate to the **Console** page.
2. Click **Basemaps** under Settings.

   The **Basemaps** window listing all the available basemaps opens.

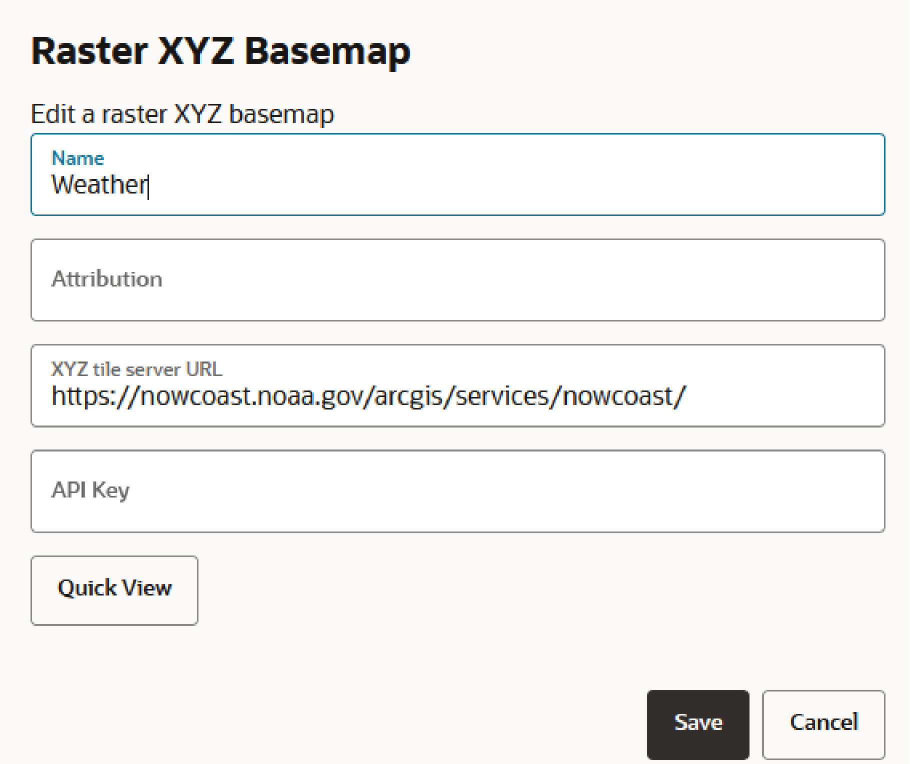
3. Click ••• against the required custom basemap and click **Edit** from the context menu.

   Note:

   Edit is disabled for predefined Spatial Studio maps.

   The custom basemap configuration details are displayed for editing as shown:

   Figure 3-63 Editing a Custom Basemap



Raster XYZ Basemap

Edit a raster XYZ basemap

Name: Weather

XYZ tile server URL: https://nowcoast.noaa.gov/arcgis/services/nowcoast/

4. Modify the required parameters, such as **Name**, **Attribution**, **URL** or **API Key**.
5. Click **Save**.

The custom basemap details are modified and the updates are shown in the **Basemaps** window.

3.8.9 Managing System Notifications

As the Spatial Studio administrator, you can create, edit, or delete system notifications. Spatial Studio supports two types of notifications:

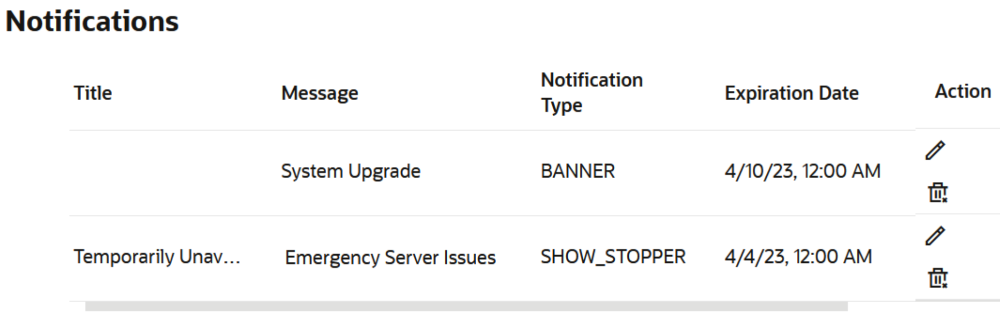
- **Banner:** These notifications are typically used to display informative message such as planned downtime, scheduled updates, and so on. Banner type notifications are displayed across the top of the web application page, just above the built-in Spatial Studio application banner.
- **Show Stopper:** These are messages that will be displayed when the Spatial Studio server is not servicing any requests such as when being investigated for emergency issues or breaches.

You can manage the system notifications as shown in the following steps:

1. Navigate to the **Console** page.
2. Click **Notifications** under Maintenance.

   The **Notifications** window listing all the configured notifications opens.

Figure 3-64 System Notifications



Notifications

Title	Message	Notification Type	Expiration Date	Action
	System Upgrade	BANNER	4/10/23, 12:00 AM	✎ 🗑
Temporarily Unav...	Emergency Server Issues	SHOW_STOPPER	4/4/23, 12:00 AM	✎ 🗑

3. Perform any one of the following required actions.
   - **Create a New Notification**
     a. Click **Create**.
     b. Select the **Notification Type**.
     c. Enter **Severity**, **Expiration Date (in UTC)**, and **Message** for banner notifications.
     d. Enter **Title**, **Expiration Date (in UTC)**, and **Message** for show stopper notifications.
     e. Click **OK**.

     The new notification appears in the **Notifications** dialog.
   - **Edit a Notification**

     Click ✎ against a notification to edit the message details.
   - **Delete a Notification**

     Click 🗑 against a notification to delete the notification.

3.8.10 Viewing and Managing Server Logs

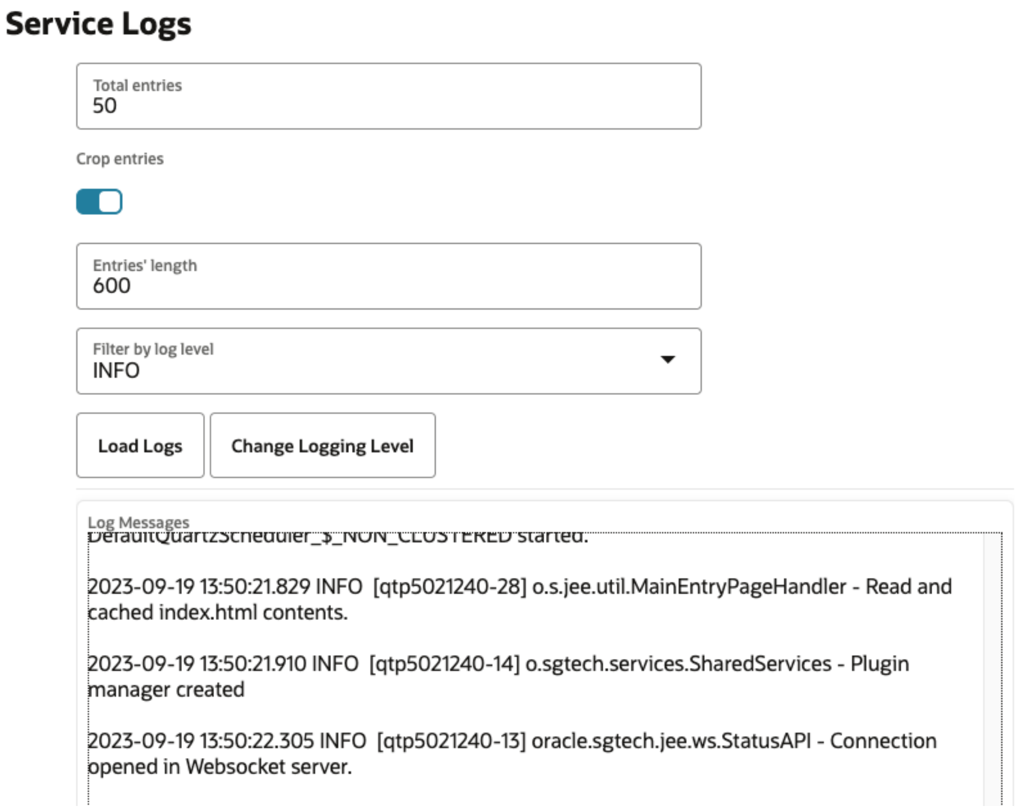
You can always view the most recent log messages generated by the server in your Spatial Studio application.

Perform the following steps to view and manage these server logs.

1. Navigate to the **Console** page.
2. Click **Service Logs** under Monitoring.

   The **Service Logs** slider opens as shown.

Figure 3-65 Service Logs



Service Logs

Total entries
50

Crop entries

Entries' length
600

Filter by log level
INFO

Log Messages

```
DefaultQuartzScheduler_$_NON_CLUSTERED started.

2023-09-19 13:50:21.829 INFO  [qtp5021240-28] o.s.jee.util.MainEntryPageHandler - Read and
cached index.html contents.

2023-09-19 13:50:21.910 INFO  [qtp5021240-14] o.sgtech.services.SharedServices - Plugin
manager created

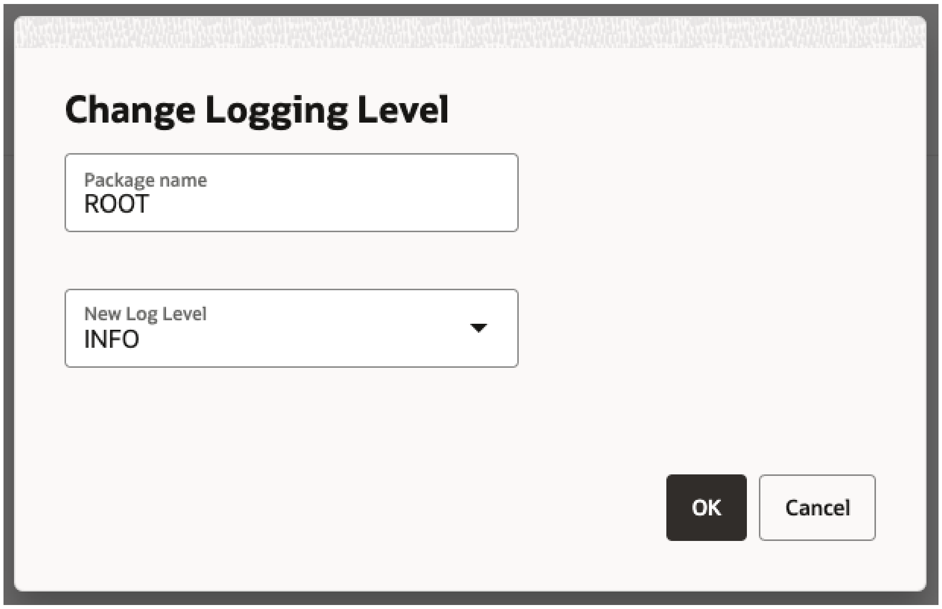
2023-09-19 13:50:22.305 INFO  [qtp5021240-13] oracle.sgtech.jee.ws.StatusAPI - Connection
opened in Websocket server.
```

3. Optionally, configure any of the following fields to customize the logs that are fetched from the server.
   - **Total entries:** This limits how many log messages or records will be loaded from the server.
   - **Crop entries:** If switched ON, then any log message with a very long string will be cropped when viewed.
   - **Entries' length:** This determines the crop length.
   - **Filter by log level:** This drop-down list allows you to filter the server logs so that only those logged at the selected level or higher (more severe in nature) will be fetched from the server for display.
     The supported log levels are:

  - ERROR
  - WARN
  - INFO
  - DEBUG
  - TRACE
- **Load Logs:** Click this button to reload the logs from the server when you change any of the preceding configurations.

4. Optionally, click **Change Logging Level** to change the server's logging level.

   Change Logging Level window opens as shown.



Change Logging Level

Package name: ROOT

New Log Level: INFO

   The **Change Logging Level** button allows the administrator user to dynamically change the logging level used by the server without restarting it.

   Sometimes it may become necessary to change the logging level, so that the Spatial Studio server can log more or less messages, or generate `DEBUG` or `TRACE` level messages for a specific functional area in order to diagnose a certain issue. By default, Spatial Studio uses the `INFO` log level, which means only log messages generated at the level `INFO`, `WARN`, or `ERROR` will be written to the log file (default location is `<OS_USER_HOME_DIR>/.sgtech/logs/sgtech.log`).

   a. Optionally, change any of the following configuration.
      - **Package name:** This specifies the area of the server that will be affected by the new logging level. If you specify `ROOT` (the default value), then the new logging level will affect all areas or functions of the Spatial Studio server. However, you can also enter a specific Java package name (maybe based on suggestions from your Oracle Support team), such as `oracle.sgtech.jee.api` when debugging issues related to Spatial Studio instance’s REST API end points. When a specific package name is entered, then the new log level will only take effect when code from that package is executed.
      - **New Log Level:** This drop-down list allows you to select the new log level to be applied to the server’s specific package or the entire server (default `ROOT`).

   b. Click **OK**.

Note that the log files may take a while to be filled with the messages logged at the new level.

3.8.11 Viewing GDAL Installation Info

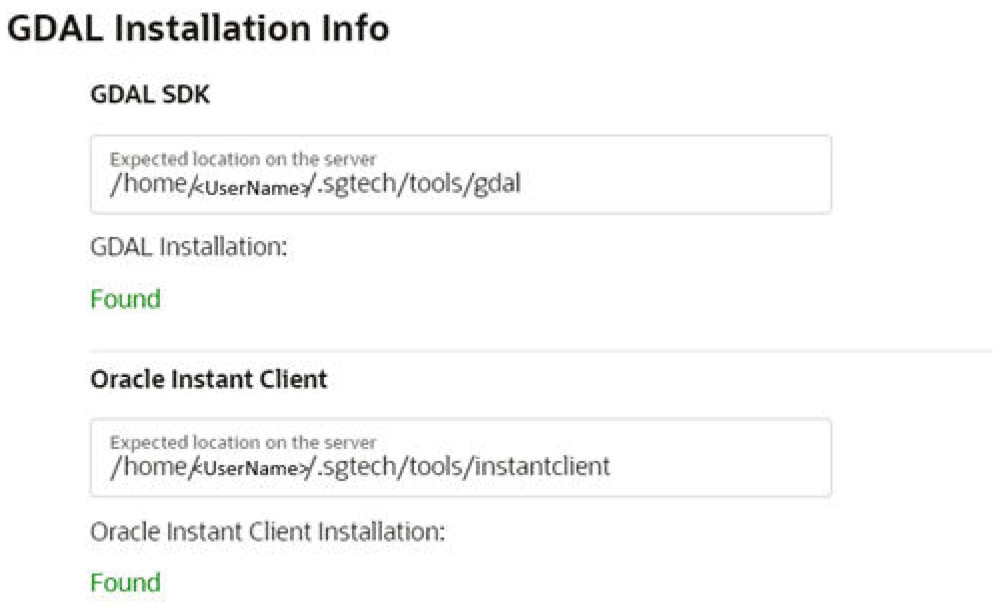
In order to upload raster imagery from files into the database, Oracle Instant Client and GDAL SDK needs to be configured correctly in Spatial Studio. You can verify if these installations are successful and view the location of these installations on the Console page.

Perform the following steps to view the GDAL installation info.

1. Navigate to the **Console** page.
2. Click **GDAL Installation Info** under Settings.

   The **GDAL Installation Info** slider opens as shown.

Figure 3-66 GDAL Installation Info



GDAL Installation Info

GDAL SDK

Expected location on the server
/home/<UserName>/.sgtech/tools/gdal

GDAL Installation:

Found

Oracle Instant Client

Expected location on the server
/home/<UserName>/.sgtech/tools/instantclient

Oracle Instant Client Installation:

Found

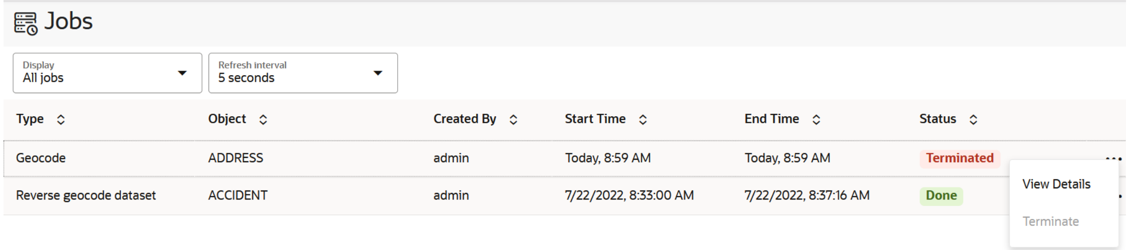
Depending on whether the GDAL SDK and Oracle Instant Client installations exist or not, the corresponding message *Found* or *Not Found* is displayed.

3.9 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 3-67 Jobs Page



Display: All jobs

Refresh interval: 5 seconds

Type	Object	Created By	Start Time	End Time	Status
Geocode	ADDRESS	admin	Today, 8:59 AM	Today, 8:59 AM	Terminated
Reverse geocode dataset	ACCIDENT	admin	7/22/2022, 8:33:00 AM	7/22/2022, 8:37:16 AM	Done

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.
- View details of a specific job.
- Terminate a job.
  Also, note the following about terminating a job:
  - You can terminate a `Processing` or `Pending` job.
  - You can terminate all job types except `Create lon-lat index` jobs.
  - Upon termination of a job, partial execution results of the job are maintained. You can choose to clear the partial results. For example, you can perform `Clear Address Geocode` after terminating a `Geocode` job.
  - Only jobs related to H3 aggregations such as `Build H3 Index` are completely rolled back when terminated.

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

- **Type:** The job type, such as "`Geocode`", "`Reverse geocode dataset`" 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

- **Start Time:** The scheduled next run time for jobs with `Pending` status or the actual job start time for any other job status.
- **End Time:** The time at which a job completed.
- **Status:** Indicates the state or progress of a job, which can be:
  - `Pending`
  - `Processing`
  - `Done`
  - `Error`
  - `Terminating`

  - `Terminated`

By clicking ••• against any job row, you can perform the following actions :

- **View Details:** To view extra information, such as the step at which a `Processing` job is currently running or error details for `Error` or `Terminated` jobs. Also, you can terminate a `Processing` job by clicking **Terminate** when viewing the job details.
- **Terminate:** To terminate a `Processing` or `Pending` job directly. It remains disabled for any other job status.

4

Visualization in Oracle Spatial Studio

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

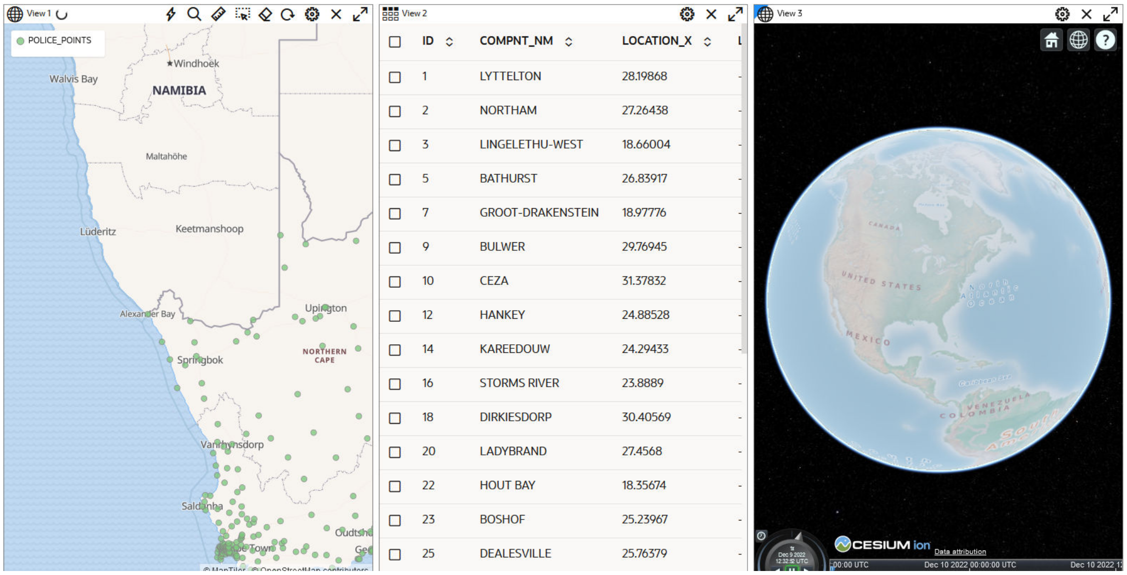
Spatial Studio supports the following visualization methods:

- 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.

Note that Spatial Studio supports multiple map visualizations as shown:

Figure 4-1 Multiple Visualizations



☐	ID	COMPNT_NM	LOCATION_X
☐	1	LYTTELTON	28.19868
☐	2	NORTHAM	27.26438
☐	3	LINGELETHU-WEST	18.66004
☐	5	BATHURST	26.83917
☐	7	GROOT-DRAKENSTEIN	18.97776
☐	9	BULWER	29.76945
☐	10	CEZA	31.37832
☐	12	HANKEY	24.88528
☐	14	KAREEDOUW	24.29433
☐	16	STORMS RIVER	23.8889
☐	18	DIRKIESDORP	30.40569
☐	20	LADYBRAND	27.4568
☐	22	HOUT BAY	18.35674
☐	23	BOSHOF	25.23967
☐	25	DEALESVILLE	25.76379

The following sections explain in detail each of these visualization techniques:

- Using a Table Visualization
  Spatial Studio allows you to visualize your data from the dataset in tables.
- Using a Map Visualization
  Spatial Studio supports several types of map visualizations.
- Using a Cesium Map Visualization
  Spatial Studio uses a CesiumJS plugin that allows you to view 3D visualizations using 3D Tiles or CZML data on a Cesium map.
- Styling a Map Layer
  Spatial Studio allows you to explore different styling options for your map layers, in order to enhance visualization and analysis.

- Filtering Data on a Map Layer
  You can filter on an attribute column of a dataset to determine the data points that must be displayed on a map visualization.
- Adding Interactions to a Map Visualization
  You can enhance your map interaction by configuring tooltips and info windows for the map layers used in the map visualization.
- Multiple Visualizations on a Canvas
  You can work on multiple visualizations in Spatial Studio.
- Configuring a Map Visualization
  Learn how to configure the settings for your map visualization.
- Searching Locations and Features on a Map
  Using the **Search** option, you can quickly find locations and features on a map.
- Changing the Pitch and Bearing of a Map
  You can set the pitch and bearing of a map by tilting or rotating your map in the map visualization panel.

4.1 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 in the Active Project page.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

   This lists the various visualization options.
2. Click and drag **Table** from the list to the visualization window on the right to create a table visualization.

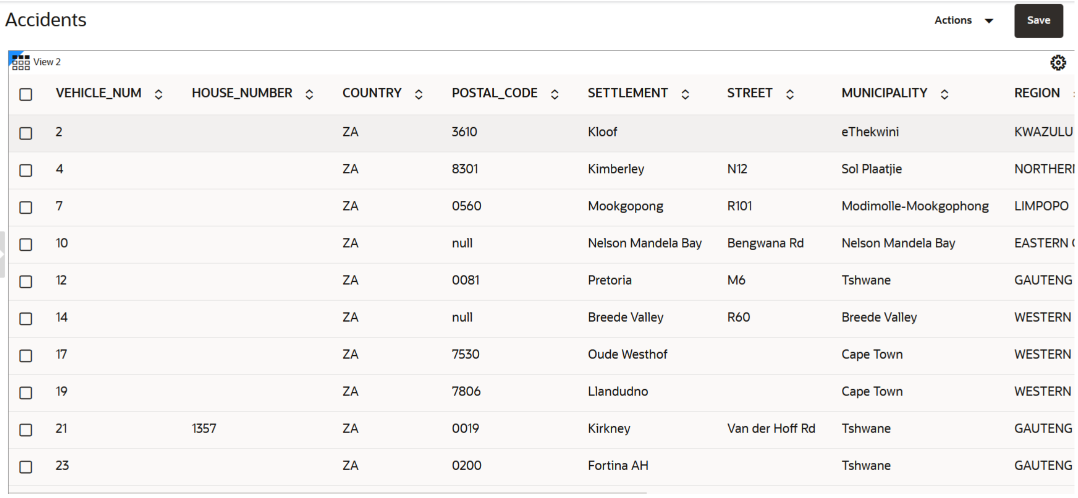
   This opens an empty layer in the visualization window.
3. Click the **Data** tab on the left pane in the Active Project page.

   This lists all the **Datasets** that are loaded for the project.
4. Click and drag the desired **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 4-2 Tabular Visualization



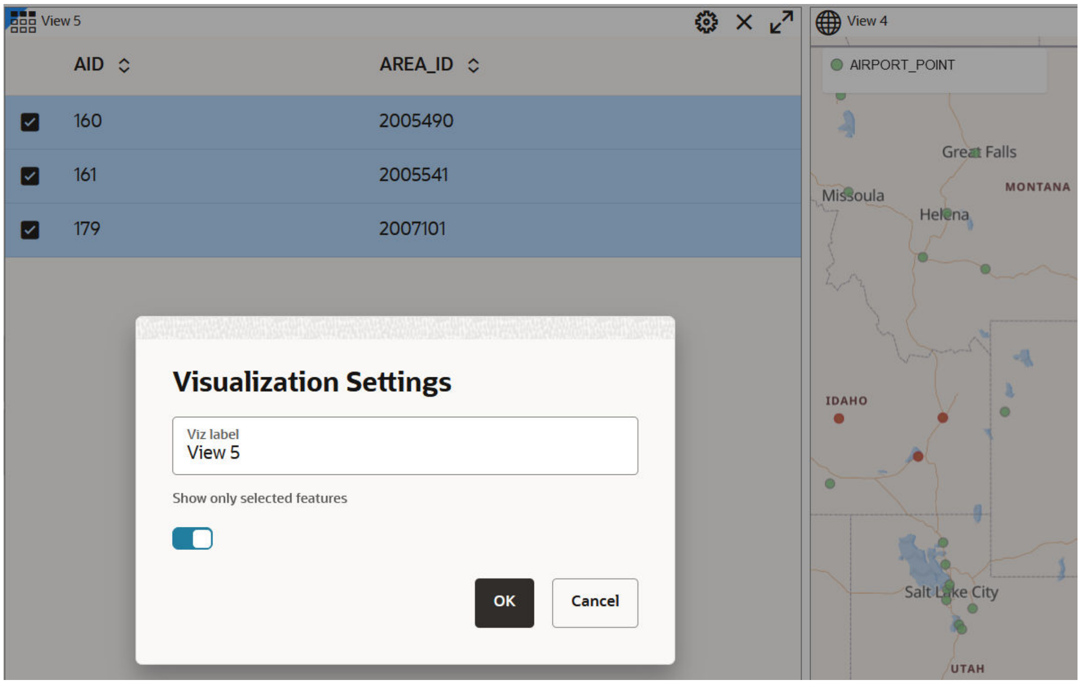
☐	VEHICLE_NUM	HOUSE_NUMBER	COUNTRY	POSTAL_CODE	SETTLEMENT	STREET	MUNICIPALITY	REGION
☐	2		ZA	3610	Kloof		eThekwini	KWAZULU
☐	4		ZA	8301	Kimberley	N12	Sol Plaatjie	NORTHER
☐	7		ZA	0560	Mookgopong	R101	Modimolle-Mookgophong	LIMPOPO
☐	10		ZA	null	Nelson Mandela Bay	Bengwana Rd	Nelson Mandela Bay	EASTERN
☐	12		ZA	0081	Pretoria	M6	Tshwane	GAUTENG
☐	14		ZA	null	Breede Valley	R60	Breede Valley	WESTERN
☐	17		ZA	7530	Oude Westhof		Cape Town	WESTERN
☐	19		ZA	7806	Llandudno		Cape Town	WESTERN
☐	21	1357	ZA	0019	Kirkney	Van der Hoff Rd	Tshwane	GAUTENG
☐	23		ZA	0200	Fortina AH		Tshwane	GAUTENG

You can easily scroll up or down the table to view the data rows as the table supports infinite scrolling.

5. Optionally, click the table **Settings** and enable **Show only selected features** to display the table rows for only the features selected on the map.

   For example, the following figure shows both a map and table visualization. The **Show only selected features** setting is enabled for the table. Therefore, the table displays only three rows of data corresponding to the three selected features (shown highlighted) on the map.

Figure 4-3 Table Visualization for Selected Features



☐	AID	AREA_ID
☑	160	2005490
☑	161	2005541
☑	179	2007101

Visualization Settings

Viz label: View 5

Show only selected features: on

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

4.2 Using a Map Visualization

Spatial Studio supports several types of map visualizations.

The following types of map visualizations are supported:

- 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:

- Visualizing a Point Map
- About GeoRaster Data Visualization
- About Hexagonal Data Visualization Using H3 Aggregations
- About Custom Map Regions Visualization
- Visualizing Spatiotemporal Datasets
  Starting from Oracle Spatial Studio Release 23.2.0, you can visualize spatiotemporal datasets using the Cesium Timeline widget.
- Visualizing OGC WMS Maps as a Dataset
  You can visualize an OGC (Open Geospatial Consortium) WMS (Web Map Service) dataset on a map.
- About Wind Animation
  Starting from Oracle Spatial Studio Release 24.2.0, you can create and visualize wind animations that depict the direction of flow between various locations.

4.2.1 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 in the Active Project page.

1. Click the **Visualizations** tab 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 layers.

3. Click the **Data** tab on the left pane in the Active Project page.

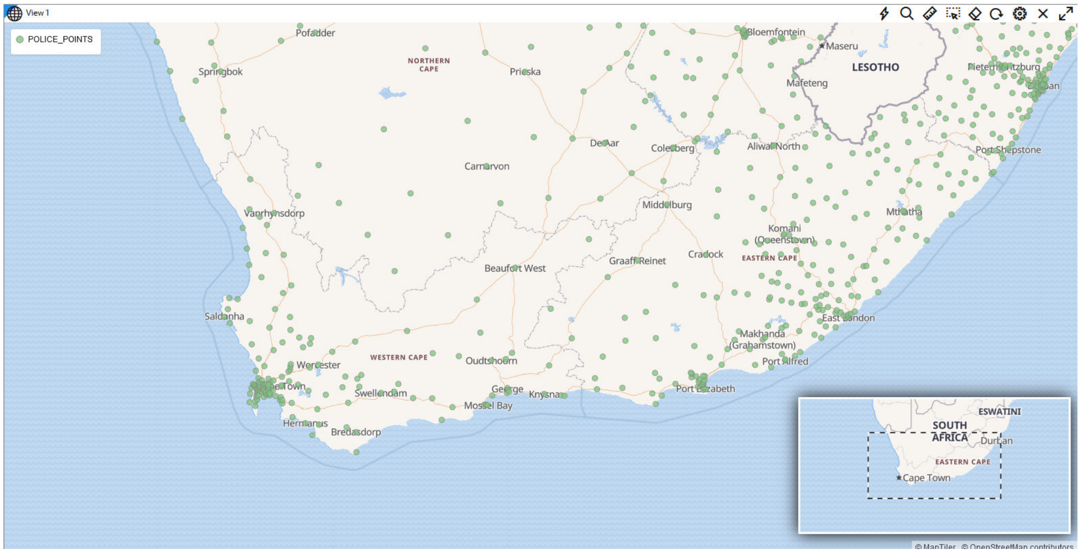
   This lists all the **Datasets** that are loaded for the project.

4. Click and drag the desired **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 layer displays the data points for visualization.

Figure 4-4   Map Visualization



5. Optionally, you can click **Settings** in the map tool bar and enable **Show minimap** in the **Visualization Settings** dialog.

   An inset map showing the overview of the main map is displayed as shown in the preceding figure.

> **See Also:**
>
> Applying a Render Style For a Point Layer to render your map using different rendering styles.

4.2.2 About 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.

- Visualizing GeoRaster Data on a Map

4.2.2.1 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 added to the project in the Active Project page. To create a GeoRaster dataset, see Creating a GeoRaster Dataset for more information.

1. Click the **Visualizations** tab 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 layers.

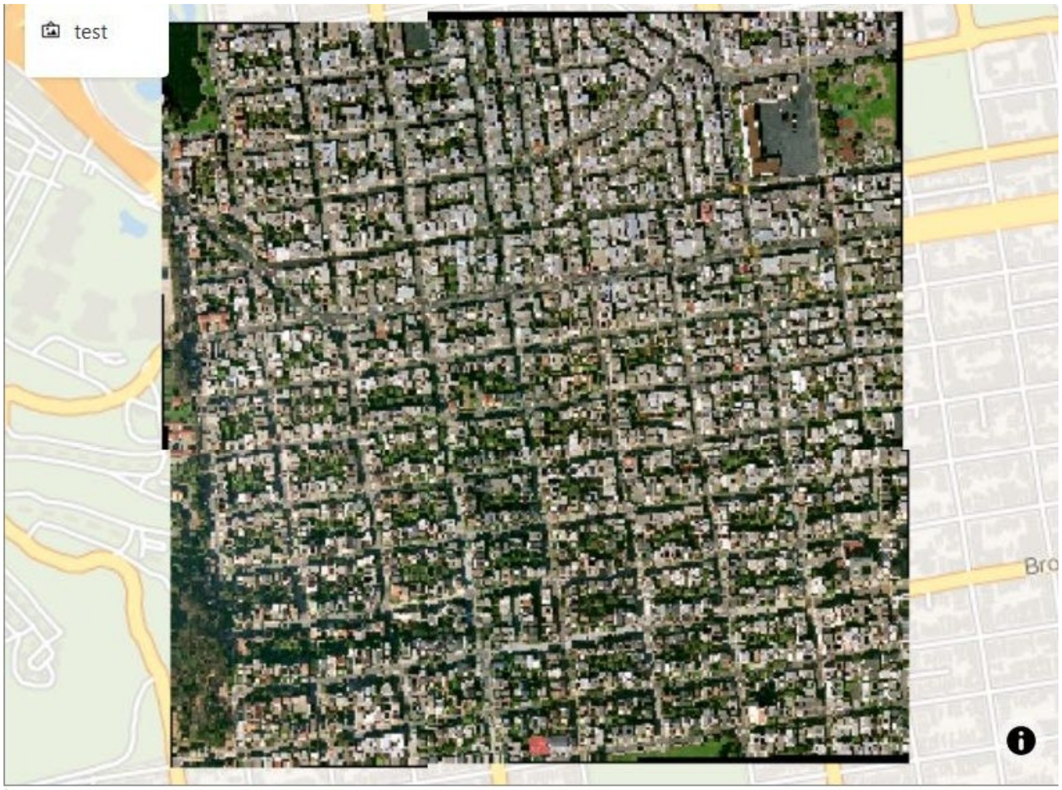
3. Click the **Data** tab on the left pane in the Active Project page.

   This lists all the **Datasets** that are loaded for the project.

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

   A GeoRaster layer is created on the map as shown:

Figure 4-5 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.

4.2.3 About 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:

- Preparing an H3 Aggregation Dataset
- Visualizing Data With H3 Aggregations

4.2.3.1 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.

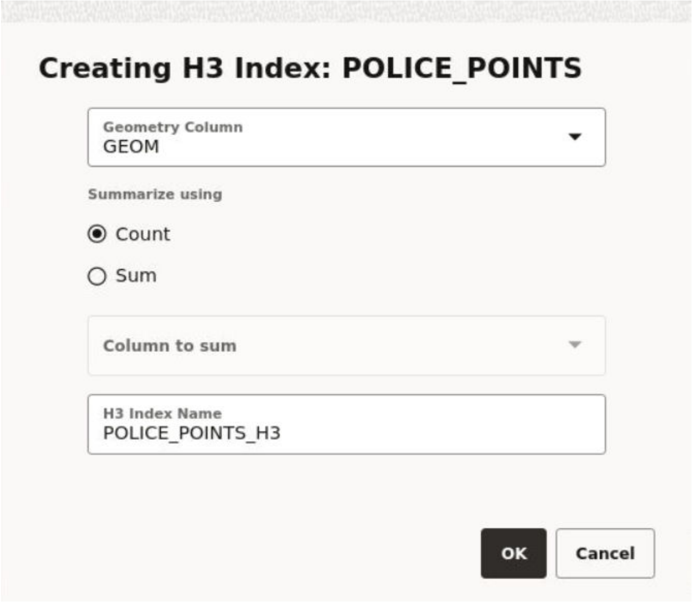
1. Navigate to the **Datasets** page.

   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 4-6 Creating an H3 Aggregation Dataset



Creating H3 Index: POLICE_POINTS

Geometry Column: GEOM

Summarize using

● Count

○ Sum

Column to sum

H3 Index Name: POLICE_POINTS_H3

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.

4.2.3.2 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 added to the project in the Active Project page.
To prepare a dataset for H3 aggregation, see Preparing an H3 Aggregation Dataset for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

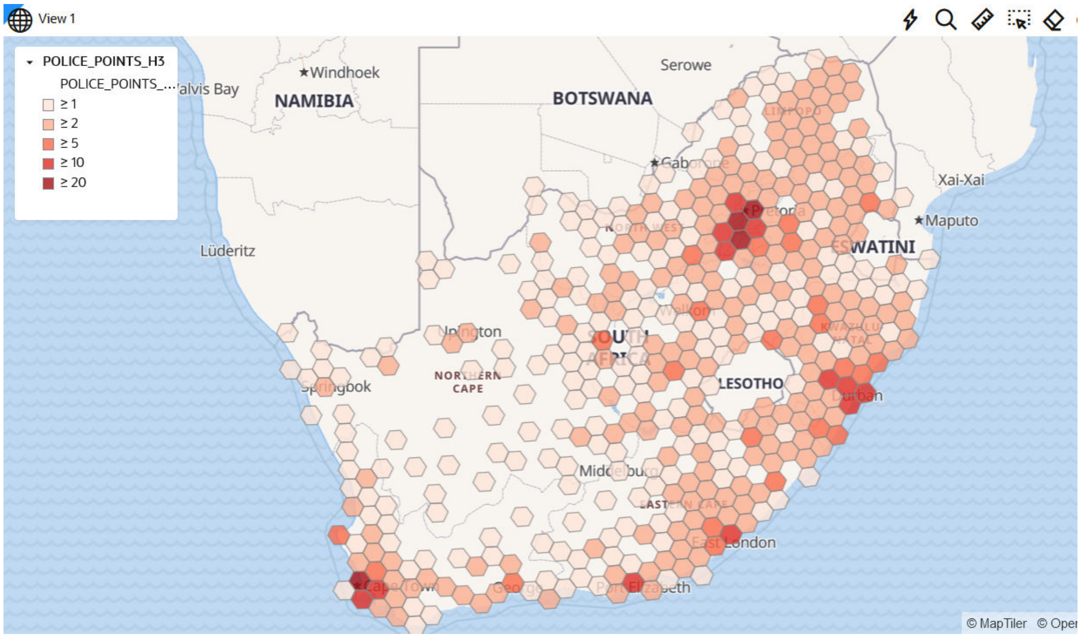
   This lists the various visualization options.
2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

   A default base map is displayed with no data visualization layers.
3. Click the **Data** tab 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 **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 4-7   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.

4.2.4 About Custom Map Regions Visualization

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, or save it as a new dataset.

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.
- The target dataset can be a new dataset or an existing dataset in the current project. For a new dataset, you need to specify the connection, the table name, the dataset name, the key-column name of the table, and provide the key value for the new region.

- Only the key value and new geometry value are inserted into the newly created target table. For inserting the new region into an existing dataset, you may provide values for all of the dataset's attributes, or only the required ones.
- An existing targets 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 that 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.

> **Note:**
>
> Prior to Release 22.3, these target dataset requirements were implemented using SQL statements. However, from Release 22.3 onwards, if a new dataset is created to store the regions, then Spatial Studio automatically takes care of updating the geometry metadata and creating a spatial index.

- For a new target dataset, once it is created and the first region is inserted, then the dataset can be manually added to the current active project and added as a layer to the map visualization. For subsequent processing, this new target dataset is treated as an existing target dataset.
- Creating Custom Regions for Visualization
- Creating a Target Dataset

4.2.4.1 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 **Visualizations** tab on the left pane in the Active Project page.

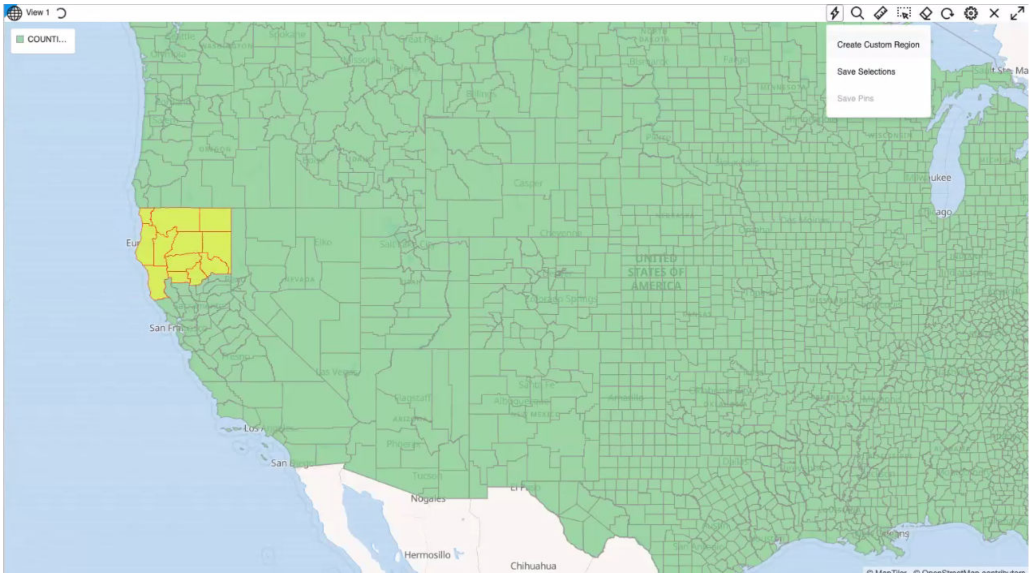
   This lists the various visualization options.
2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

   A default base map is displayed with no data visualization layers.
3. Click the **Data** tab 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.

Figure 4-8   Creating Custom Map Shapes

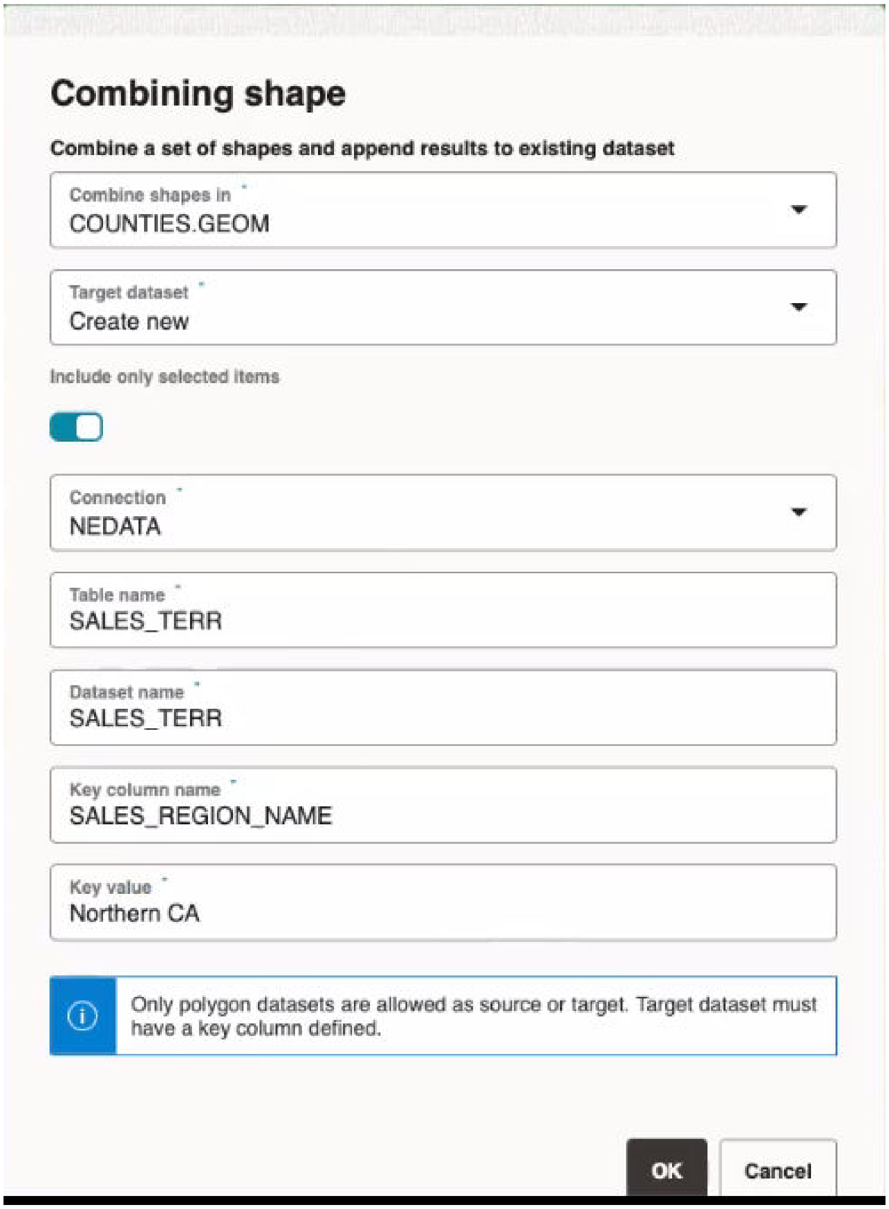


> **Tip:**
>
> Alternatively, you can also select multiple polygons by using the keyboard shortcut `Ctrl + Click` on a Windows system.

b. Click ⚡ , **Actions** icon on the map tool bar and select **Create Custom Region**.

   Combining shape dialog opens as shown:

Figure 4-9 Create a Custom Region



Combining shape

Combine a set of shapes and append results to existing dataset

Combine shapes in *: COUNTIES.GEOM

Target dataset *: Create new

Include only selected items: on

Connection *: NEDATA

Table name *: SALES_TERR

Dataset name *: SALES_TERR

Key column name *: SALES_REGION_NAME

Key value *: Northern CA

Only polygon datasets are allowed as source or target. Target dataset must have a key column defined.

c. Select the source dataset from the **Combine shapes in** drop-down list.

d. Select one of the following desired options for **Target dataset**:

- **Create new:** To create a new target dataset:
  i. Enter **Connection**, **Table name**, and **Dataset name** details for the new target dataset.
  ii. Enter the **Key column name** and the **Key value** that uniquely identifies the custom map region.
- **Append to existing:** To append the custom polygon shapes to an existing target dataset:
  i. Select an existing target dataset from the **Append result to dataset** drop-down list.

   ii. Click **Enter new shape attributes** and enter a unique key value for the **Key column name** of the target dataset.

e. Optionally, switch on or off the **Include only selected items** toggle button:

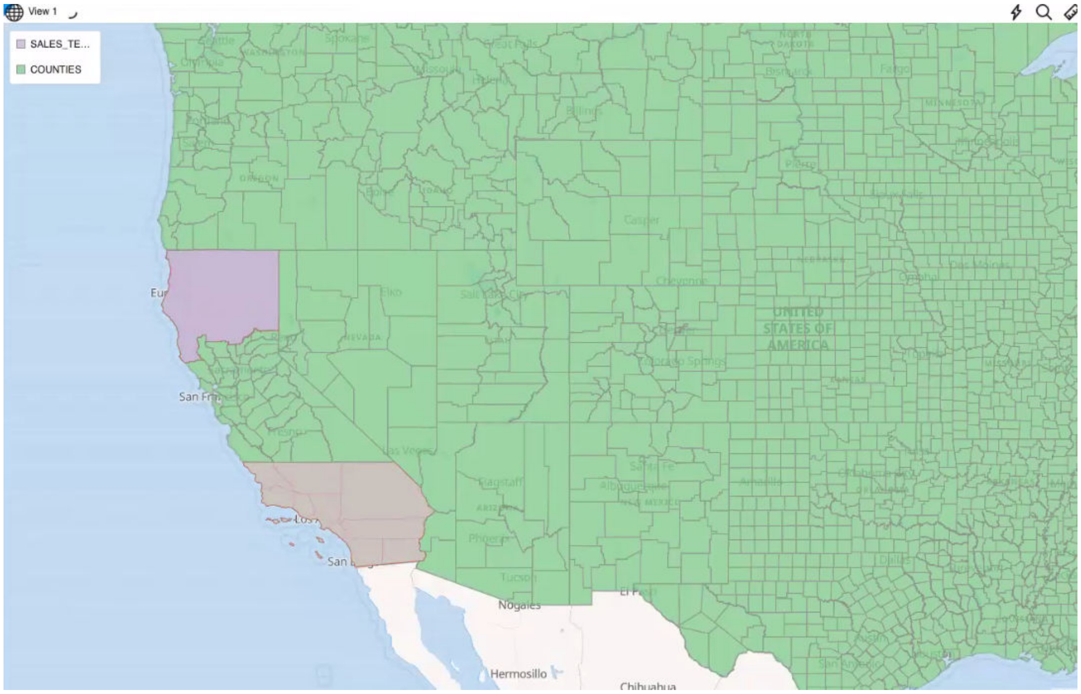
> **Caution:**
>
> The whole source dataset may be aggregated into one region if **Include only selected items** is switched off. In this case the process may run for a long time depending on the number of features in the source dataset. Therefore, use this option only if required.

f. Click **OK** to create the custom map region.

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 the newly defined custom regions that were inserted into the target dataset.

Figure 4-10   Displaying the Custom Shapes on the Target Dataset



4.2.4.2 Creating a Target Dataset

There are two ways to create a target dataset:

- **By Spatial Studio**: Refer to the Create New Target Dataset option in the earlier section. Note that you must specify the key column name for the target dataset as the key values are stored in the key column names for the corresponding geometries (custom map regions).
- **By manual process**: Perform the following steps to create a dataset manually:

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.

4.2.5 Visualizing Spatiotemporal Datasets

Starting from Oracle Spatial Studio Release 23.2.0, you can visualize spatiotemporal datasets using the Cesium Timeline widget.

The following sections provide more information on the Cesium Timeline widget and the supported visualizations.

- Overview of the Cesium Timeline Widget
  Spatial Studio provides a new standalone Cesium Timeline widget starting from Release 23.2.
- Configuring the Cesium Timeline Settings
  You can configure custom settings for the Cesium timeline.
- About Map Layers and the Timeline
  Learn more about the spatiotemporal map layers and the Cesium timeline.
- Visualizing Live Moving Objects Dataset
  You can visualize live moving objects on a map in Spatial Studio.
- Visualizing Live and Non-Moving Objects Dataset
  You can visualize a spatiotemporal dataset having ongoing inserts of real-time data, but the locations of the data entities do not change.
- Visualizing Non-Live Moving Objects Dataset
  You can visualize moving objects with historic timestamp values on a map in Spatial Studio.

- Visualizing Non-Live and Non-Moving Objects Dataset
  You can visualize a spatiotemporal dataset that simply contains different timestamp values in each row which are not grouped by any entity ids.
- Visualizing Spatiotemporal Data in OGC WMS Datasets
  You can visualize OGC WMS datasets that contain spatiotemporal data.
- Visualizing GeoJSON URL Datasets with Spatiotemporal Data
  You can visualize GeoJSON URL based datasets that contain spatiotemporal data.
- Configuring Animation for Moving Objects Dataset
  You can animate a spatiotemporal map layer of a moving objects dataset based on Cesium map events.
- Characteristics of Spatiotemporal Map Layers for Moving Objects Dataset
  This section describes the distinct characteristics of the primary and secondary map layers when visualizing a spatiotemporal dataset containing moving objects.

4.2.5.1 Overview of the Cesium Timeline Widget

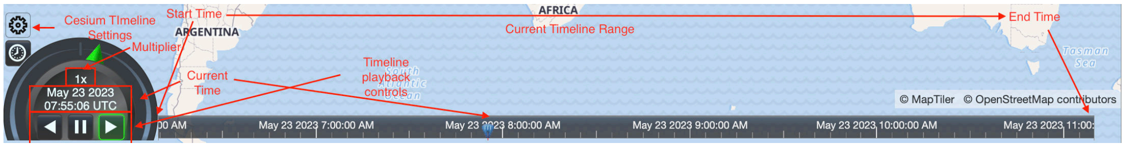
Spatial Studio provides a new standalone Cesium Timeline widget starting from Release 23.2.

The Cesium Timeline widget in Spatial Studio provides the following capabilities:

- Dataset filtering.
- Serves as a hub for controlling all kinds of spatiotemporal data (such as live, historic, moving objects, and so on).
  The only exception being the GeoJSON URL based datasets. These datasets do not cater to Cesium timeline as the external URLs may not have the capability to provide GeoJSON corresponding to a time value, but are rather simply refreshed to provide newer values every `x` seconds.
- Offers a scalable solution to add multiple layers of different dataset types at once that can be time-synced as required.

The following figure shows the Cesium Timeline Widget on a map visualization in Spatial Studio.

Figure 4-11   Cesium Timeline Widget



The key concepts of the Cesium Timeline are as follows:

- **Cesium Timeline Modes:** The timeline supports two modes of operation. If even one layer corresponding to a **live** dataset is listening to the timeline, then the mode of operation is **LIVE**. Otherwise, the mode of operation is always **HISTORIC**.
- **Cesium Clock Start Time**: Starting point of the current range of timeline. This is the point in time from which the Cesium clock starts ticking.
- **Cesium Clock Stop Time**: Ending point of the current range of timeline. This is the point in time until which the Cesium clock ticks. However upon reaching the end, the timeline behavior depends on the mode:

  - **LIVE:** The timeline will move ahead by updating the start time and stop time values as per the current time.
  - **HISTORIC:** The timeline will loop back to the start time.
- **Cesium Clock Current Time**: The current time frame of the clock. It begins at the Cesium clock start time and ticks every `500ms`. Optionally, you can slide the pointer on the timeline manually to set your current time.
  Also note the following with respect to the type of the spatiotemporal dataset:
  - **Live Spatiotemporal Dataset:** The Cesium clock current time value for such datasets is configured to always be pointing to current UTC time (unless manually changed).
  - **Non-Live Spatiotemporal Dataset:** If no other dataset is added to the timeline, then the Cesium clock for such a dataset automatically sets its range to minimum and maximum of the timestamp column, and the Cesium clock current time starts from the minimum value.
- **Multiplier**: Multiplies to the interval at which the clock ticks (`500ms`) in order to make the clock jump ahead or rewind accordingly.
- **Timeline Playback Controls**:
  1. **Pause**: Stops the timeline from animating and throwing tick events. The timeline pauses at current timeline frame.
  2. **Forward and Backward Play Buttons**: Makes the timeline animate in the chosen direction and includes the multiplier value (`+/- Multiplier * 500ms`)
- **Cesium Timeline settings**: Allows you to control the timeline settings.

Related Topics

- Configuring the Cesium Timeline Settings
  You can configure custom settings for the Cesium timeline.
- About Map Layers and the Timeline
  Learn more about the spatiotemporal map layers and the Cesium timeline.

4.2.5.2 Configuring the Cesium Timeline Settings

You can configure custom settings for the Cesium timeline.

Perform the following steps to configure the Cesium Timeline settings in your map visualization.

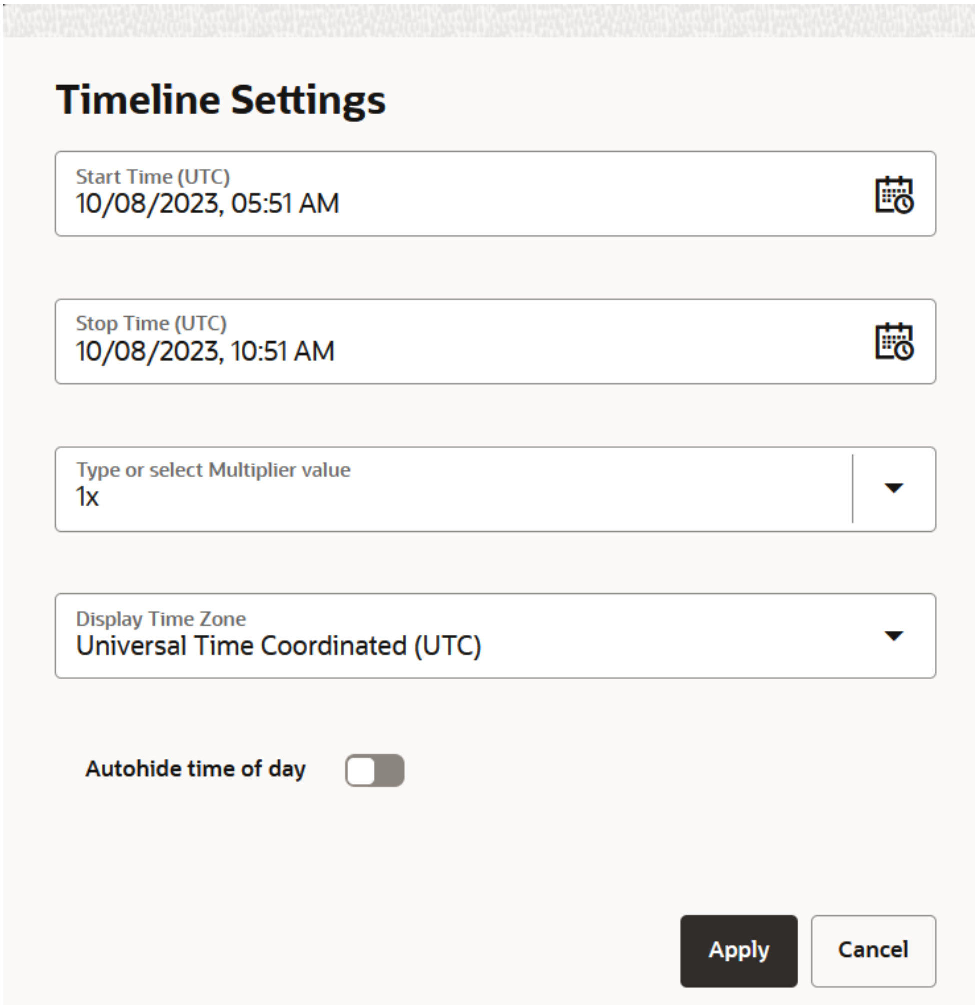
The instructions assume that you have a project linked to a spatiotemporal dataset and the project is opened on your Active Project page.

1. Click the **Settings** icon in your map tool bar.
2. Switch `ON` the **Show timeline** toggle and click **OK**.

   The Cesium Timeline widget appears at the bottom of the map visualization canvas.
3. Click ⚙ on the timeline to configure the Cesium timeline settings.

   The **Timeline Settings** dialog opens as shown:

Figure 4-12   Timeline Settings



Timeline Settings

Start Time (UTC): 10/08/2023, 05:51 AM

Stop Time (UTC): 10/08/2023, 10:51 AM

Type or select Multiplier value: 1x

Display Time Zone: Universal Time Coordinated (UTC)

a. Select the **Start Time** and **Stop Time** to set the timeline range.

b. Enter or select a multiplier value from the **Type or select Multiplier value** list box.

   You can use a preset (Second, Minutes, Hours, Days, Weeks, Month, Year) multiplier or type a value such as `15` or `15x`.

c. Select the **Display Time Zone** in which you want the Cesium timeline to display its current time and timeline labels.

d. Optionally, switch `ON` the **Autohide time of day**.

   If you opt to autohide time of day, then the time values from the timeline labels are hidden if the timeline range selected is greater than a week.

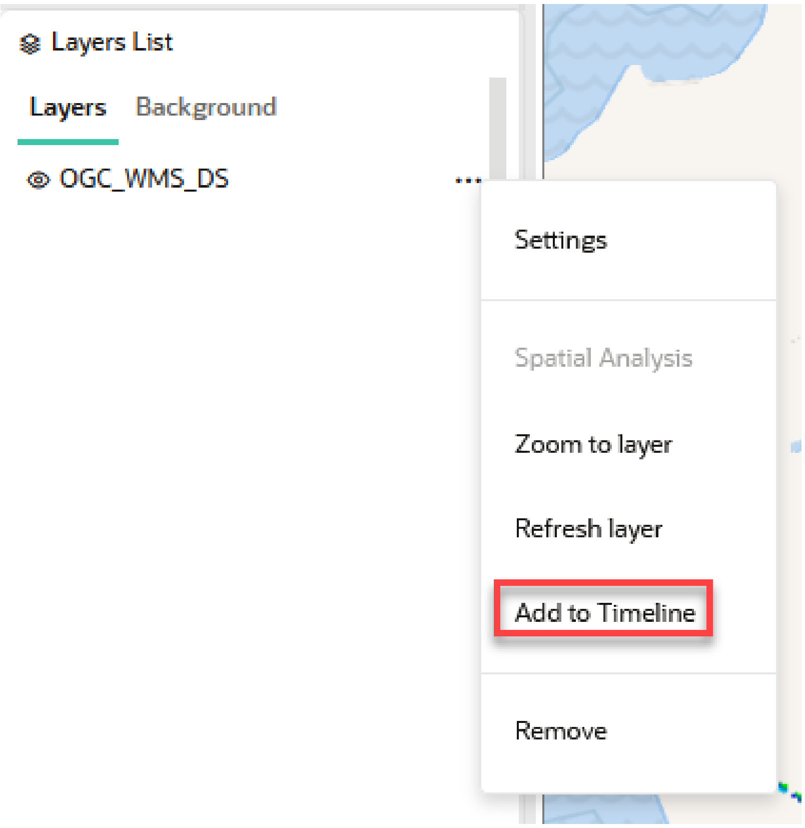
e. Click **Apply**.

4.2.5.3 About Map Layers and the Timeline

Learn more about the spatiotemporal map layers and the Cesium timeline.

- In order to add a map layer to the timeline, you must first enable spatiotemporal in the underlying dataset for the map layer. See Enabling Spatiotemporal for a Dataset for more information.
- You can then add one or more spatiotemporal map layers to the Cesium timeline by performing the following steps:
  - Click the **Settings** icon in your map tool bar and switch `ON` the **Show timeline** toggle to view the Cesium timeline widget at the bottom of the map visualization canvas.
  - Select the **Add to Timeline** option in the context menu of the map layer as shown:

Figure 4-13 Adding a Map Layer to the Timeline



The map layer gets added to the timeline.

- Note the following if you add multiple map layers to the timeline:
  - Each of these map layers respond to the timeline events independently. Therefore, you can configure each map layer to have its own properties (such as refresh time) and they then accordingly respond to the listener events. As the timeline events are thrown at every `500ms` tick interval, each layer can have it own refresh time (more than `500ms`) as to when they want to respond to these events.
  - Also, in case of the map layers for datasets with historic timestamp values, all layers will loop back as per the current timeline range. This may either correspond to the first layer added to the timeline or it can be a custom range that you set in the timeline settings.

  - If a layer corresponding to a live dataset is added to the timeline, then irrespective of the historic dataset layers listening to the timeline already, the timeline will never loop back and will keep moving forward.

- If you make any changes to the underlying dataset properties of a map layer, which is already added to the timeline, such as:
  - * Disabling the **Enable Spatiotemporal** toggle
    * Toggling **Data is Live** and **Moving Objects**

    Then, the listener gets removed from the timeline. In such cases, it is recommended that you remove the layer from the timeline and add it again after changing the properties.
  - If you change the **Time Unit** property of a standard filtering dataset, then this will take effect immediately and the filtering on the map visualization will adhere to the new **Time Unit** value.

4.2.5.4 Visualizing Live Moving Objects Dataset

You can visualize live moving objects on a map in Spatial Studio.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See Configuring Spatiotemporal for Live Moving Objects Dataset for more information.

1. Click the **Visualizations** tab 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 layers.
3. Click the **Data** tab on the left pane in the Active Project page.

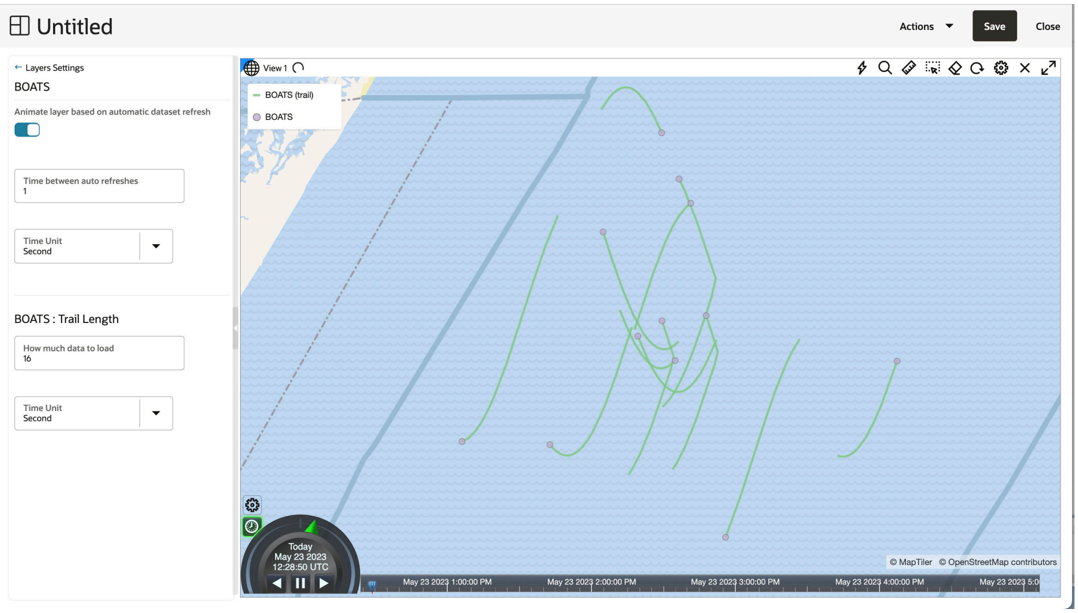
   This lists all the **Datasets** that are loaded for the project.
4. Click and drag the desired spatiotemporal dataset from the list to the map view on the right.

   Two map layers belonging to the dataset are created on the map. The second layer representing the trails of the moving object is added automatically in Spatial Studio. See Characteristics of Spatiotemporal Map Layers for Moving Objects Dataset for more information on the two map layers.
5. Click the **Settings** icon in your map tool bar.
6. Switch `ON` the **Show timeline** toggle and click **OK**.

   The Cesium timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.
7. Click ⋯ against the primary layer in the **Data** tab of the **Layers** list and click **Add to Timeline**,

   Adding a map layer to the timeline will point to the current UTC time and the layer is now listening to the timeline events. However, the timeline is not operational at this step. Optionally, repeat this step to add multiple layers (of different spatiotemporal datasets) to the timeline and listen to its events.
8. Configure animation for the map layer by following the steps in Configuring Animation for Moving Objects Dataset.

Figure 4-14 Configuring Animation Settings



← Layers Settings

BOATS

Animate layer based on automatic dataset refresh

Time between auto refreshes
1

Time Unit
Second

BOATS : Trail Length

How much data to load
16

Time Unit
Second

9. Select **Zoom Timeline to Range** in the context menu of the map layer.

   The timeline is refocused on current UTC time.

10. Optionally, configure custom **Start Time**, **Stop Time**, **Multiplier**, and so on from the timeline settings. You can also use the Cesium timeline controls and make the current time pointer slide to a different timeframe.

11. Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

4.2.5.5 Visualizing Live and Non-Moving Objects Dataset

You can visualize a spatiotemporal dataset having ongoing inserts of real-time data, but the locations of the data entities do not change.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See Configuring Spatiotemporal for Live and Non-Moving Objects Dataset for more information.

1. Click the **Visualizations** tab 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 layers.

3. Click the **Data** tab 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 spatiotemporal dataset from the list to the map view on the right.

   Two map layers belonging to the dataset are created on the map.

5. Click the **Settings** icon in your map tool bar.

6. Switch `ON` the **Show timeline** toggle and click **OK**.

The Cesium Timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.

7. Click ••• against the primary layer in the **Data** tab of the **Layers** list and click **Add to Timeline**.
8. Select **Configure Animation** from the context menu of the map layer.
9. Switch ON **Animate layer based on automatic dataset refresh**.

   The dataset animates with the Cesium clock events.
10. Specify **Time between auto refreshes** to indicate the frequency of data refresh from the backend. This configuration also determines the smoothness and speed of the temporal animation.

    Also, note the following:

    - Spatial Studio displays a default frequency value which is same as the **Data Change Rate** value configured on the Spatiotemporal dataset used for the visualization.
    - Only one dataset layer for the geometry animates (attributes change) as per the Cesium clock's current time (which points to the present UTC time value) and the multiplier value (default is `1x`). Since the dataset is a streaming entity it will not have data ahead of time. Hence you must not change the default Cesium clock values. If you expect the data to be updated every `x` minutes, then configure **Time between auto refreshes** to `x` minutes, but do not change the Cesium timeline range or the multiplier value.
11. Select **Zoom Timeline to Range** in the context menu of the map layer to make the timeline reset to current clock time and a `1x` multiplier.

    Upon reaching the set end time, the timeline will keep moving ahead and will not loop back.
12. Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

4.2.5.6 Visualizing Non-Live Moving Objects Dataset

You can visualize moving objects with historic timestamp values on a map in Spatial Studio.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See Configuring Spatiotemporal for Non-Live Moving Objects Dataset for more information.

1. Click the **Visualizations** tab 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 layers.
3. Click the **Data** tab 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 spatiotemporal dataset from the list to the map view on the right.

   Two map layers belonging to the dataset are created on the map. The second layer representing the trails of the moving object is added automatically in Spatial Studio. See

Characteristics of Spatiotemporal Map Layers for Moving Objects Dataset for more information on the two map layers.

5. Click the **Settings** icon in your map tool bar.
6. Switch `ON` the **Show timeline** toggle and click **OK**.

   The Cesium Timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.
7. Click ⋯ against the primary layer in the **Data** tab of the **Layers** list and click **Add to Timeline**.

   The map layer gets added to the timeline and the timeline will range from minimum value to maximum value of the timestamp column. the current time will point to the min value of the timestamp column and the layer is now listening to the timeline events. However, the timeline is not operational at this step. Optionally, repeat this step to add multiple layers (of different spatiotemporal datasets) to the timeline.
8. Configure animation for the map layer by following the steps in Configuring Animation for Moving Objects Dataset.
9. Select **Zoom Timeline to Range** in the context menu of the map layer.

   The timeline is refocused to range from minimum value to maximum value of the timestamp column and current time will point to the minimum value of the timestamp column. This acts as a looping mechanism for a historic dataset.
10. Optionally, configure custom **Start Time**, **Stop Time**, **Multiplier**, and so on from the timeline settings. You can also use the Cesium timeline controls and make the current time pointer slide to a different timeframe.
11. Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

4.2.5.7 Visualizing Non-Live and Non-Moving Objects Dataset

You can visualize a spatiotemporal dataset that simply contains different timestamp values in each row which are not grouped by any entity ids.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See Configuring Spatiotemporal for Non-Live and Non-Moving Objects Dataset for more information.

1. Click the **Visualizations** tab 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 layers.
3. Click the **Data** tab 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 spatiotemporal dataset from the list to the map view on the right.

   A single map layer is created on the map.
5. Click the **Settings** icon in your map tool bar.
6. Switch `ON` the **Show timeline** toggle and click **OK**.

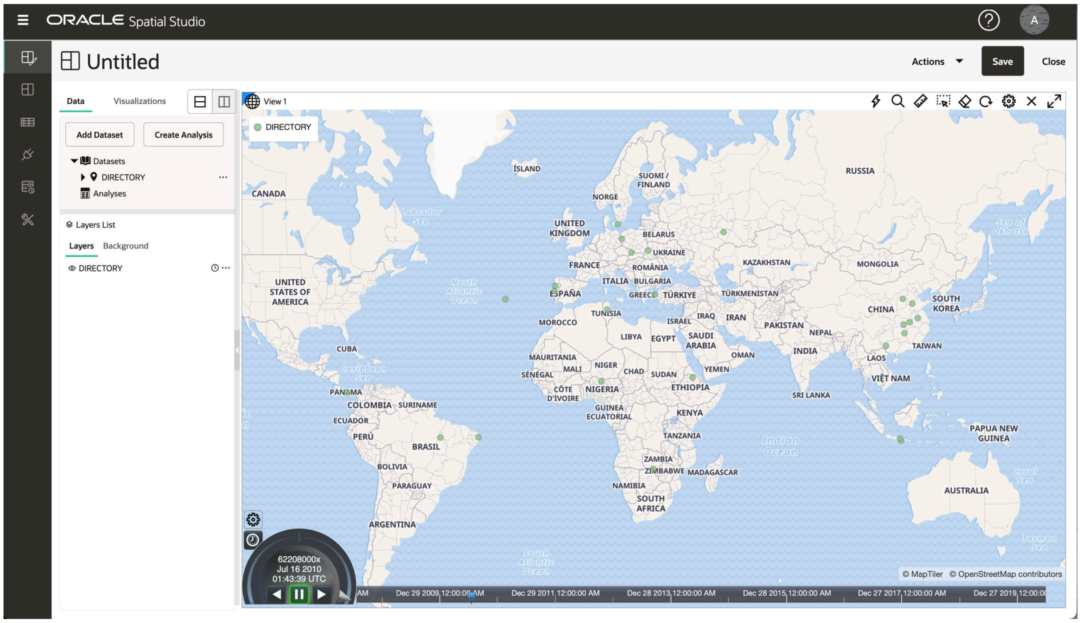
The Cesium Timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.

7. Click ··· against the primary layer in the **Data** tab of the **Layers** list and click **Add to Timeline**.

   The map layer gets added to the timeline and the timeline will range from minimum value to maximum value of the timestamp column. The current time will point to the minimum value of the timestamp column and the layer is now listening to the timeline events. Also, the filtering configured for the spatiotemporal settings will automatically be applied and the map layer will be filtered as per the Cesium clock current time. For example, if the Cesium clock current time is Monday, May 22, 2023 5:13 PM and the configured time unit for filtering is `month`, then the map visualization will show all the geometries that have the timestamps between May 1, 2023 and May 31, 2023.

   The multiplier of the timeline matches the filtering time unit selected. However, you can also change the time unit at which the dataset is currently being filtered (see Configuring Spatiotemporal for Non-Live and Non-Moving Objects Dataset).

Figure 4-15 Applying Standard Filtering on a Map Layer



8. Select **Zoom Timeline to Range** in the context menu of the map layer.

   The timeline is refocused to range from minimum value to maximum value of the timestamp column and the current time will point to the minimum value of the timestamp column. This acts as a looping mechanism for a historic dataset.

9. Optionally, select custom **Start Time**, **Stop Time**, **Multiplier**, and so on from the timeline settings. You can also use the Cesium timeline controls and make the current time pointer slide to a different time frame.

10. Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

4.2.5.8 Visualizing Spatiotemporal Data in OGC WMS Datasets

You can visualize OGC WMS datasets that contain spatiotemporal data.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See Configuring Spatiotemporal for OGC WMS Datasets for more information.

1. Click the **Visualizations** tab 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 layers.

3. Click the **Data** tab 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 spatiotemporal dataset from the list to the map view on the right.

   A single map layer is created on the map.

5. Click the **Settings** icon in your map tool bar.

6. Switch `ON` the **Show timeline** toggle and click **OK**.

   The Cesium Timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.

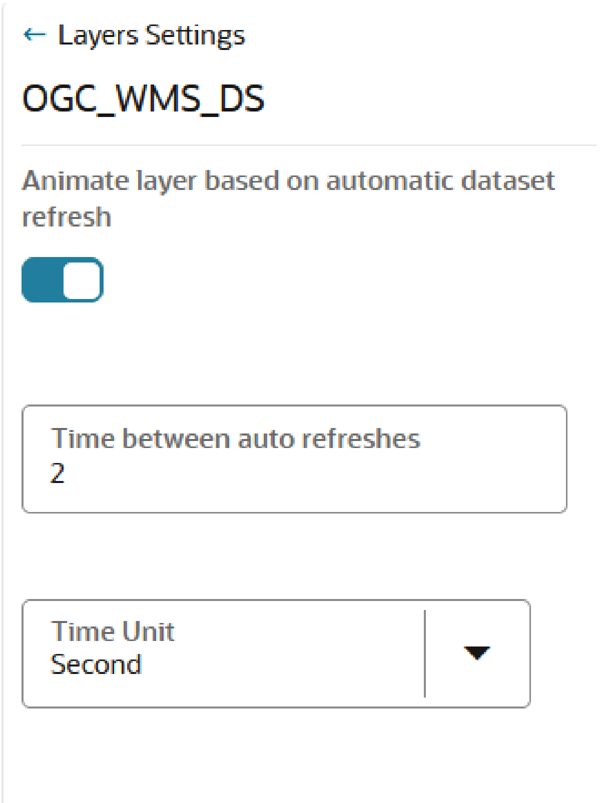
7. Click ⋯ against the map layer in the **Data** tab of the **Layers** list and select **Add to Timeline**.

   The map layer gets added to the timeline. Although the timeline is now listening to the timeline events, it is still not operational.

8. Select **Configure Animation** from the context menu of the map layer.

   The animation configuration dialog opens as shown:

Figure 4-16   Configuring Animation for an WMS Dataset



← Layers Settings

OGC_WMS_DS

Animate layer based on automatic dataset refresh

Time between auto refreshes
2

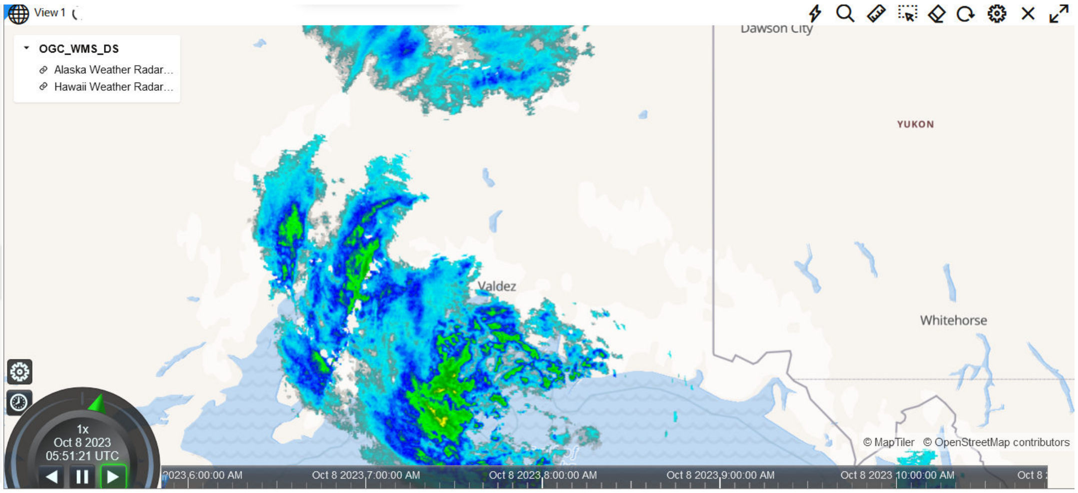
Time Unit
Second

9. Switch ON **Animate layer based on automatic dataset refresh**.

   The dataset animates with the Cesium clock events.

   The dataset will poll the WMS service to fetch the images as per the time value under the Cesium clock current time.

Figure 4-17   Visualizing WMS Dataset with Spatiotemporal Data



10. Specify **Time between auto refreshes** to indicate the frequency of data refresh from the backend. This configuration also determines the smoothness and speed of the temporal animation.

Also, note the following:

- Spatial Studio displays a default value of `2 seconds` for WMS datasets. The effective refresh rates depend on how fast images are fetched from the respective WMS service. Empirically, for WMS data, any data change rate less than 2 seconds is not sufficient to retrieve image and refresh the tiles. It can cause incomplete image loading before the new refresh, or the visualization may remain stuck in refresh state.
- The parameter ignores all the tick events from the timeline if the Cesium clock current time is less than `previousRefreshTime + x seconds` (or any other time unit). For example, if a dataset is supposed to refresh every 30 seconds, then configure this value in **Time between auto refreshes** so that even if the Cesium clock continues to throw tick events for all layers, this layer will ignore any such events.

11. Specify a **Time Unit**.
12. Optionally, select custom **Start Time**, **Stop Time**, **Multiplier**, and so on from the timeline settings. You can also use the Cesium timeline controls and make the current time pointer slide to a different time frame.

> **Note:**
>
> **Zoom Timeline to Range** is disabled for an OGC WMS dataset. This is because each WMS dataset may comprise more than one image layers and it will be inaccurate to choose a time range for any one of these layers automatically. Therefore, use the Cesium timeline settings (see Configuring the Cesium Timeline Settings) to manually set the appropriate range of the timeline for the specific image layer that you wish to animate.

13. Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

4.2.5.9 Visualizing GeoJSON URL Datasets with Spatiotemporal Data

You can visualize GeoJSON URL based datasets that contain spatiotemporal data.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See Visualizing GeoJSON URL Datasets with Spatiotemporal Data for more information.

1. Click the **Visualizations** tab 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 layers.
3. Click the **Data** tab 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 spatiotemporal dataset from the list to the map view on the right.

   A single map layer is created on the map.
5. Click ⋯ against the map layer in the **Data** tab of the **Layers** list and select **Configure Animation**.

> **Note:**
>
> GeoJSON URL based datasets are not dependent on the time values represented by the Cesium Timeline. They are just required to refresh periodically and therefore you need not enable the Cesium Timeline for such datasets.

6. Switch ON **Animate layer based on automatic dataset refresh**.
7. Specify **Time between auto refreshes** to indicate the frequency of data refresh from the backend. This configuration also determines the smoothness and speed of the temporal animation.

   The GeoJSON URL map layer is set to refresh periodically based on this configured interval value.

4.2.5.10 Configuring Animation for Moving Objects Dataset

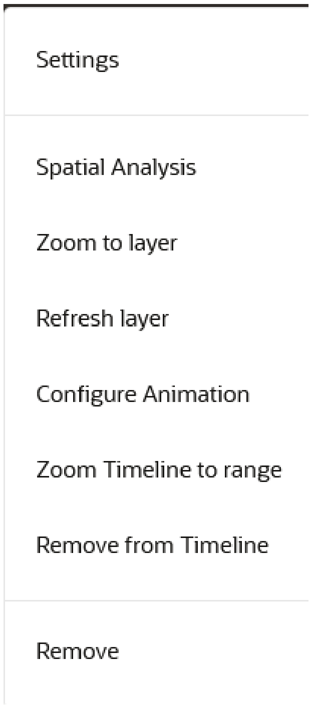
You can animate a spatiotemporal map layer of a moving objects dataset based on Cesium map events.

The instructions assume that the spatiotemporal map layer is already added to the Cesium Timeline.

1. Click ⋯ against the primary layer in the **Data** tab of the **Layers** list.

   The context menu of the map layer displays the following options:

   Figure 4-18 Context Menu for a Map Layer



2. Select **Configure Animation**.

   The animation settings for the map layer opens.

3. Switch ON **Animate layer based on automatic dataset refresh**.

   The dataset animates with the Cesium clock events.

4. Specify **Time between auto refreshes** to indicate the frequency of data refresh from the backend. This configuration also determines the smoothness and speed of the temporal animation.

   Also, note the following:

   - Spatial Studio displays a default frequency value which is same as the **Data Change Rate** value configured on the Spatiotemporal dataset used for the visualization.
   - All the map layers added to the timeline can individually have their own refresh or animation intervals.
   - The parameter ignores all the tick events from the timeline if the Cesium clock current time is less than `previousRefreshTime + x seconds` (or any other time unit). For example, if a dataset is supposed to refresh every 30 seconds, then configure this value in **Time between auto refreshes** so that even if the Cesium clock continues to throw tick events for all layers, this layer will ignore any such events.

5. Specify a **Time Unit**.

6. Specify **How much data to load**, the trail length of your moving object. A trail length value of `N` indicates that Spatial Studio must fetch the recent `N` units (unit value as specified in the following step) of data of the moving object during every refresh.

   > **Tip:**
   >
   > If the underlying database table or view contains millions of records, you can limit the map animation to display only the most recent `N` units of data as configured in **Trail Length**.

   Note that Spatial Studio displays a default trail length value which is 15 times the **Data Change Rate** value configured on the Spatiotemporal dataset and is rounded to the nearest integer.

7. Specify a **Time Unit** for the trail length.

   The animation settings are configured and you can view the animation of moving objects on the map.

   > **Note:**
   >
   > You can choose a symbol and color for your moving object. However, ensure that the symbol you select adheres to the conditions explained in Characteristics of Spatiotemporal Map Layers for Moving Objects Dataset.

4.2.5.11 Characteristics of Spatiotemporal Map Layers for Moving Objects Dataset

This section describes the distinct characteristics of the primary and secondary map layers when visualizing a spatiotemporal dataset containing moving objects.

- The trails map layer is considered the *secondary* layer to the main layer. If you delete the main layer from the map, then the trails map layer is automatically deleted as well.

- The main layer which shares the same name as the dataset is always a Point-type layer, that you can visualize using either as circle or using symbols or icons. When you use symbols, Spatial Studio will also automatically rotate the symbol based on the direction your object is moving.
  Also note, the current release of Spatial Studio supports only those symbols that naturally point North (or point up) or those that do not represent an inherent direction or angle, such as any rounded symbols.
- The main layer will keep its animation even when you toggle the secondary layer invisible. However, if you toggle the main layer invisible, the trail layer will remain static as no new data is fetched from the backend.
- You cannot switch the main layer to Heatmap or Cluster type.
- You cannot use sticky Tooltip or popup as they cannot stick to the moving object when it moves to new locations.
- Spatial Studio drives the animation of moving objects and their trails by constantly refreshing the main layer’s data from the backend. This implies that the base table is queried and the last `N` seconds of data is fetched by filtering the records based on the `TIMESTAMP` column.
- If you are working in a multi-user or multi-visualization environment or both, you must take care to avoid overloading the database with many animating layer's data refresh queries. For instance, ensure a layer is not refreshing its data too frequently, or fetching too many seconds of data on each refresh, or both.

4.2.6 Visualizing OGC WMS Maps as a Dataset

You can visualize an OGC (Open Geospatial Consortium) WMS (Web Map Service) dataset on a map.

This is in addition to creating a custom basemap that is based on external WMS maps, and switching to such a basemap in your map visualization. The main issue in using basemaps is that a single map visualization can only have one basemap. For instance, if you are using a basemap based on WMS images, then you can no longer display other background maps, such as OpenStreetMap. Therefore, the geographic context is lost as the WMS images typically do not contain detailed administrative boundaries, or other common features seen on a regular background map.
To overcome this limitation, Spatial Studio allows you to use a regular background map, while adding the WMS map images as a dataset layer on top. As the WMS images are just another dataset, which can be displayed as another layer on the map, you can easily reorder the layers, or toggle the visibility of the WMS images just like with any other map layer.

To visualize an OGC WMS dataset on a map, you must perform the following steps.

As a prerequisite ensure the following:

- The OGC WMS dataset is created using an OGC WMS connection and exists in Spatial Studio. See Creating an OGC WMS Dataset for more information.
- The required OGC WMS dataset is added to the project in the Active Project page.

1. Click the **Visualizations** tab 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.

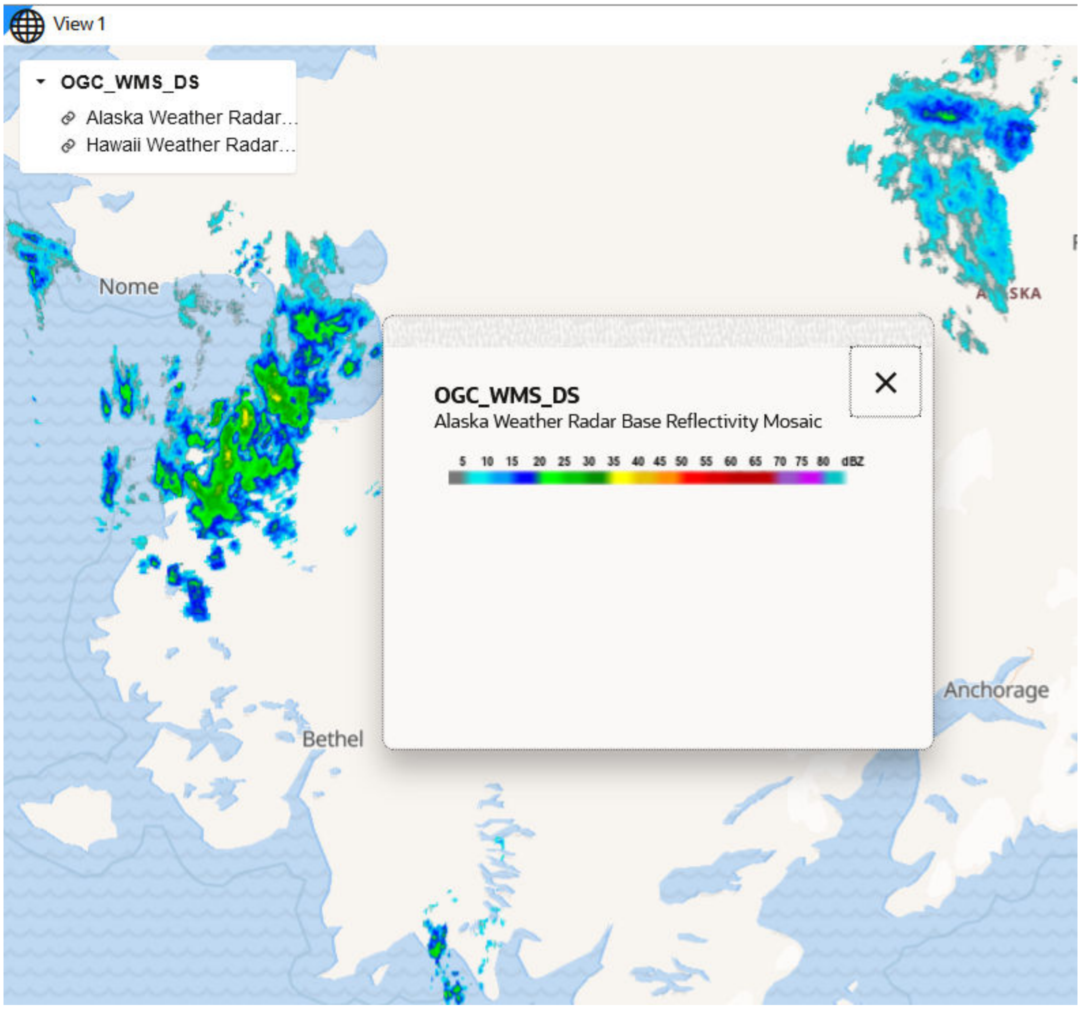
   A default base map is displayed with no data visualization layers.
3. Click the **Data** tab on the left pane in the Active Project page.

This lists all the **Datasets** that are loaded for the project.

4. Drag and drop the desired **OGC WMS dataset** from the list to the map view on the right.

   The OGC WMS data layer gets displayed on the map. The map will automatically zoom to the area covered by the WMS dataset if it is the very first dataset to be added to your map.

Figure 4-19 Visualizing an OGC WMS Data Layer


View 1
OGC_WMS_DS
Alaska Weather Radar…
Hawaii Weather Radar…
Nome
Bethel
Anchorage
A SKA
OGC_WMS_DS
Alaska Weather Radar Base Reflectivity Mosaic
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 dBZ

The preceding figure illustrates the weather pattern images (loaded from a WMS service) which are overlaid on top of the OpenStreetMap background.

> **Tip:**
>
> Click the **Image** link on the map legend to view the legend information generated by the WMS service for the OGC WMS map layer.

> **Note:**
>
> When you display a new WMS dataset for visualization, your browser will be sending the WMS image requests directly to the WMS server. You can always refresh the map layer to reflect the current data from the WMS server.

Related Topics

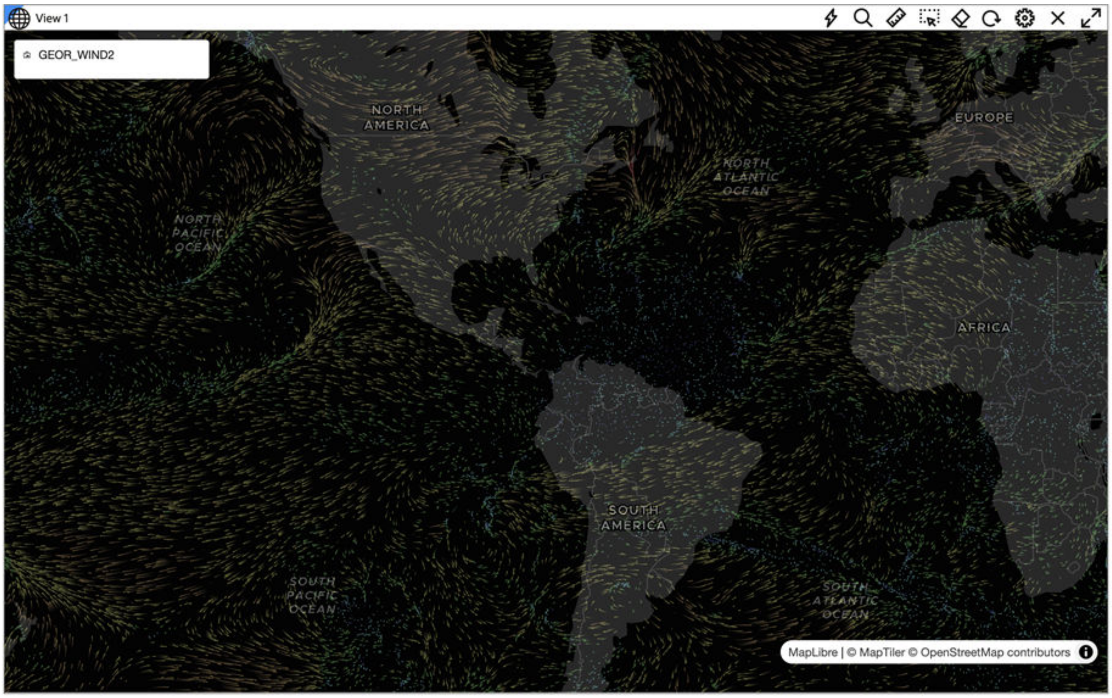
- Creating an OGC WMS Connection
  You can create a new connection to an external OGC (Open Geospatial Consortium) WMS (Web Map Service) service.
- Creating an OGC WMS Dataset
  Starting with Spatial Studio release 22.3, you can define datasets that are based on the `GetMap` responses from any external OGC (Open Geospatial Consortium) WMS (Web Map Service) services.

4.2.7 About Wind Animation

Starting from Oracle Spatial Studio Release 24.2.0, you can create and visualize wind animations that depict the direction of flow between various locations.

Although commonly referred to as wind animation, this visualization applies for any movement-based visualization. For instance, it can be used to render wind speeds, depict tectonic plate movements, or other vector-based simulations. The following figure shows a sample wind animation in Spatial Studio:

Figure 4-20 Sample Wind Animation

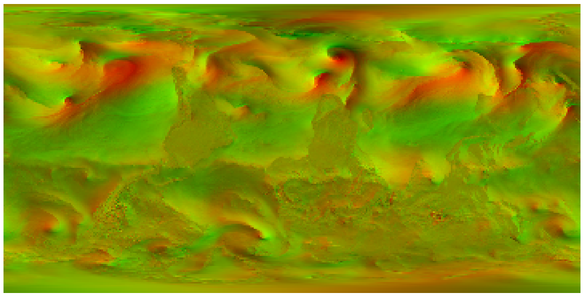


These visualizations rely on wind velocities along the `x (u)` and `y (v)` axes as input. These velocities are encoded within an image, where the red (R) and green (G) channels represent the `x` and `y` velocities, respectively. The values are scaled and mapped to an integer range of 0–255, with the R channel holding the `u` velocities and the G channel holding the `v` velocities.

The base image thus serves as a grid of `u` and `v` velocities at each integral longitude and latitude point within the specified bounding box (bbox). With this setup, the visualization generates random particles on the map, which are then animated according to the wind velocities, creating dynamic flowing visuals.

The following shows a sample base image that can be used to create a wind animation:

Figure 4-21 Sample Base Image for Wind Animation



The base image for the wind animation can be generated from a NOAA dataset or from any other supported data providers (see Generating a Base Wind Image From a NOAA Dataset for an example). You can then load this image as GeoRaster to Oracle Database and create a wind animation dataset for visualization.

- Generating a Base Wind Image From a NOAA Dataset
  This section provides the steps for generating a base wind image using a NOAA provider.
- Visualizing a Wind Animation Dataset
  You can create a wind animation visualization in Spatial Studio.

4.2.7.1 Generating a Base Wind Image From a NOAA Dataset

This section provides the steps for generating a base wind image using a NOAA provider.

You can generate a base image for creating a wind animation dataset from the NOAA GFS Dataset website or programmatically through scripts.

1. Open the URL NOAA GFS Dataset in your browser.
2. Select a **Subdirectory** for any specified data and time and proceed to the **atmos** option to work with atmospheric data.
3. Set the file type to `gfs.t06z.pgrb2.1p00.f000`.
4. Select the layer type as **10m above the ground**.
5. Select the **UGRD** (U-component of wind, eastward velocity) variable, specify the bounding box (bbox) you wish to analyze, and then click **Start Download**.
6. Repeat the previous step for **VGRD** (V-component of wind, northward velocity).

   Note that the velocity grids are downloaded as GRIB files.
7. Parse to extract the grid values from these files using GRIB tools (for example, wgrib2).
8. Create the base image by combining the grid values for UGRD and VGRD.

   Note the following for creating the base image:

- The **R (Red)** channel represents UGRD (x-axis velocities).
- The **G (Green)** channel represents VGRD (y-axis velocities).
- The velocity values must be scaled to fit within the 0-255 range, where `umin`, `umax`, `vmin`, and `vmax` represent the minimum and maximum values for the `u` (x-axis) and `v` (y-axis) velocities.
  These minimum and maximum values are crucial for encoding and decoding the velocity values from the base image, as they will be scaled to fit the 0-255 range for visualization purposes.

  > **Note:**
  >
  > It is important that you note the data range values as these will be required to create the wind animation dataset for the first time in Spatial Studio.

Alternatively, you can generate the base wind image programmatically through code as shown in the following example scripts.
The following scripts describe the steps for downloading, parsing grid values, and finally writing them into an image format for use in visualization.

download.sh

```
#!/bin/bash

GFS_DATE="20240719"
GFS_TIME="00"; # 00, 06, 12, 18
RES="1p00" # 0p25, 0p50 or 1p00
BBOX="leftlon=0&rightlon=360&toplat=90&bottomlat=-90"
LEVEL="lev_10_m_above_ground=on"
GFS_URL="https://nomads.ncep.noaa.gov/cgi-bin/filter_gfs_${RES}.pl?
dir=%2Fgfs.${GFS_DATE}%2F${GFS_TIME}
%2Fatmos&file=gfs.t06z.pgrb2.1p00.f000&${LEVEL}=on&subregion=${BBOX}"
curl "${GFS_URL}&var_UGRD=on" -o utmp.grib
curl "${GFS_URL}&var_VGRD=on" -o vtmp.grib

grib_set -r -s packingType=grid_simple utmp.grib utmp_out.grib
grib_set -r -s packingType=grid_simple vtmp.grib vtmp_out.grib

printf "{\"u\":`grib_dump -j utmp_out.grib`,\"v\":`grib_dump -j
vtmp_out.grib`}" > tmp.json

rm utmp.grib vtmp.grib utmp_out.grib vtmp_out.grib

DIR=`dirname $0`
node ${DIR}/prepare.js ${1}/${GFS_DATE}${GFS_TIME}
```

prepare.js

```
const PNG = require('pngjs').PNG;
const fs = require('fs');

const data = JSON.parse(fs.readFileSync('tmp.json'));
const name = process.argv[2];
const umessage = data.u.messages[0];
const vmessage = data.v.messages[0];

const unpack = (message) =>
    message.reduce((acc, { key, value }) => ({ ...acc, [key]: value }),
{});
const u = unpack(umessage);
const v = unpack(vmessage);

const width = u.Ni;
const height = u.Nj;

console.log(`Width: ${width}, Height: ${height}`);
console.log(`u: min=${u.minimum}, max=${u.maximum}`);
console.log(`v: min=${v.minimum}, max=${v.maximum}`);
console.log(`u values length: ${u.values.length}, v values length: $
{v.values.length}`);

const png = new PNG({
    colorType: 2,
    filterType: 4,
    width: width,
    height: height
});

for (let y = 0; y < height; y++) {
    for (let x = 0; x < width; x++) {
        const i = (y * width + x) * 4;
        const k = y * width + x;

        if (k < 0 || k >= u.values.length || k >= v.values.length) {
            console.error(`Index out of bounds at (x: ${x}, y: ${y}) ->
k: ${k}`);
            continue;
        }

        const uValue = u.values[k];
        const vValue = v.values[k];

        if (isNaN(uValue) || isNaN(vValue)) {
            console.error(`Invalid value at (x: ${x}, y: ${y}) -> u: $
{uValue}, v: ${vValue}`);
            continue;
        }

        png.data[i + 0] = Math.floor(255 * (uValue - u.minimum) /
(u.maximum - u.minimum));
        png.data[i + 1] = Math.floor(255 * (vValue - v.minimum) /
(v.maximum - v.minimum));
        png.data[i + 2] = 0;
        png.data[i + 3] = 255;
    }
}

png.pack().pipe(fs.createWriteStream(`/Users/user1/Downloads/build/$
{name}.png`));
```

```
fs.writeFileSync(`/Users/user1/Downloads/build/${name}.json`,
JSON.stringify({
    source: 'http://nomads.ncep.noaa.gov',
    date: formatDate(u.dataDate + '', u.dataTime),
    width: width,
    height: height,
    uMin: u.minimum,
    uMax: u.maximum,
    vMin: v.minimum,
    vMax: v.maximum
}, null, 2) + '\n');

function formatDate(dateStr, timeStr) {
    const year = dateStr.slice(0, 4);
    const month = dateStr.slice(4, 6);
    const day = dateStr.slice(6, 8);
    const hour = String(timeStr).padStart(4, '0');
    return `${year}-${month}-${day}T${hour.slice(0, 2)}:00:00Z`;
}
```

4.2.7.2 Visualizing a Wind Animation Dataset

You can create a wind animation visualization in Spatial Studio.

The following instructions assume that you have a wind animation enabled GeoRaster dataset and the dataset is already added to the project in the Active Project page. See Creating a Wind Animation Dataset and Enabling Wind Animation For an Existing GeoRaster Dataset for more information.

1. Click the **Visualizations** tab 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 layers.

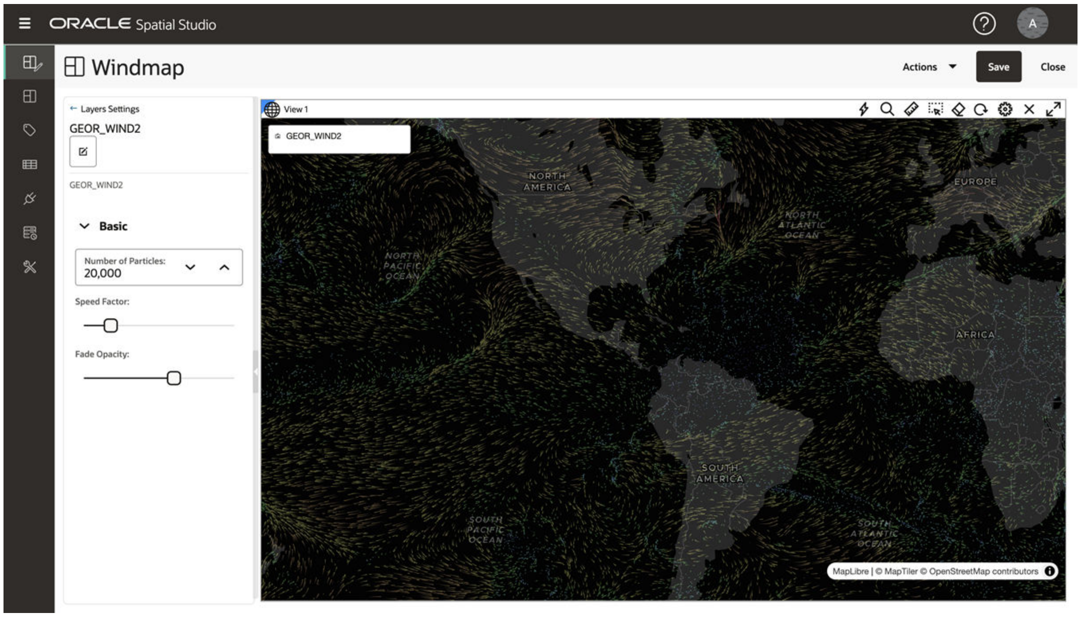
3. Click the **Data** tab on the left pane in the Active Project page.

   This lists all the **Datasets** that are loaded for the project.

4. Click and drag the desired wind animation dataset from the list to the map view on the right.

   The wind animation visualization gets displayed as shown:

Figure 4-22 Visualizing Wind Animation



← Layers Settings
GEOR_WIND2
GEOR_WIND2
Basic
Number of Particles: 20,000
Speed Factor:
Fade Opacity:

It is important to note that wind animations do not support pitch and rotation actions. If the view is rotated or pitched, then the wind animation will be disabled, and a warning will be displayed. The wind animation will automatically be reenabled once the pitch/rotate is returned to the default (0).

5. Optionally, click ··· against the wind animation dataset layer in the **Data** tab of the **Layers** list and configure the following properties.
   - **Number of Particles**: Controls how many particles are randomly drawn in the current viewport. These particles will be animated based on the wind velocities.
   - **Speed Factor**: A multiplier between zero and one that adjusts the on-screen movement in relation to the actual wind speed.
   - **Fade Opacity**: Manages the length of particle trails and when they should fade out, affecting the smoothness of the animation.

4.3 Using a Cesium Map Visualization

Spatial Studio uses a CesiumJS plugin that allows you to view 3D visualizations using 3D Tiles or CZML data 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 can upload one of the following files to Spatial Studio:

- **3D Tileset:** Supports formats are:
  - Point Cloud (`.pnts`)
  - Batched 3D Model (`.b3dm`)
- **CZML file:** CZML formatted data in `.czml` files

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

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

- Visualizing a 3D Tileset Using a Cesium Map
- Visualizing CZML Data Using a Cesium Map

4.3.1 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 added to the project in the Active Project page. To create a dataset with 3D Tiles, see Creating a Dataset from Cesium Datasets for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

   This lists the various visualization options.

2. 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

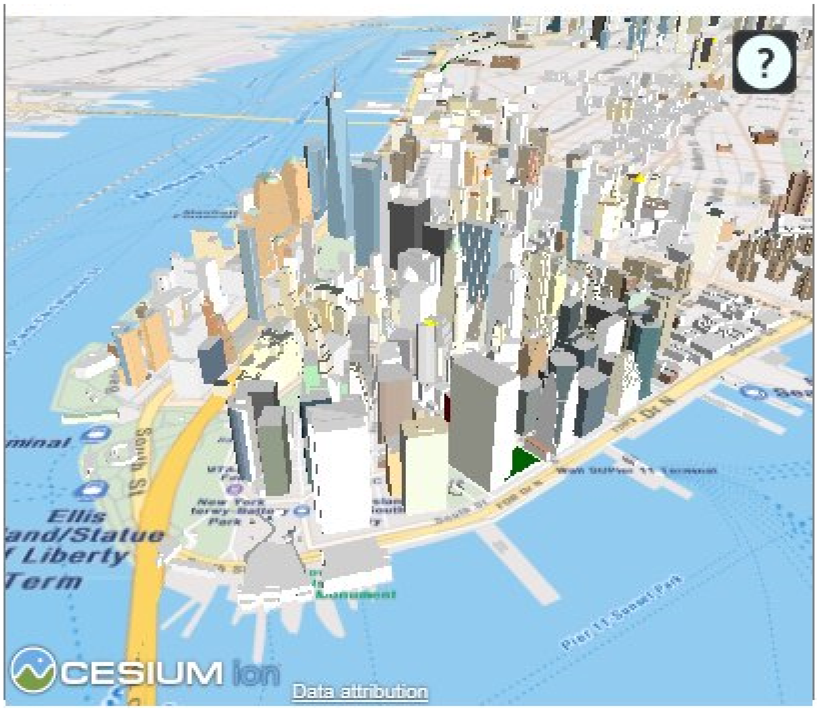
3. Click the **Data** tab on the left pane in the Active Project page.

   This lists all the **Datasets** that are loaded for the project.

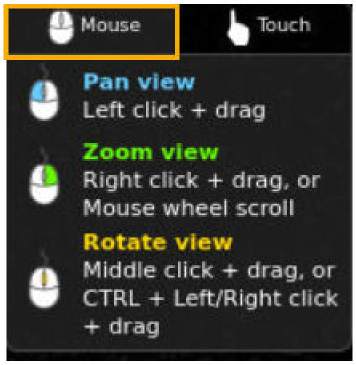
4. Click and drag the desired **3D Tiles dataset** from the list to the map view on the right.

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

Figure 4-23   3D Cesium Map Visualization



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

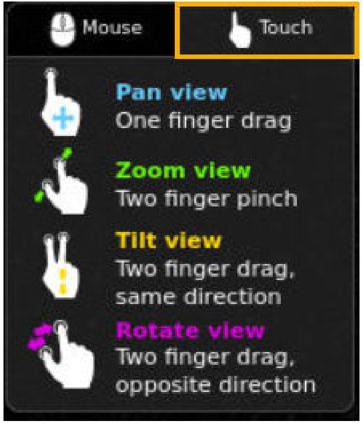


Mouse | Touch

Pan view
Left click + drag

Zoom view
Right click + drag, or
Mouse wheel scroll

Rotate view
Middle click + drag, or
CTRL + Left/Right click
+ drag



Mouse | Touch

Pan view
One finger drag

Zoom view
Two finger pinch

Tilt view
Two finger drag,
same direction

Rotate view
Two finger drag,
opposite direction

4.3.2 Visualizing CZML Data Using a Cesium Map

You can visualize your CZML dataset on a Cesium map using the following steps.

The instructions assume that the CZML formatted data is uploaded and the CZML dataset is already added to the project in the Active Project page. To create a dataset using `.czml` file, see Creating a Dataset from Cesium Datasets for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

   This lists the various visualization options.

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

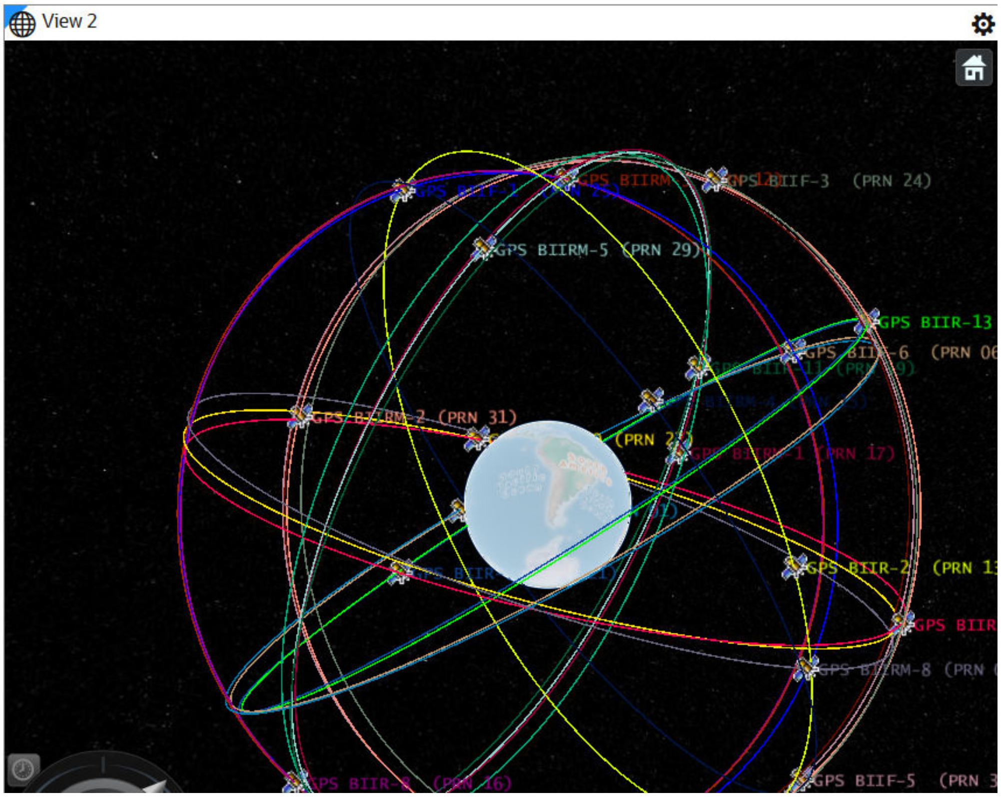
3. Click the **Data** tab on the left pane in the Active Project page.

   This lists all the **Datasets** that are loaded for the project.

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

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

Figure 4-24   Cesium Map Visualization Using a CZML Dataset



4.4 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:

- Applying a Render Style For a Point Layer
- Applying Style for a GeoRaster Layer
- Applying Data-Driven Style to a Map with H3 Aggregations
- Applying Predefined Colors to a Map Layer
- Applying Predefined Symbols to a Map Layer
- Applying Predefined Colors to Symbols
- Applying Custom Map Symbols to a Map Layer
- Applying an Animated Map Symbol to a Map Layer

- Applying Style to a CZML Cesium Map Layer
- Applying Style to a Map Layer Using a GeoJSON URL Dataset
- Setting Selection Tolerance on a Map Layer
- Adding a Pin on a Map
- Applying Map Backgrounds
- Using the Redline Map Tool

4.4.1 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.

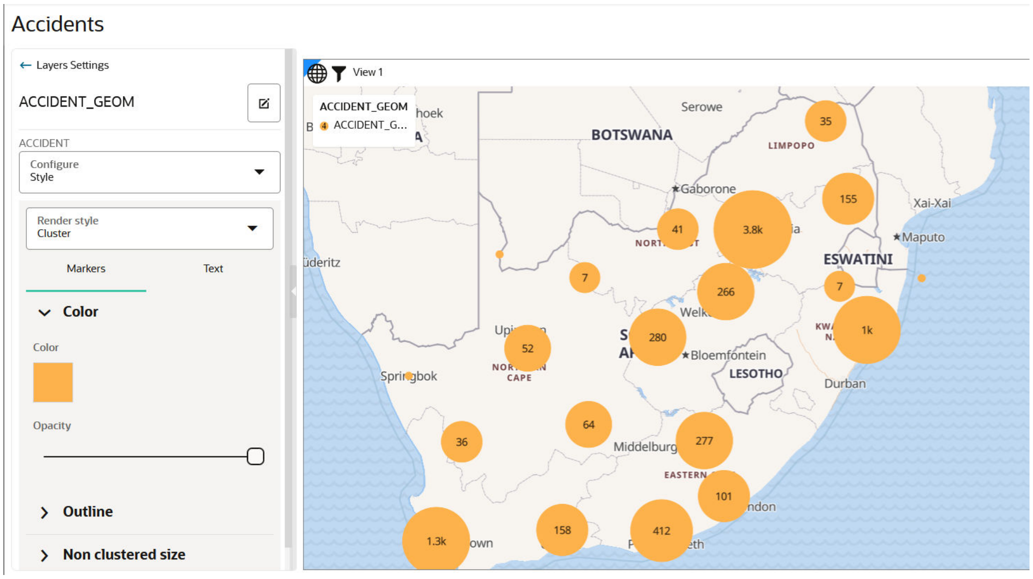
1. Click ••• against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Configure **Style** and select a **Render Style** option from the drop-down list.

   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 4-25 Applying a Cluster Style


Accidents

← Layers Settings

ACCIDENT_GEOM

ACCIDENT

Configure Style

Render style: Cluster

Markers | Text

Color

Color

Opacity

Outline

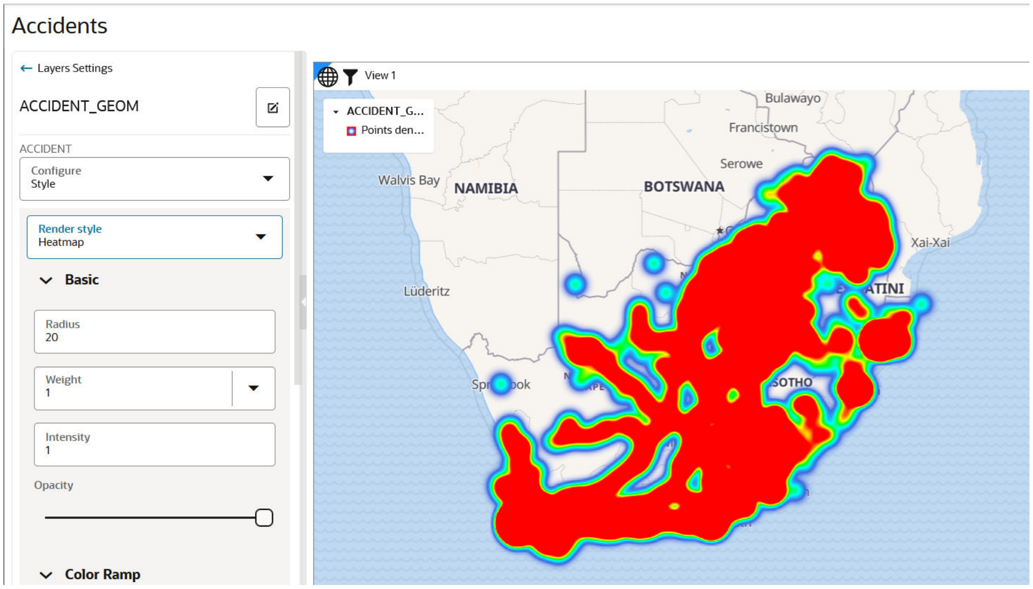
Non clustered size

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.

Figure 4-26 Applying a HeatMap Style


Accidents

← Layers Settings

ACCIDENT_GEOM

ACCIDENT

Configure Style

Render style: Heatmap

Basic

Radius: 20

Weight: 1

Intensity: 1

Opacity

Color Ramp

Also, you can further customize the Heatmap visualization by changing the **Radius** or **Weight** (or both) in the **Basic** settings panel shown in the preceding figure. The following describes more about these parameters:

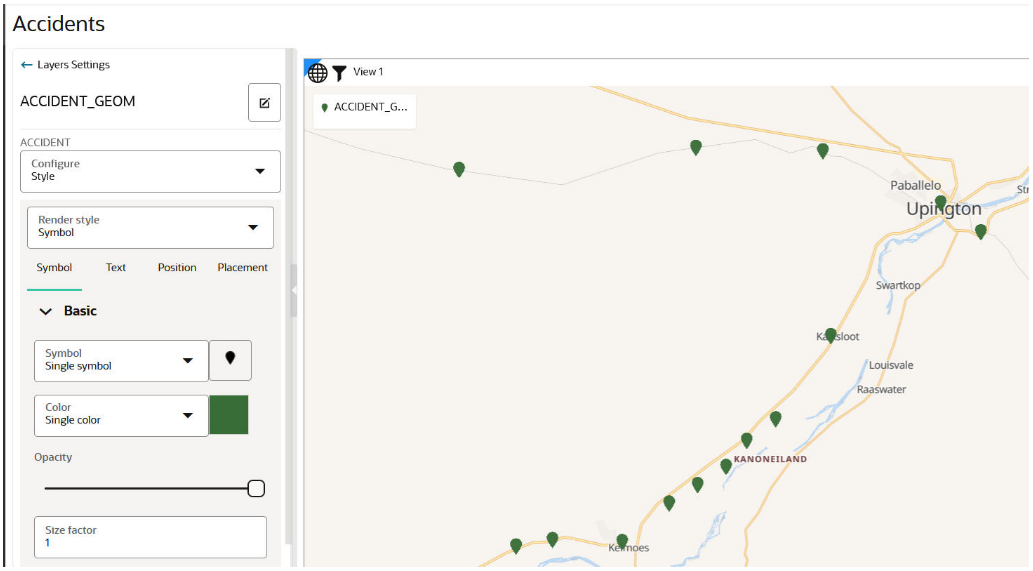
  - **Radius:** This value defines (in pixel) how far each data point contributes to (influences) the heat of its surrounding area. Its contribution drops to zero for any area beyond this radius with the data point at the center.
  - **Weight:** This value defines how much weight a data point contributes to the heat. The default value is set to 1 which means all data points contribute equally to the heat. If you select a numeric column (with zero or positive values) in the **Weight** drop down list, then that value determines the weight contributed by a data point to the heat calculation. For instance, if a data point's weight column has a value of 5, then it is contributing to the heat as if there are five data points at that location (each with the default weight of 1). However, if the weight column contains a negative value, then note that the result is not predictable.
  - **Intensity:** This value should always be 1.

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

- 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 4-27   Applying a Symbol Style



Accidents

ACCIDENT_GEOM

ACCIDENT

Configure: Style

Render style: Symbol

Symbol: Single symbol

Color: Single color

Size factor: 1

You can customize the symbol used to represent the data points by clicking the image button next to the **Symbol** drop-down list. Spatial Studio provides several built-in sets of symbols and also supports custom map symbols (icons).

> **See Also:**
>
> - Applying Predefined Symbols to a Map Layer
> - Applying Custom Map Symbols to a Map Layer

The map layer gets rendered with the appropriate style.

4.4.2 Applying Style for a GeoRaster Layer

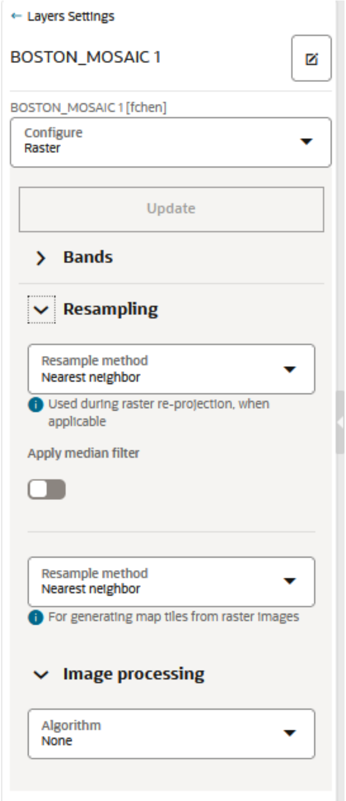
You can style a GeoRaster map layer using the following steps.

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**:
   - **Opacity**
   - **Maximum Brightness**
   - **Minimum Brightness**
   - **Saturation**
   - **Contrast**
   - **Hue Rotate**
   - **Fade Duration**
4. Optionally, modify any of the following rendering options in the **Raster** tab:

Figure 4-28 Raster Configuration for GeoRaster Map Layer



Configure
Raster

Resample method
Nearest neighbor
Used during raster re-projection, when applicable

Apply median filter

Resample method
Nearest neighbor
For generating map tiles from raster images

Algorithm
None

- **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.
- **Resampling:** The following two types of resampling processes are supported:
  - **Image Reprojection:** This represents the interpolation method to be used when transforming an image from one SRS (Spatial Reference System) to another. This applies only if the SRS of the source image in the database table is different from Spatial Studio's base map projection.
  - **Map Image Tile Generation:** This represents the image interpolation value that determines how each image cell's value on a view port is interpolated using the original image pixels. During an image tile generation, resampling occurs (although the provided images are in the same SRS) as the spatial resolution of the two images may be different.
    The following interpolation algorithm options are supported:
    - 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.

        - CUBIC: This option uses cubic convolution function to estimate image cell's value. Since a 4x4 neighboring pixels participate in the interpolation, it results in a smoother image.
    - **Image Processing:** represents the subprogram to be used to enhance the visual quality of the images.

    The GeoRaster map layer is rendered with the updated settings.

4.4.3 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.

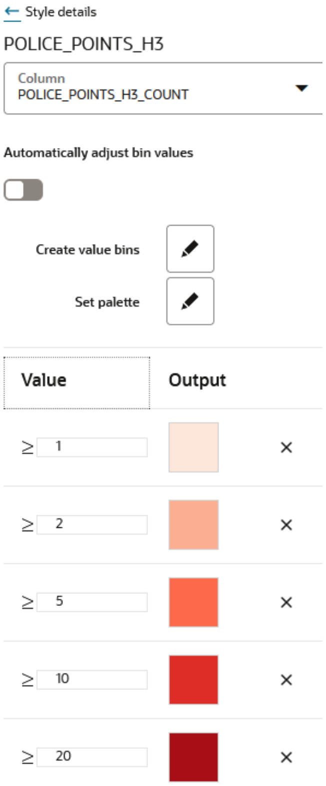
The instructions assume that you have a H3 map layer displayed on your Active Project page.

1. Click ⋯ against the map layer in the **Layers** tab of the **Layers List** list.
2. Select **Settings** in the context menu.
3. Configure **Style**.
4. Select **Based on Data** for the **Color** value under **Fill**.

   The **Style details** panel is displayed.
5. Select the **Column** to control styling.
6. 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.
7. Assign colors to the bins based on data values.

   The following figure shows the Style details panel options:

Figure 4-29 Applying Data-Driven Color Styling for H3 Map Layer



← Style details

POLICE_POINTS_H3

Column: POLICE_POINTS_H3_COUNT

Automatically adjust bin values

Create value bins

Set palette

Value	Output	
≥ 1	🟥	×
≥ 2	🟥	×
≥ 5	🟥	×
≥ 10	🟥	×
≥ 20	🟥	×

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

4.4.4 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.

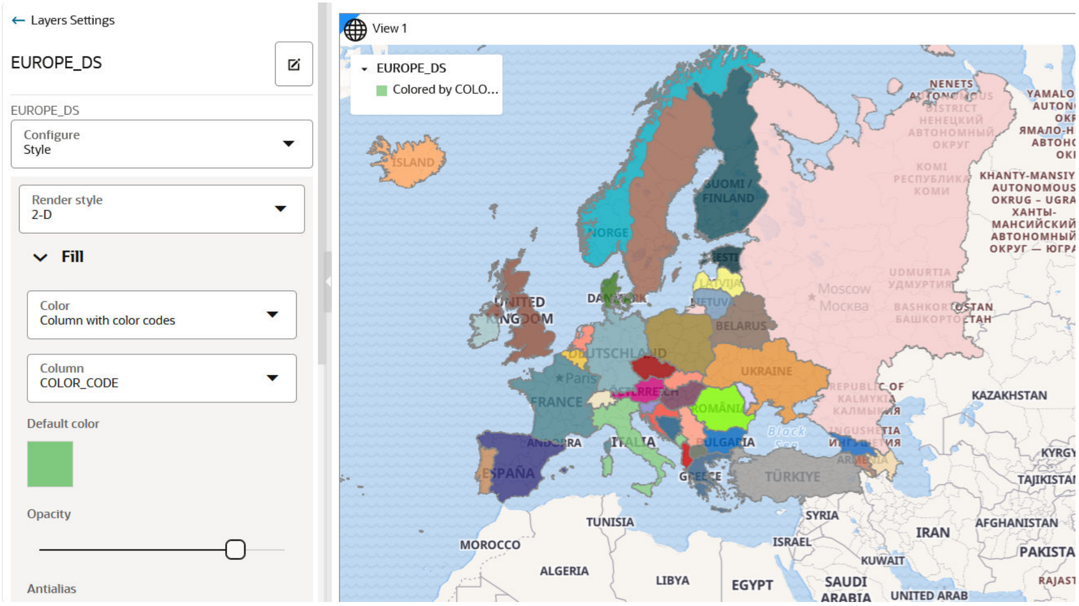
The following steps enable you to color code your map layer.

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 map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Configure **Style** by selecting **Column with color codes** for the **Color** value under **Fill**.
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 4-30 Color Coding a Map Layer


← Layers Settings

EUROPE_DS

EUROPE_DS

Configure: Style

Render style: 2-D

Fill

Color: Column with color codes

Column: COLOR_CODE

Default color: 🟩

Opacity

Antialias

View 1

EUROPE_DS

🟩 Colored by COLO...

The color code gets applied to the map layer.

4.4.5 Applying Predefined Symbols to a Map Layer

Using a column with predefined symbol values, you can apply data-driven symbol styling to your map layer.

However, the symbol must belong to one of the supported symbol sets. Symbols in Spatial Studio are grouped into three sets and each set is identified by a `Symbol set id` as described in the following table:

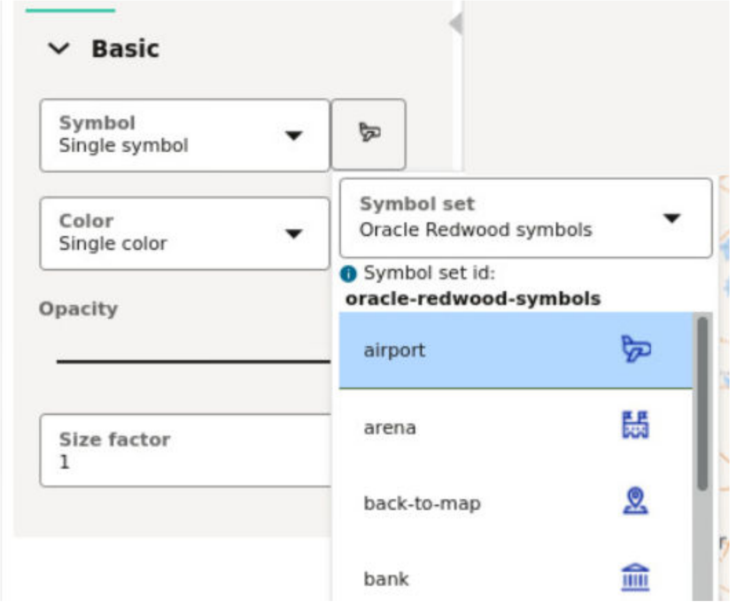
Table 4-1 Symbol Set

Symbol Set	Symbol set id
Spatial Studio default	`studio`
Oracle Redwood symbols	`oracle-redwood-symbols`
Airfields	`airfields`

You can store a symbol name and the symbol set to which it belongs in a column of your dataset and then use this column property to assign symbols to your map.

For example, assume you want to use the `airport` icon as shown in the following figure:

Figure 4-31   Symbols and Symbol Set



You must then use `oracle-redwood-symbols/airport` as the symbol name in your dataset column. In this case:

- `oracle-redwood-symbols`: is the symbol set id
- `airport`: is the name for the icon to be used on the map layer

The following steps enable you to apply data driven symbol styling for your map layer.

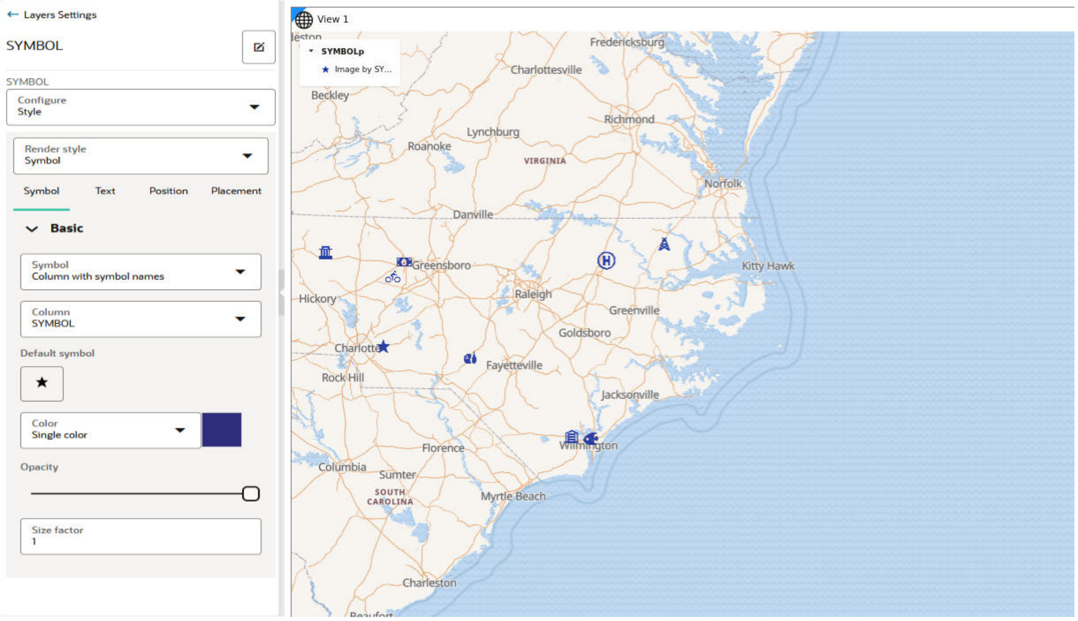
The instructions assume that the map layer displayed on your Active Project page uses a dataset having a column property that contains symbol names following the convention as explained earlier in this section.

1. Click ··· against the map layer in the **Layers** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Configure **Style** and select **Symbol** as the **Render Style**.
4. Select **Column with symbol names** from the **Symbol** drop-down list in the **Basic** section of the **Symbol** tab.
5. Select the **Column** that contains the symbol name value.

   The following figure shows the styling of the map layer using the symbol name variables in the dataset:

   > **Note:**
   >
   > If incorrect symbol names are present in the dataset column, then for those data points, the **Default symbol** is displayed on the map layer.

Figure 4-32 Custom Symbol Styling in Map Visualization



SYMBOL

Configure: Style

Render style: Symbol

Symbol: Column with symbol names

Column: SYMBOL

Default symbol: ★

Color: Single color

Opacity

Size factor: 1

The symbols gets applied to the map layer.

4.4.6 Applying Predefined Colors to Symbols

You can color the symbols on a map layer by using an attribute column of the dataset that contains predefined color codes.

The following steps enable you to color code the symbols on a map layer.

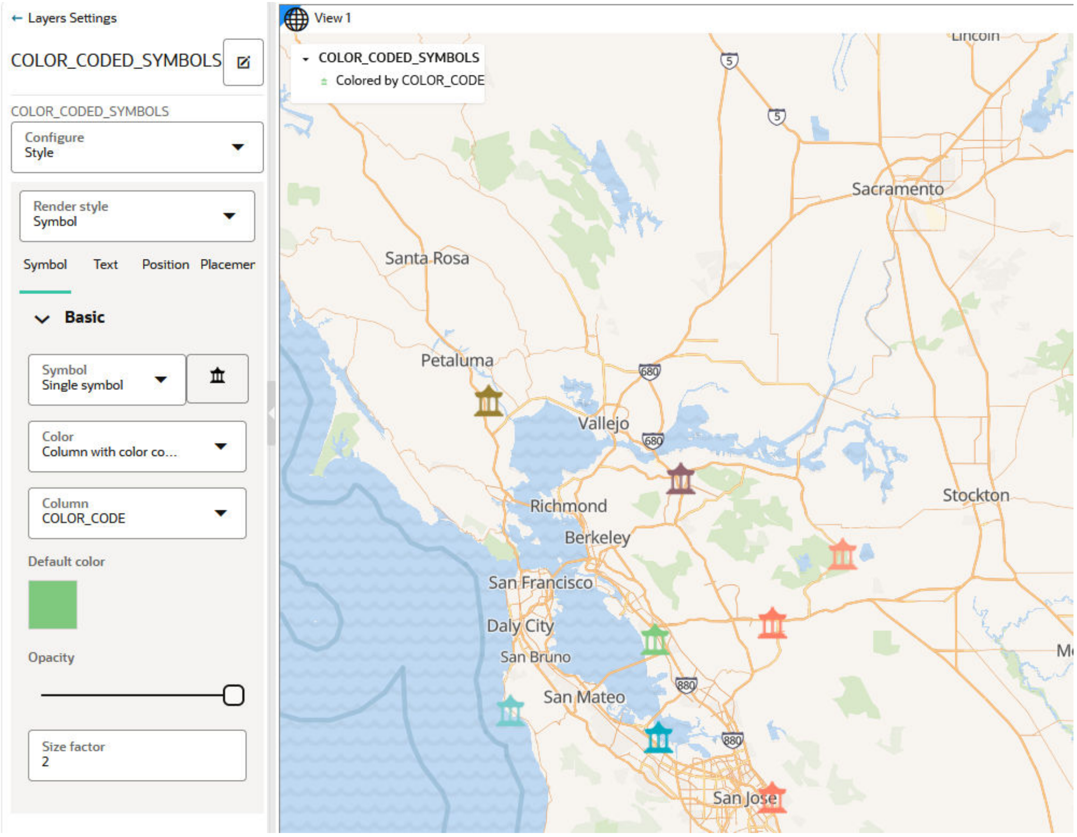
The instructions assume that the map layer displayed on your Active Project page uses a dataset having a column property that contains color-coded values.

1. Click ⋯ against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Configure **Style** by selecting **Column with color codes** for the **Color** value in the **Basic** panel.
4. Select the **Column** that contains the color value.

   Note that the color values in the column must be in `#RGB` notation with the `#` character included.

   The color code gets applied to the symbols on the map layer. The following figure shows the color-coded symbols on the map layer using the color variable in the dataset:

Figure 4-33 Color-Coded Symbols



COLOR_CODED_SYMBOLS
Configure
Style
Render style
Symbol
Symbol
Single symbol
Color
Column with color co...
Column
COLOR_CODE
Size factor
2

4.4.7 Applying Custom Map Symbols to a Map Layer

You can apply custom map symbols for styling your map layer.

However, note that if a point dataset is being styled by custom symbols, then it can no longer use any of the built-in symbols. Essentially, you cannot mix both custom and built-in symbols on a map layer in the map visualization.

Perform the following steps to style your map layer using custom map symbols.

The instructions assume that a map layer is displayed on the Active Project page and the custom map symbols are already added in Spatial Studio. See Uploading a Map Symbol for more information.

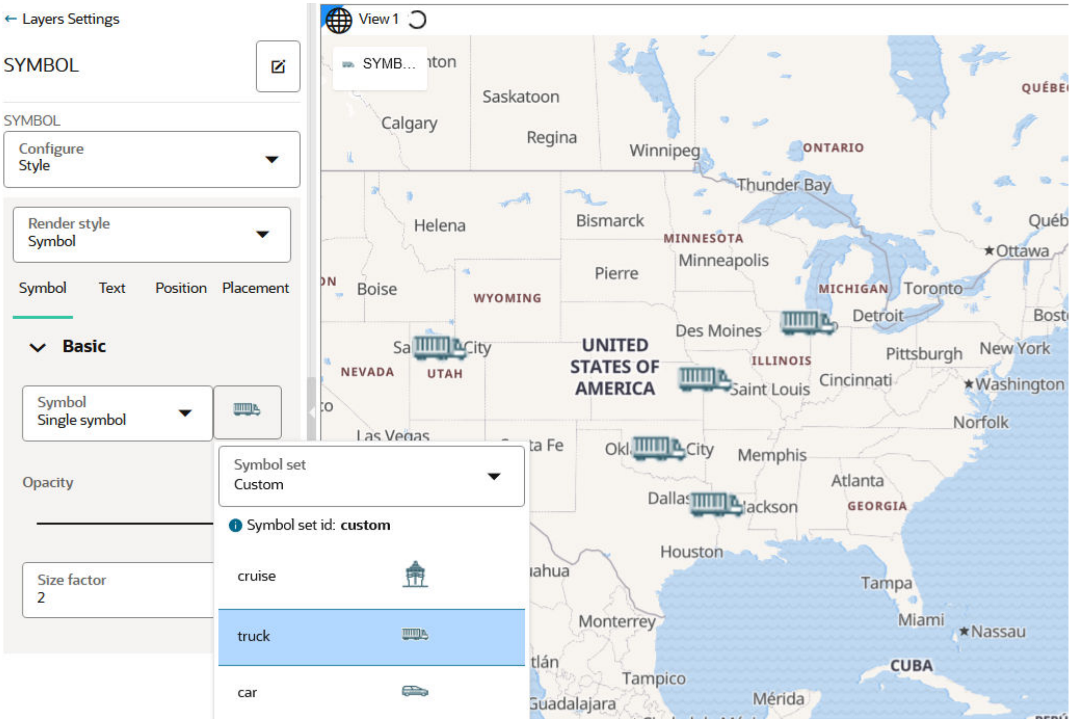
1. Click ••• against the map layer in the **Layers** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Configure **Style** and select **Symbol** as the **Render Style**.
4. Click the image button next to the **Symbol** drop-down list.

   The **Symbol set** drop-down appears.
5. Select *Custom* under **Custom symbols** in the **Symbol set** drop-down list.

   The uploaded custom symbols list appears.
6. Select the required custom symbol.

   The symbol gets applied to the map layer as shown in the following figure:

Figure 4-34 Using a Custom Map Symbol in Visualization



SYMBOL

Configure: Style

Render style: Symbol

Symbol: Single symbol

Symbol set: Custom

Symbol set id: custom

Size factor: 2

4.4.8 Applying an Animated Map Symbol to a Map Layer

You can apply a circular animating (pulsing) symbol for styling point-type map layers.

Perform the following steps to apply an animating symbol to a map layer.

The instructions assume that a point map layer is already displayed on the map. The new animating symbol is found in the Symbol render style or symbol picker.

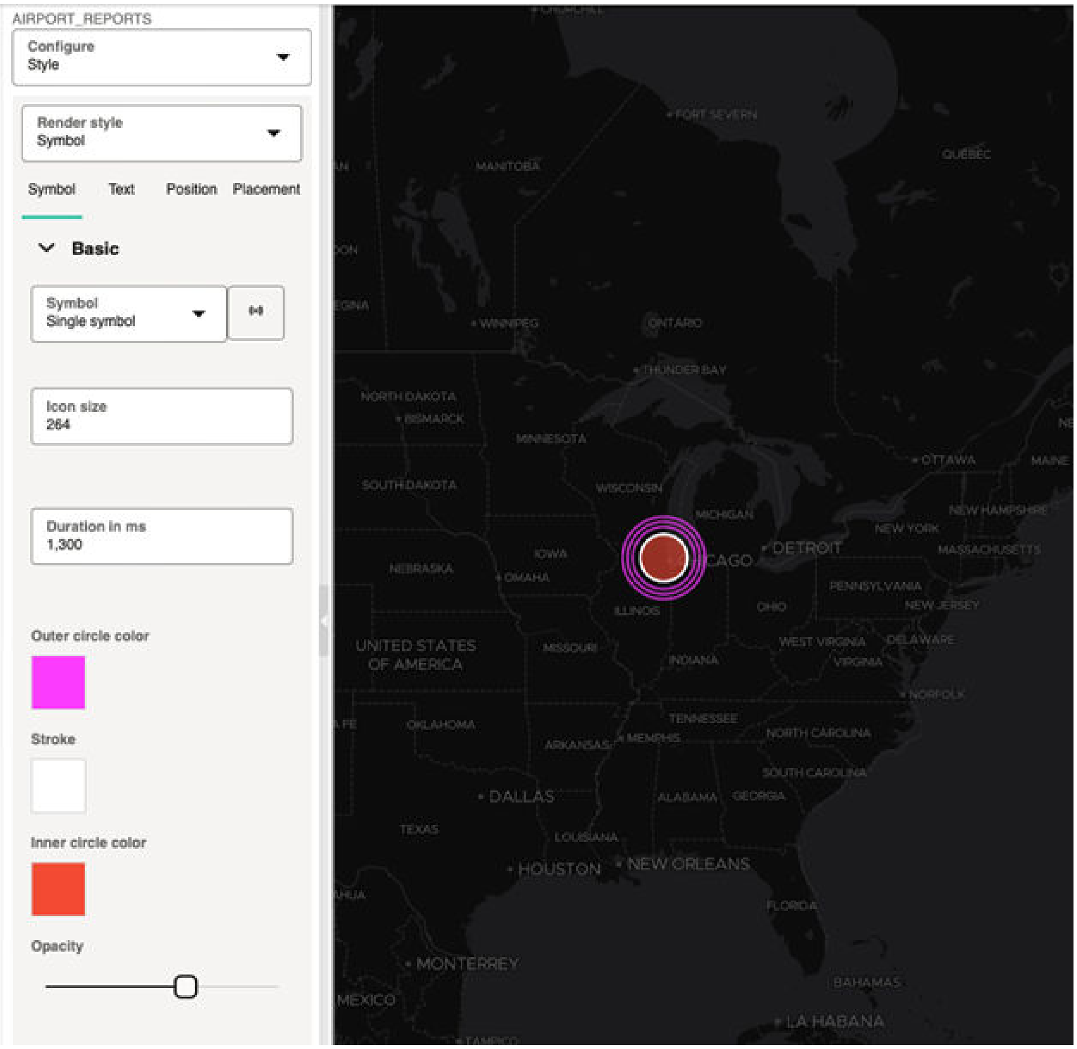
1. Click ••• against the map layer in the **Layers** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Configure **Style** and select **Symbol** as the **Render Style**.
4. Click the image button next to the **Symbol** drop-down list.

   The **Symbol set** drop-down appears.
5. Select the *pulsing-dot* symbol under the **Animations** section in the **Symbol set** drop-down list.
6. Optionally, customize the animating symbol.

   This includes the overall **Icon size**, **Inner circle color**, **Outer circle color**, **Stroke**, and **Opacity** of the inner circle. Also, you can customize the animation speed by configuring the **Duration in ms** field.

   The following figure shows custom styling of an animated symbol on a map visualization.

Figure 4-35   Animated Map Symbol



AIRPORT_REPORTS

Configure: Style

Render style: Symbol

Symbol: Single symbol

Icon size: 264

Duration in ms: 1,300

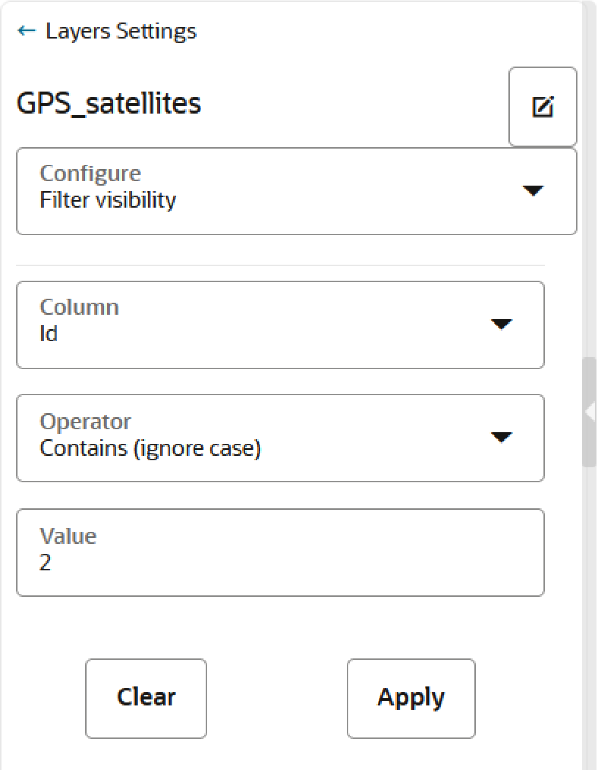
4.4.9 Applying Style to a CZML Cesium Map Layer

When using a CZML dataset in a Cesium map visualization, you can filter on a specific entity value or control the visibility (show or hide) for the displayed entities. Also, you can add an info window to enhance your map interaction.

The instructions assume that you have added a CZML dataset to a Cesium map on your Active Project page.

1. Click ⋯ against the CZML map layer in the **Layers** tab of the **Layers List** list.
2. Select **Settings** in the context menu.
3. Configure **Interaction** to set an **Info window**.
4. Configure **Filter Visibility** and set the filter value for the required column name.

Figure 4-36 Applying Filters for CZML Map layer



Configure: Filter visibility

Column: Id

Operator: Contains (ignore case)

Value: 2

5. Configure **Toggle Visibility** to show or hide the required entities on the map.

4.4.10 Applying Style to a Map Layer Using a GeoJSON URL Dataset

Spatial Studio supports data-driven styling for your GeoJSON URL dataset map layer. You can access the dataset columns that are sourced from the source URL and apply the desired styling for the map layer.

> **See Also:**
>
> Creating a GeoJSON URL Dataset

The instructions assume that you have added a GeoJSON URL dataset on your Active Project page.

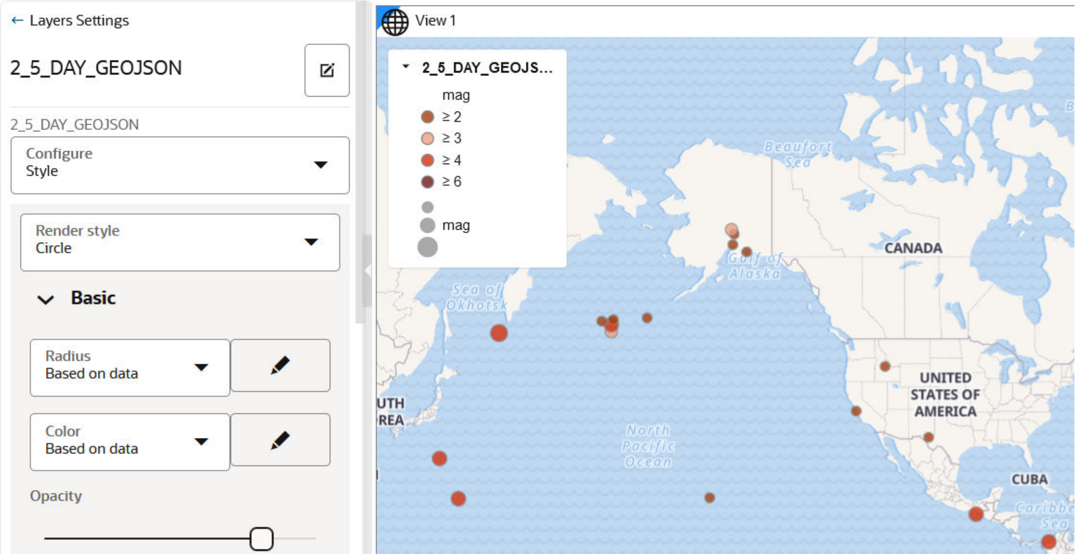
1. Click ··· against the map layer in the **Layers** tab of the **Layers List** list.
2. Select **Settings** in the context menu.
3. Configure **Style**.
4. Apply the radius or color styling based on data columns.
   - **Styling based on data**
     a. Select **Based on Data** in the **Radius** or **Color** drop down list.
     b. Click the **Edit bind** icon.
     c. Select the **Column** to control styling.

   d. Optionally, adjust the bin and the output values.

- **Applying predefined colors**
   a. Select **Column with color codes** in the **Color** drop down list.
   b. Select the **Column**.

The following figure shows the radius and color styling applied to a GeoJSON URL dataset map layer:

Figure 4-37 Data-Driven Styling for GeoJSON URL Map Layer



4.4.11 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.

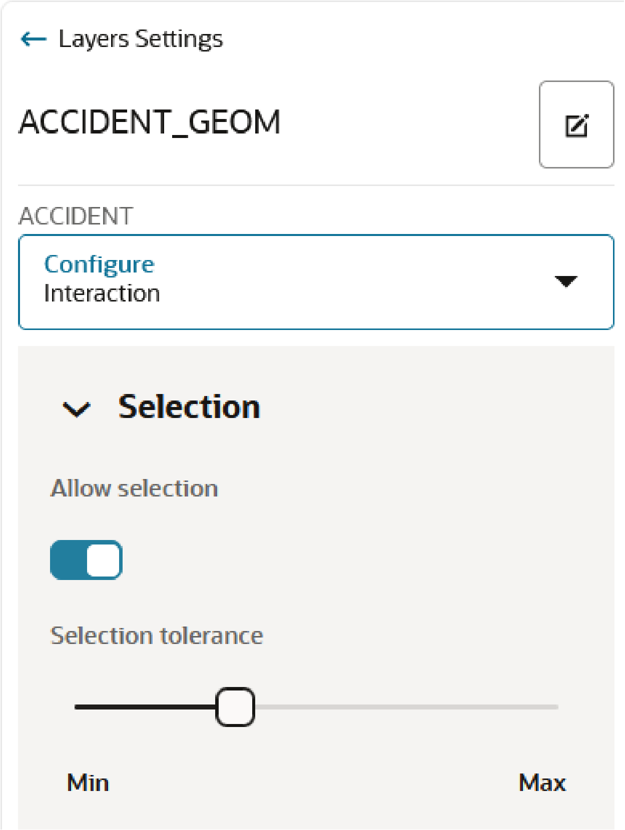
The following steps enable you to adjust and set the selection tolerance on a map.

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 configure **Interaction**.
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 4-38 Setting the Selection Tolerance



The custom selection tolerance gets applied to the map layer.

4.4.12 Adding a Pin on a Map

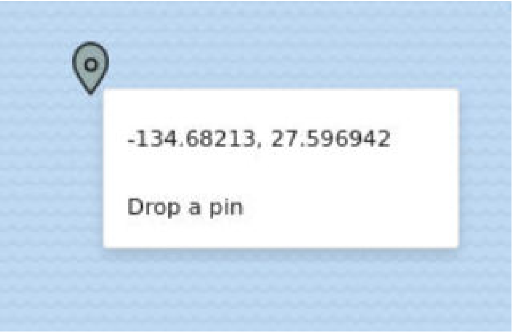
The following steps enable you to inspect the current mouse pointer's latitude and longitude coordinates and pin a location on the map layer.

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 4-39 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.

4.4.13 Applying Map Backgrounds

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

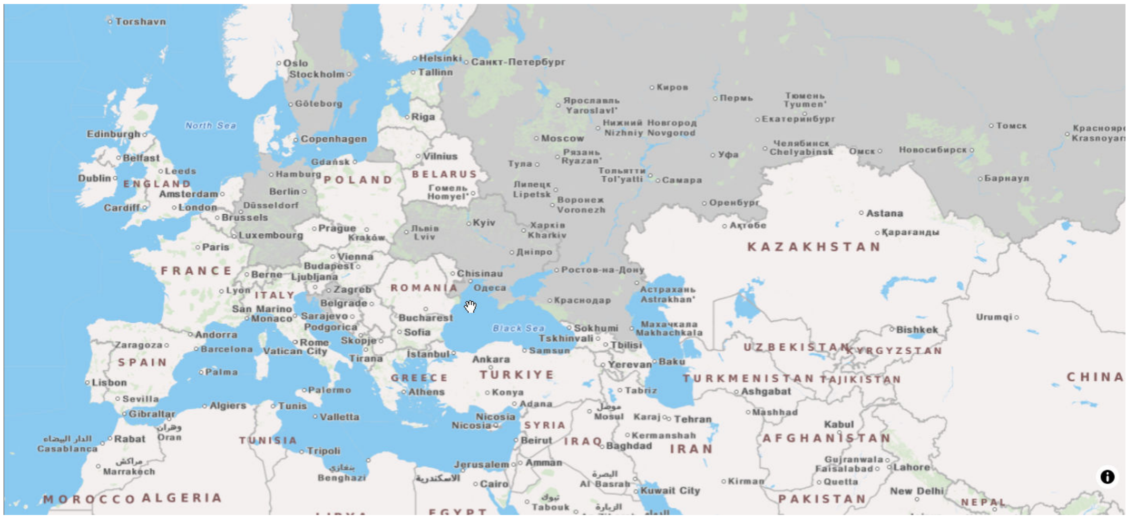
You can select one of the following map backgrounds for your project visualization:

- 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 Console Page for more information on adding basemaps.

The labels on the the basemap are displayed in English along with the local language of the region. However, you can change the language for the basemap labels. See Configuring a Map Visualization for more information.

Figure 4-40 Basemap Displaying English and Local Language Labels



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

- Changing Map Backgrounds

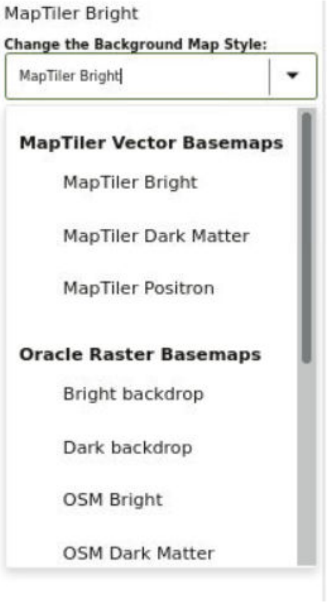
4.4.13.1 Changing Map Backgrounds

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 4-41 Changing a Map Background



MapTiler Bright

Change the Background Map Style: MapTiler Bright

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

The selected map background gets applied to your project visualization.

4.4.14 Using the Redline Map Tool

Spatial Studio provides the Redline map tool for drawing and annotating different geometry shapes on your map.

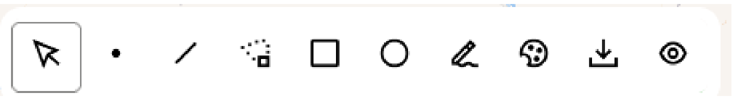
In addition, you can edit, delete, or share these redline drawing sets by exporting it to a GeoJSON file.

Perform the following steps to get started with the Redline map tool. The instructions assume that you have a project opened on your Active Project page and the map layer is displayed for visualization.

1. Click the **Actions** icon on the map tool bar and select **Redline**.

   Alternatively, right-click on the map layer and select **Show redline toolbar**.
   The Redline map tool bar appears as shown:

Figure 4-42 Redline Map Tool



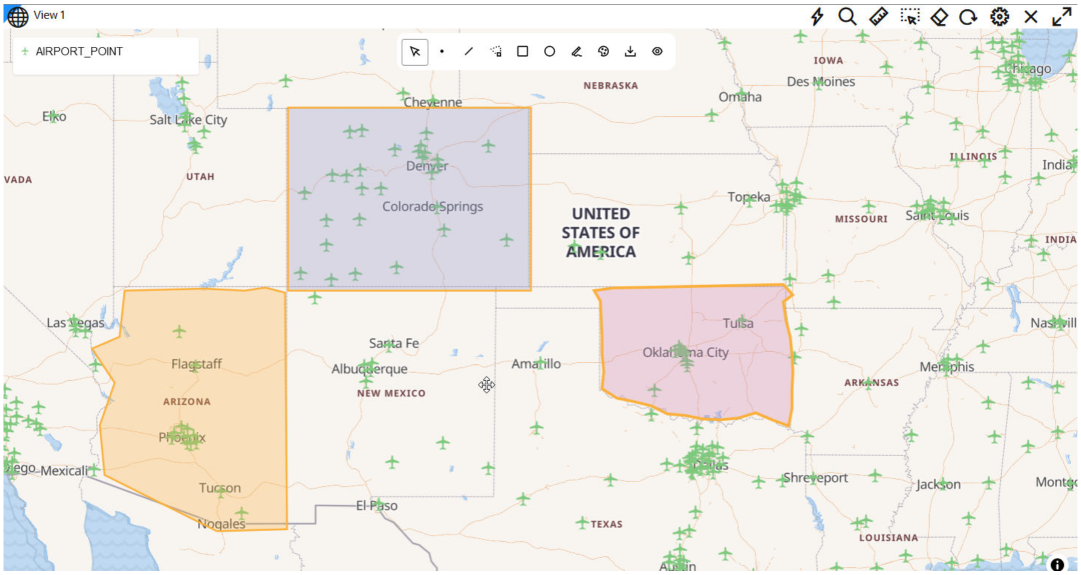
The tool bar provides the following options for defining or managing Redline objects on the map:

- **Select Feature (default):** To select a Redline object for update or delete.
- **Draw Point:** To define a Redline point.
- **Draw Line:** To define a Redline line.
- **Draw Polygon:** To define a Redline polygon.
- **Draw Rectangle:** To define a Redline rectangle.
- **Draw Circle:** To define a Redline circle.
- **Draw Freehand:** To draw a Redline freehand.
- **Click to choose a color:** To choose the default color for the Redline objects.
- **Export Features:** To export the Redline objects to a GeoJSON file. You can later upload the file to create a **Dataset** which can be used in Map Visualizations. See Creating a Dataset by Uploading a File to upload a GeoJSON file.
- **Toggle Visibility:** To hide or unhide the marked Redline objects.

2. Click the desired drawing option and draw the corresponding shape on the map.

   For example, the following figure shows three Redline objects added to a map layer:

Figure 4-43 Redlining Areas in Map Visualization



Repeat this step to add as many Redline objects as required.

> **Tip:**
>
> You can duplicate and move a Redline object on the map.

3. Optionally, perform any of the following actions on a defined Redline object.

   - **Modify the Shape of the Redline Object**

      a. Click **Select Feature** on the Redline map toolbar.
      b. Click the required Redline object.
         The existing vertices of the object are shown highlighted in red.
      c. Click along the object boundary to add new vertices (points) and adjust its shape as required.
      d. Optionally, move the entire object to the desired location on the map.
   - **Edit Feature Properties**
      a. Click **Select Feature** on the Redline map toolbar.
      b. Right-click and select **Edit Feature Properties** on the required Redline object.
      c. Add a **Description** to annotate the object.
         This description will be displayed as a tooltip when you mouse over a Redline object.
      d. Optionally, modify the **Fill** and **Outline** width.
   - **Duplicate Feature**
      a. Click **Select Feature** on the Redline map toolbar.
      b. Right-click and select **Duplicate Feature** on the required Redline object.
      c. Move the duplicated object to the desired area on the map.
   - **Delete Feature**
      a. Click **Select Feature** on the Redline map toolbar.
      b. Right-click and select **Delete Feature** on the required Redline object to be deleted.

   Also, note that the following keyboard shortcuts are supported when working with Redline objects:

   - Click `esc` to deselect the currently selected feature.
   - Click `del` to delete the currently selected feature.
   - Click `ctrl + r` and drag to rotate the currently selected feature.
   - Click `ctrl + s` and drag to scale or resize the currently selected feature.

4. Optionally, export all the marked Redline objects to a GeoJSON file.
   a. Click **Export Features** on the Redline map toolbar.
   b. Click **Download as GeoJson** and save the `.geojson` file to your system.

      Also, note the following details regarding the exported GeoJSON file:

      - Each Redline object is automatically assigned a unique ID (UUID), which will be a exported.
      - Any description entered for a Redline object is exported.
      - Any styling information, such as custom colors and outline width are NOT exported.
5. Click **Save** to save your project with the Redline drawings.

   The drawings will be persisted as a part of the project. Note that when you reopen an existing project with Redline drawings, the shapes are initially not editable. You must select the Redline tool again to "rehydrate" the tool with the drawings.
6. Close the Redline map tool by clicking the **Actions** icon on the map tool bar and selecting **Redline**.

4.5 Filtering Data on a Map Layer

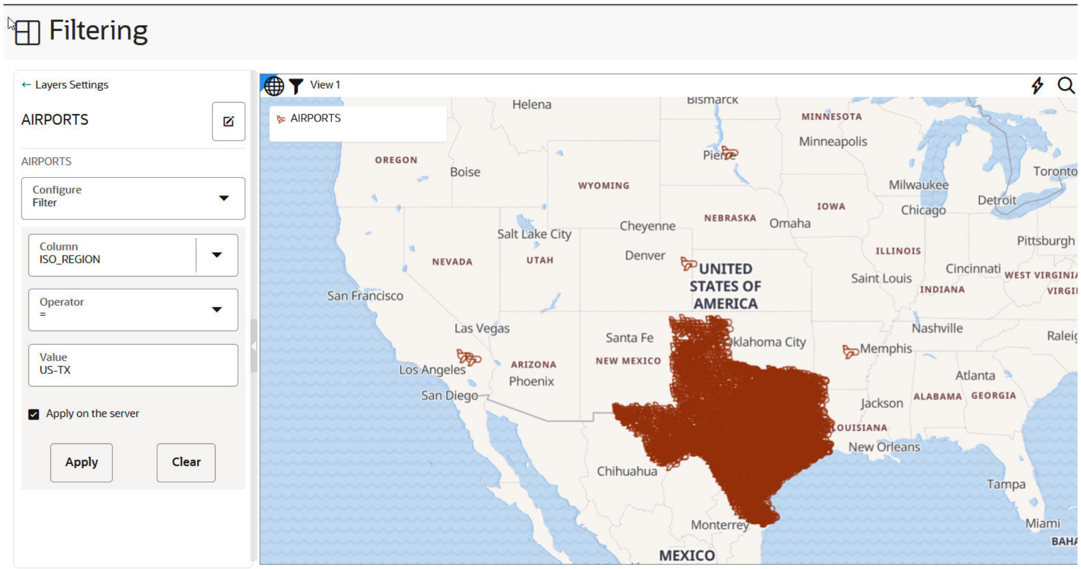
You can filter on an attribute column of a dataset to determine the data points that must be displayed on a map visualization.

The following steps enable you to add a data filter on a map layer.

The instructions assume that a map layer is displayed on your Active Project page.

1. Click ⋯ against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Select **Filter** from the **Configure** drop-down list as shown.

Figure 4-44 Adding Data Column Filter



Filtering

← Layers Settings

AIRPORTS

AIRPORTS

Configure: Filter

Column: ISO_REGION

Operator: =

Value: US-TX

☑ Apply on the server

Apply

Clear

4. Select the **Column** name against which you want to filter data.
5. Select the **Operator** and enter the data **Value**.
6. Optionally, select **Apply on the server** checkbox if you wish to filter the data at the server side.

   If **Apply on the server** option is not checked, then the filter is applied instantly on the client and only on the data that is currently displayed on the map. It is important to note that if the source table contains large amount of data, then Spatial Studio may not always bring all the data to the visualization client. Therefore, the client-side filter may not be able to find an item that should be there but is not displayed (due to server performing automatically data sampling when generating vector tiles).

   However, server side filter always queries the source table with the filter condition and brings the filtered result to the client for display.
7. Click **Apply**.

   The data points on the map layer are filtered as per the column filter.

4.6 Adding Interactions to a Map Visualization

You can enhance your map interaction by configuring tooltips and info windows for the map layers used in the map visualization.

Spatial Studio supports the following interactive features:

- **Tooltip:** A tooltip is shown when you hover over a location on your map and displays the specified attribute information.
- **Info Window** An info window (popup window) displays the configured information for one or more map layers at a given location or shape on your map.
- Configuring and Viewing an Info Window
- Configuring and Viewing a Tooltip

4.6.1 Configuring and Viewing an Info Window

You can configure an info window to display selected attributes of a map layer at a given location on your map visualization.
Perform the following steps to configure an info window.

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

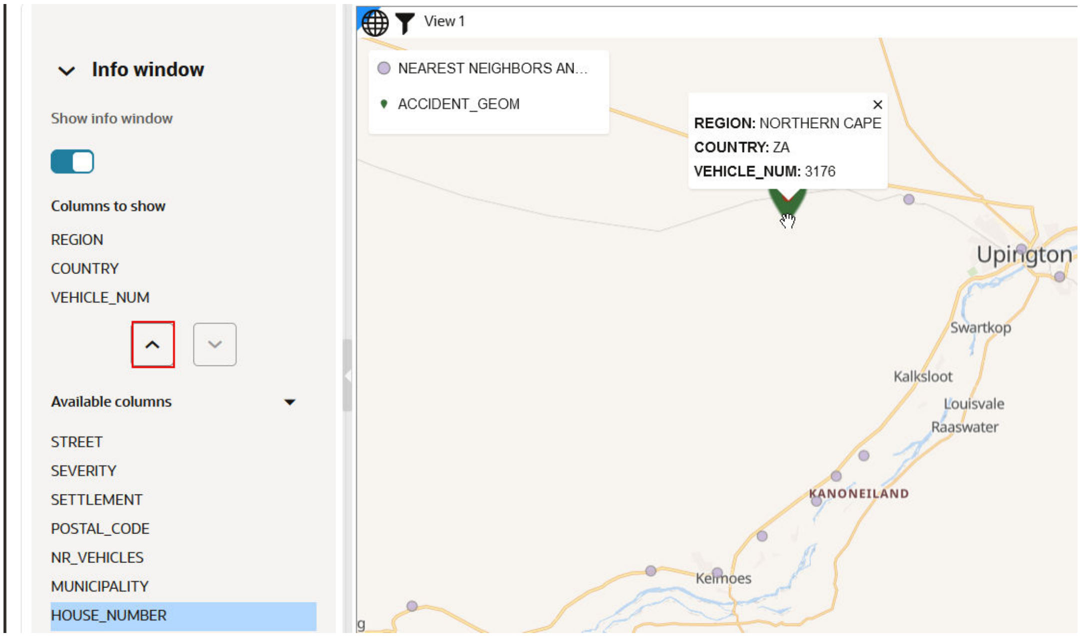
1. Click ⋯ against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Select the **Interaction** option from the **Configure** drop-down list.
4. Enable **Show info window** under **Info window**.
5. Select one or more **Columns to show** as shown in the following steps.
   a. Select the desired dataset column from the list under **Available Columns**, and click the up arrow (shown highlighted in the following figure) to add the column.

      The selected column appears under **Columns to show**.
      Alternatively, you can click the down arrow to remove a previously selected column.

   b. Optionally, rearrange the columns using drag and drop.

      This affects the display order of the selected columns inside the info window on the map.
6. Optionally, repeat the above steps for all the required map layers used in your map visualization.
7. Click on a specific location on your map to view the info window.

Figure 4-45   Viewing Info Window on a Map Visualization



Info window

Show info window

Columns to show

REGION
COUNTRY
VEHICLE_NUM

Available columns

STREET
SEVERITY
SETTLEMENT
POSTAL_CODE
NR_VEHICLES
MUNICIPALITY
HOUSE_NUMBER

REGION: NORTHERN CAPE
COUNTRY: ZA
VEHICLE_NUM: 3176

The map visualization shown in the preceding figure contains two map layers. The info window displays data values for both the map layers as the data points for these map layers overlap at the specified location.

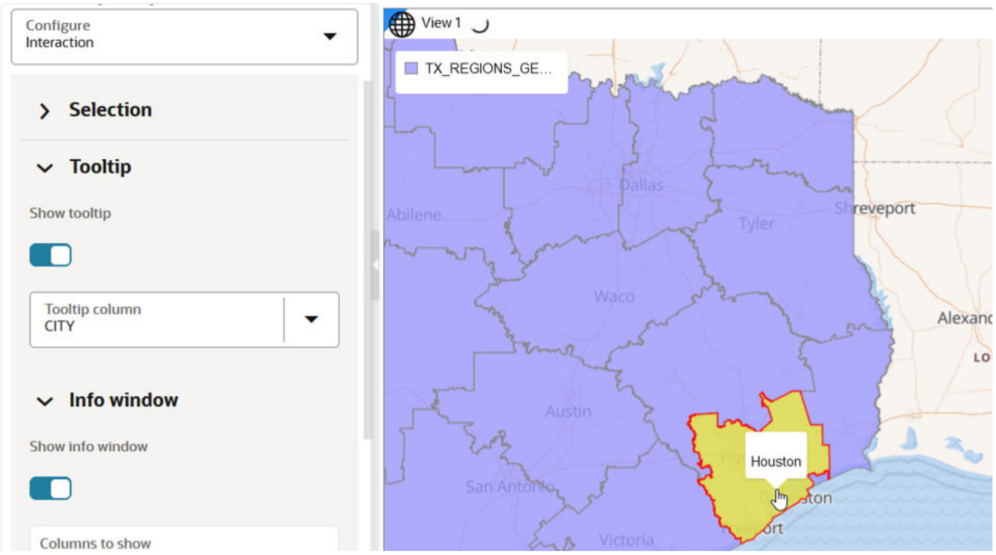
4.6.2 Configuring and Viewing a Tooltip

Perform the following steps to configure a tooltip.

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

1. Click ⋯ against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Select the **Interaction** option from the **Configure** drop-down list.
4. Enable **Show tooltip** under **Tooltip**.
5. Select a **Tooltip column**.
6. Hover over a specific data point or shape on your map to view the tooltip information.

Figure 4-46   Viewing a Tooltip on Map Visualization



Configure Interaction

Selection

Tooltip

Show tooltip: on

Tooltip column: CITY

Info window

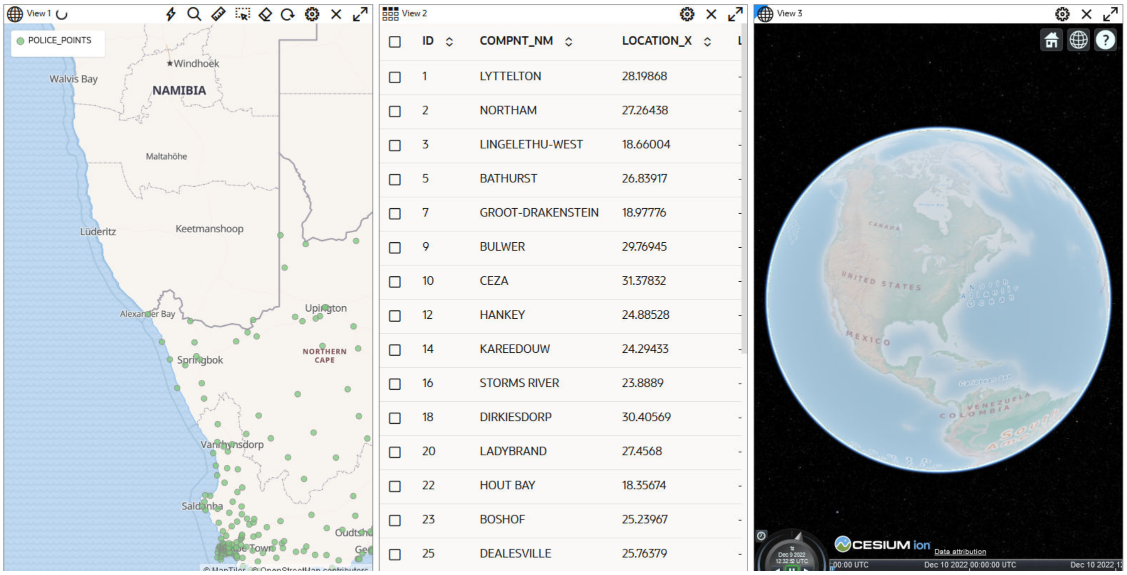
Show info window: on

Columns to show

4.7 Multiple Visualizations on a Canvas

You can work on multiple visualizations in Spatial Studio.

Figure 4-47   Multiple Map Visualizations



View 2

☐	ID	COMPNT_NM	LOCATION_X
☐	1	LYTTELTON	28.19868
☐	2	NORTHAM	27.26438
☐	3	LINGELETHU-WEST	18.66004
☐	5	BATHURST	26.83917
☐	7	GROOT-DRAKENSTEIN	18.97776
☐	9	BULWER	29.76945
☐	10	CEZA	31.37832
☐	12	HANKEY	24.88528
☐	14	KAREEDOUW	24.29433
☐	16	STORMS RIVER	23.8889
☐	18	DIRKIESDORP	30.40569
☐	20	LADYBRAND	27.4568
☐	22	HOUT BAY	18.35674
☐	23	BOSHOF	25.23967
☐	25	DEALESVILLE	25.76379

When adding a new visualization to the canvas, if there is already an existing visualization, then you can choose on which adjacent edge of the existing visualization the new one must be placed. This applies even if there are multiple existing visualizations. You can always insert the new visualization to be next to any existing visualization of your choice.

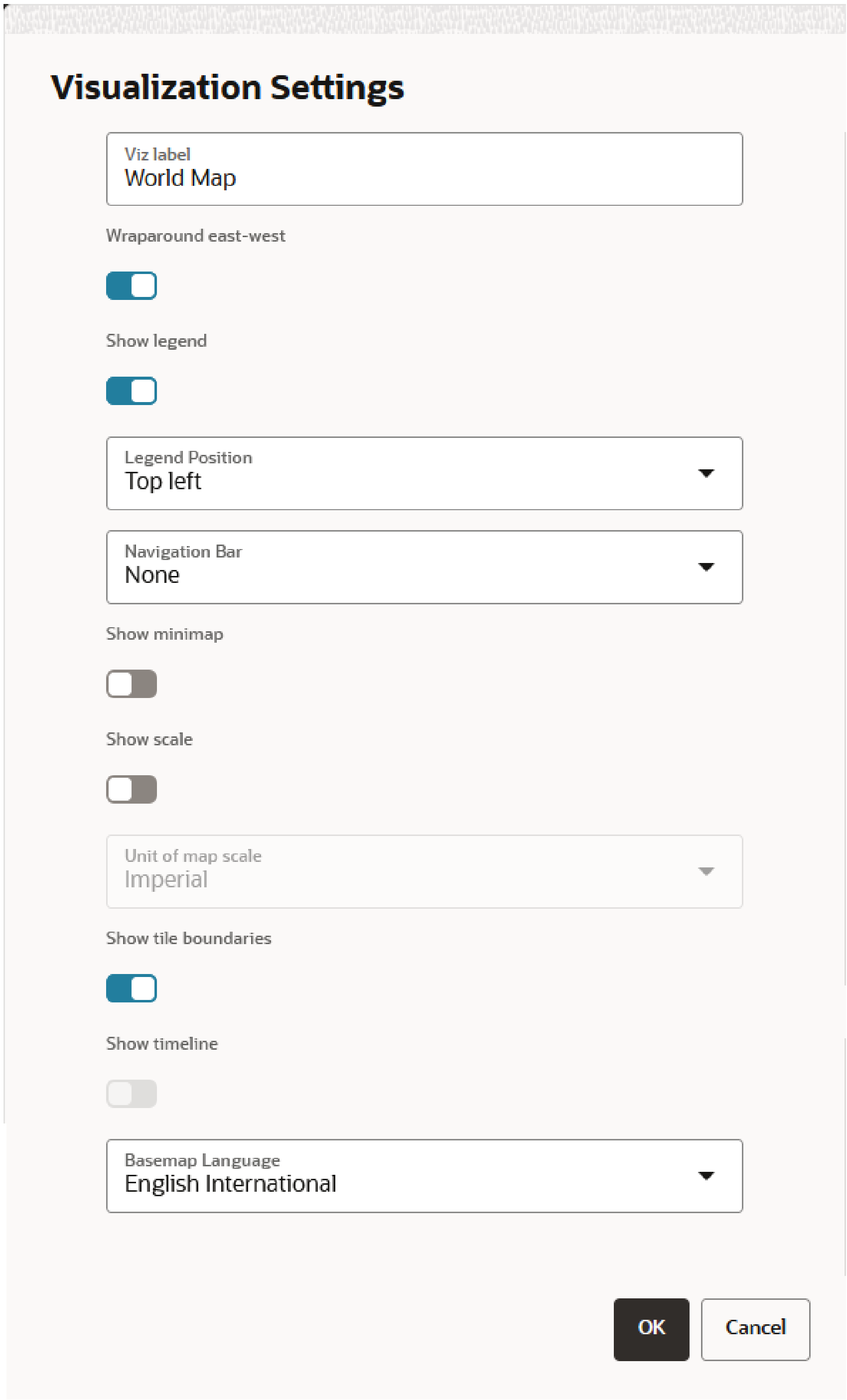
When you drag a new visualization to the canvas with existing visualizations, the border of the existing visualization highlights to indicate where the new visualization will be placed when dropped. The canvas will automatically adjust the layout to make space for the new visualization in an intuitive way. You can also temporarily maximize any one of the existing visualizations.

4.8 Configuring a Map Visualization

Learn how to configure the settings for your map visualization.

You can configure the map visualization settings, by clicking ⚙ , the **Settings** icon in the map tool bar.
The Visualization Settings dialog opens with the default configuration values as shown as shown:

Figure 4-48 Visualization Settings



Visualization Settings

Viz label
World Map

Wraparound east-west
☑

Show legend
☑

Legend Position
Top left

Navigation Bar
None

Show minimap
☐

Show scale
☐

Unit of map scale
Imperial

Show tile boundaries
☑

Show timeline
☐

Basemap Language
English International

Spatial Studio supports the configuration of the following values:

- **Viz label**: You can define the label for your map visualization.
- **Wraparound east-west**: By default, the map is continuous, that is, the map displayed for visualization is east-west wrap around. You can choose to disable this option if you prefer to display the map in a non-repeating mode.
- **Show legend**: The legend displays the map layers that are used in the visualization.

- **Legend Position**: This determines where the legend gets displayed on the map.
- **Navigation Bar**: This displays zoom and compass controls on the map.
- **Show minimap**: You can enable this option if you want to view an overview of the main map as an inset within the main map.
- **Show scale**: You can enable this option if you want to configure a specific scale for the map.
- **Unit of map scale**: Supported scale types are:
  - Imperial
  - Metric
  - Nautical
- **Show tile boundaries**: You can switch `ON` this toggle to view the vector tile boundaries on the map. The current map zoom level and tile column and row number are displayed for each visible tile. This is mostly used as an information tool for debugging map rendering issues.
- **Show timeline**: By enabling this slider, you can display the Timeline on the map.
- **Basemap Language**: This option appears only if you are using one of the three built-in MapTiler vector basemaps as a map background. You can then set the language for your basemap.

4.9 Searching Locations and Features on a Map

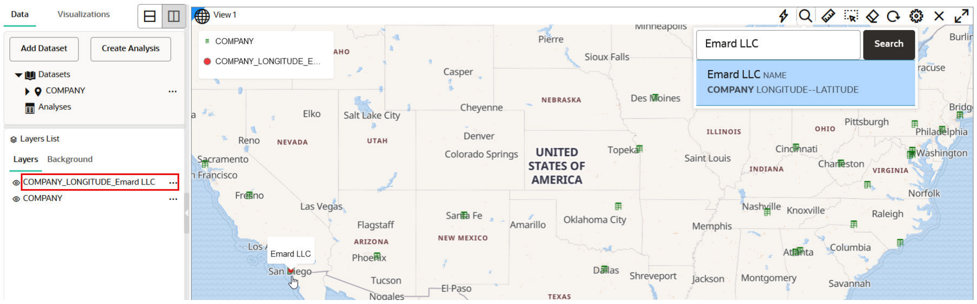
Using the **Search** option, you can quickly find locations and features on a map.

1. Click 🔍 in the map tool bar to search on the map.
2. Select one of the following option to perform the search.
   - **Search by Locations**
     a. Click **Address or Longitude, Latitude** in the search drop-down list.
     b. Enter **Address or place name**, or alternatively, enter **Longitude** and **Latitude** to search.
        Note that as you enter the address (or place name), suggestions more relevant to your search are displayed first.
     c. Select the required suggestion from the list if you entered **Address or place name** in the preceding step.
        Spatial Studio drops a pin and zooms to the location of the search result.
   - **Search by Feature ID**
     A feature is a geometry object (point, line, or polygon type) on the map.
     a. Click **Feature** in the search drop-down list.
     b. Enter the complete ID of the feature in the search input box.
        Note the following:
        - The feature ID is identified by the key property column value of the specific feature in its dataset.
        - The search key is not case sensitive.
        - You must enter the complete feature key to find the feature on the map.
     c. Click **Search**.

If the feature is found, Spatial Studio displays the feature ID and the dataset name in the selection box.

d. Select the feature in the selection box.
Spatial Studio performs a search on the source data table and displays the search results on a separate map layer as shown:

Figure 4-49 Searching Features on the Map



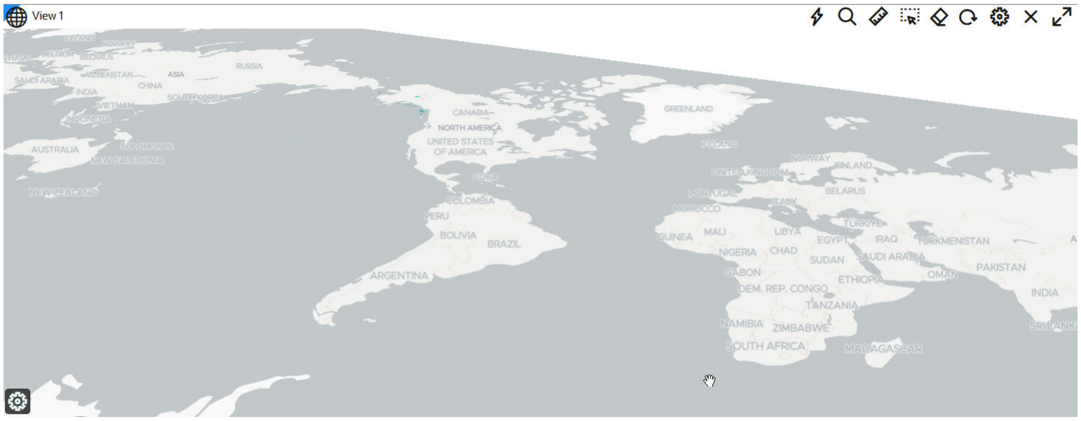
4.10 Changing the Pitch and Bearing of a Map

You can set the pitch and bearing of a map by tilting or rotating your map in the map visualization panel.

1. Navigate to the **Active Project** page where the desired project is displayed.
2. Click and drag the right mouse button if you wish to tilt the map.
3. Click and rotate the right mouse button if you wish to rotate the map.

   The following example shows a tilted and rotated map:

Figure 4-50 Tilting and Rotating of a Map



4. Optionally, click **Save** to save the project with the new pitch and bearing settings.

5

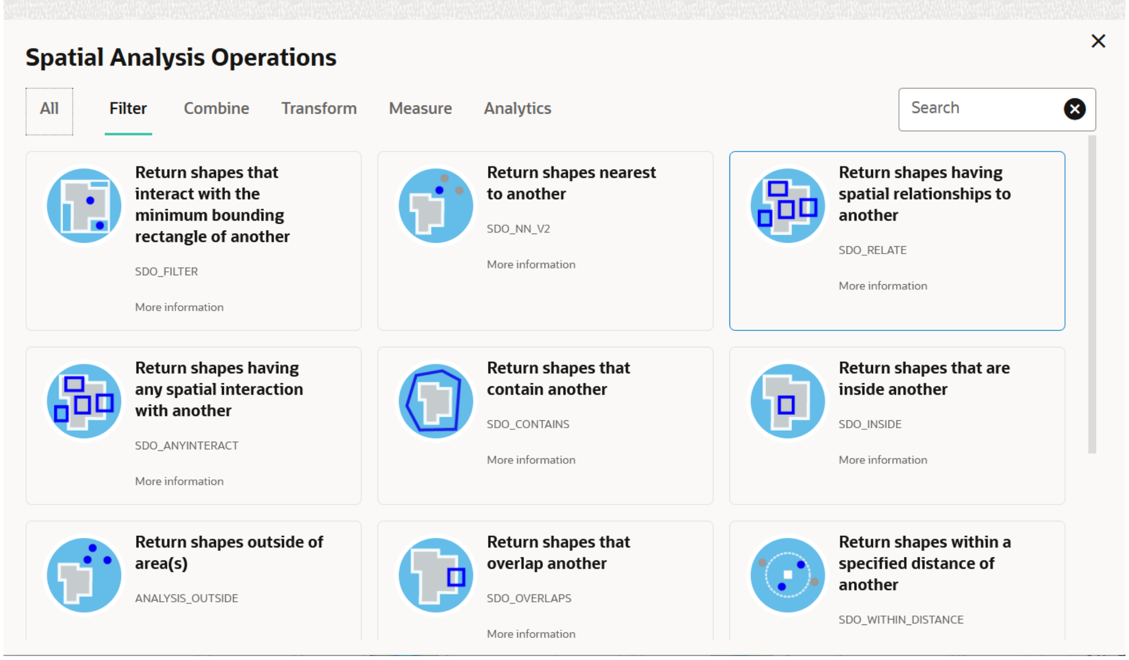
Performing Analyses in Spatial Studio

You can perform various spatial analyses (such as filtering by proximity, nearest neighbor analysis and so on) and visualize the results in Spatial Studio.

These spatial analyses are grouped under the following categories in Spatial Studio:

- Filter
- Combine
- Transform
- Measure
- Analytics

Figure 5-1 Spatial Analysis Operations



Return shapes that interact with the minimum bounding rectangle of another
SDO_FILTER
More information

Return shapes nearest to another
SDO_NN_V2
More information

Return shapes having spatial relationships to another
SDO_RELATE
More information

Return shapes having any spatial interaction with another
SDO_ANYINTERACT
More information

Return shapes that contain another
SDO_CONTAINS
More information

Return shapes that are inside another
SDO_INSIDE
More information

Return shapes outside of area(s)
ANALYSIS_OUTSIDE

Return shapes that overlap another
SDO_OVERLAPS
More information

Return shapes within a specified distance of another
SDO_WITHIN_DISTANCE

The following topics explore a few spatial analysis operations:

- Determining the Geometries Within a Specified Distance
  Using the `SDO_WITHIN_DISTANCE` filter, you can filter coordinates that are within a specific distance from a point on the map layer.
- Determining the Geometries Filtered By Non-Spatial Attributes
  You can perform non-spatial filter analysis using a compound query.
- Determining the N-Nearest Geometries
  Using the `SDO_NN_V2` filter, you can determine the N-nearest geometries to a geometry.

- Summarize By Region Analysis
  Spatial Studio supports descriptive analysis where you can obtain the summary of data points (such as count, average, sum, minimum, and maximum) on a region based dataset.
- Creating Lines to Connect Latitude/Longitude Pairs
  The **Create lines from start/end points** transform operation creates a line connecting two pairs of latitude and longitude coordinates on a map layer.
- Finding the Shortest and Quickest Route
  Using the **Driving route** spatial analysis operation, you can find and store the shortest or fastest driving route between two points.
- Creating an Isochrone Map for Analysis
  You can create isochrone (driving-time) polygons, which show the areas that can be reached within a specified distance or time, for a set of input locations.
- Densify Geometry Analysis
  The **Densify Geometry** transform operation densifies the input geometry by adding more points based on an interval value.
- Editing a Spatial Analysis
  You can edit an existing spatial analysis to modify certain essential parameters.

5.1 Determining the Geometries Within a Specified Distance

Using the `SDO_WITHIN_DISTANCE` filter, you can filter coordinates that are within a specific distance from a point on the map layer.

To filter points based on this proximity filter, you must perform the following steps.

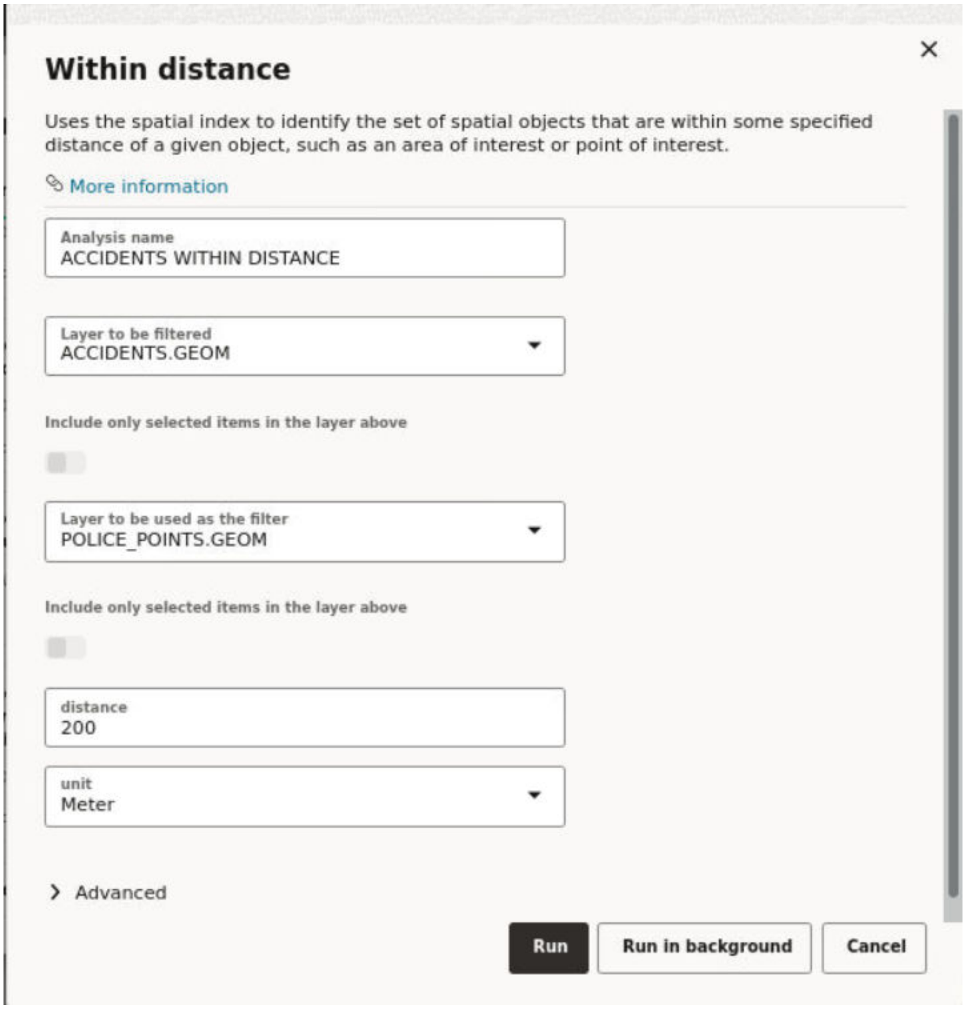
The instructions assume that you have the layer to be filtered and the map layer to be used as a filter displayed on your Active Project page.

1. Click ··· against the map layer whose coordinates needs to be filtered in the **Layers** tab.
2. Select **Spatial Analysis**.

   The **Spatial Analysis Operations** slider opens as shown in Figure 5-1.
3. Click on the **Filter** tab and select **Return shapes within a specific distance of another**.

   Within distance slider opens as shown:

Figure 5-2 Spatial Analysis - Within Distance Configuration



Within distance

Uses the spatial index to identify the set of spatial objects that are within some specified distance of a given object, such as an area of interest or point of interest.

Analysis name: ACCIDENTS WITHIN DISTANCE

Layer to be filtered: ACCIDENTS.GEOM

Include only selected items in the layer above

Layer to be used as the filter: POLICE_POINTS.GEOM

Include only selected items in the layer above

distance: 200

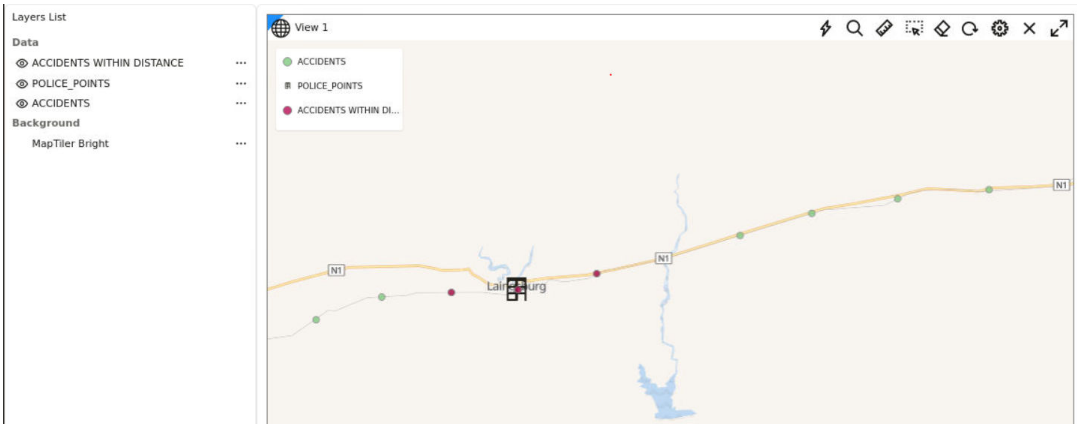
unit: Meter

4. Enter **Analysis name**.
5. Select the **Layer to be filtered**.
6. Select the **Layer to be used as the filter**.
7. Enter **distance** and **unit**.
8. Click **Run**.

   The Analysis result is listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.
9. Drag and drop the analysis result on the map view.

   This creates a new map layer highlighting the filtered coordinates within a specific distance from a point as shown:

Figure 5-3   Spatial Analysis - Within Distance Visualization



5.2 Determining the Geometries Filtered By Non-Spatial Attributes

You can perform non-spatial filter analysis using a compound query.

To run a compound query with non-spatial attributes, you must perform the following steps.

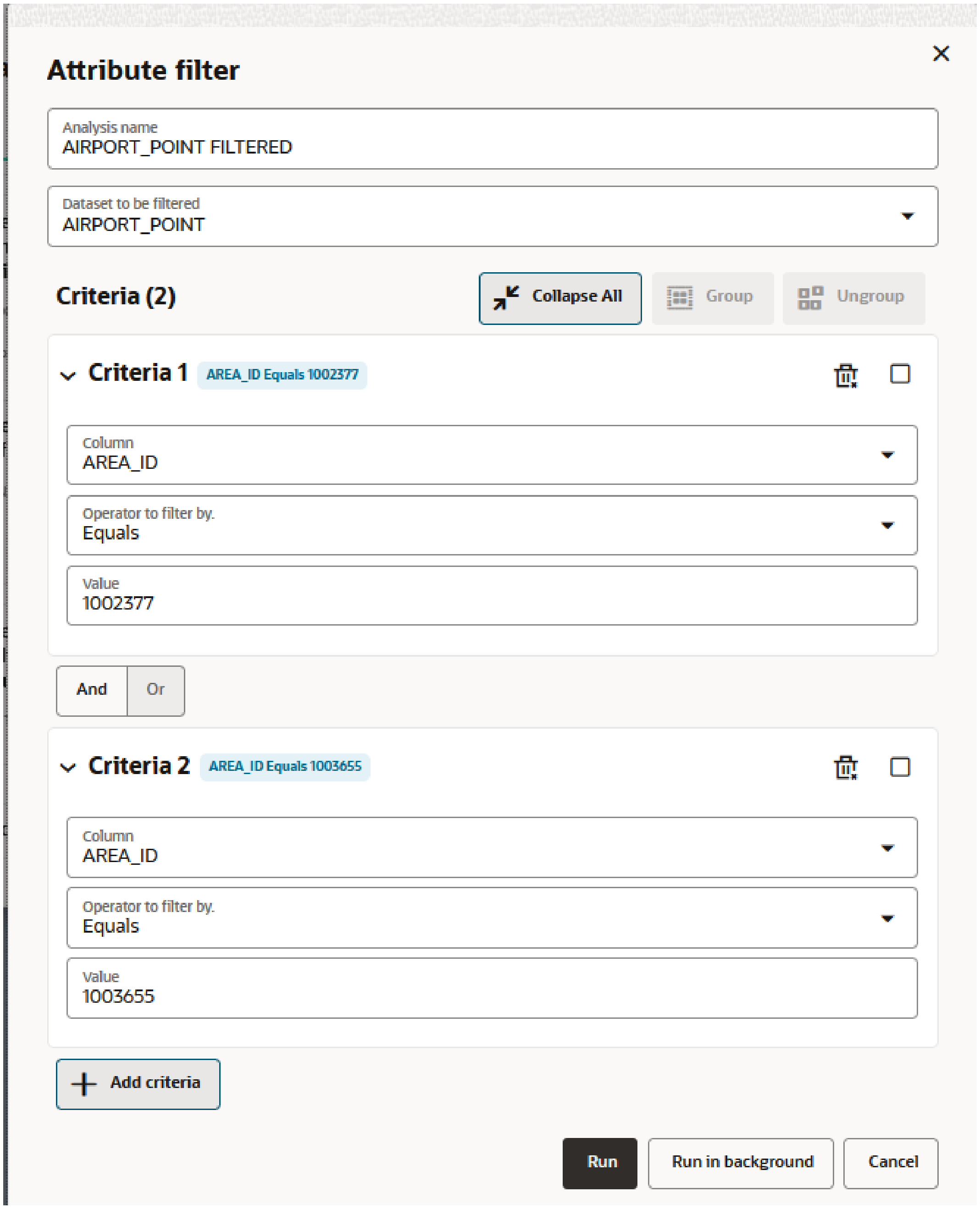
The instructions assume that you have the layer to be filtered displayed on your Active Project page.

1. Click ••• against the map layer, whose coordinates needs to be filtered, in the **Layers** tab.
2. Select **Spatial Analysis**.

   The **Spatial Analysis Operations** slider opens as shown in Figure 5-1.
3. Click the **Filter** tab and select **Return elements filtered by non-spatial rules**.

   The **Attribute Filter** slider opens as shown:

Figure 5-4 Non-Spatial Attributes Filter



Analysis name
AIRPORT_POINT FILTERED

Dataset to be filtered
AIRPORT_POINT

Column
AREA_ID

Operator to filter by.
Equals

Value
1002377

Column
AREA_ID

Operator to filter by.
Equals

Value
1003655

4. Optionally, change the default **Analysis name**.
5. Optionally, change the **Dataset to be filtered** only if you want to apply the filter criteria against a different dataset. In such a case, Spatial Studio removes any existing criteria associated with the default dataset.
6. Select the **Column** name.
7. Select the **Operator to filter by** from the drop-down list.
8. Enter the **Value** to be filtered.
9. Optionally, click **Add Criteria** to repeat from step-6 to step-8 to add as many criteria as required. Also, click the `And` or `Or` operator to form the compound query.

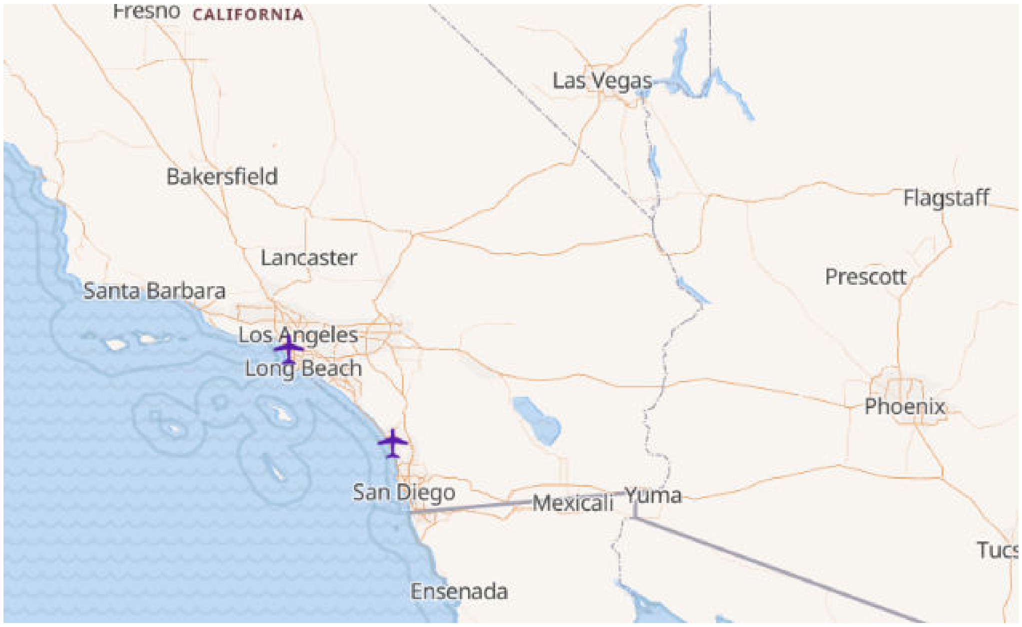
10. Click **Run**.

    The Analysis result is listed under **Analyses** in the **Data** elements panel on the left pane in the Active Project page.

11. Drag and drop the analysis result on the map view.

    This creates a new map layer highlighting the geometry for the filtered attributes.

Figure 5-5 Non-Spatial Filter Analysis



5.3 Determining the N-Nearest Geometries

Using the `SDO_NN_V2` filter, you can determine the N-nearest geometries to a geometry.

> **Note:**
>
> The `SDO_NN_V2` filter, introduced in Spatial Studio release 22.2, is an improved form of the `SDO_NN` filter which was used in the prior releases of Oracle Spatial Studio. The old behavior will continue to be supported when you modify analyses that were created using the `SDO_NN` filter. However, when creating a new analysis, the current `SDO_NN_V2` filter will be used.

To find the N-nearest geometries, you must perform the following steps.

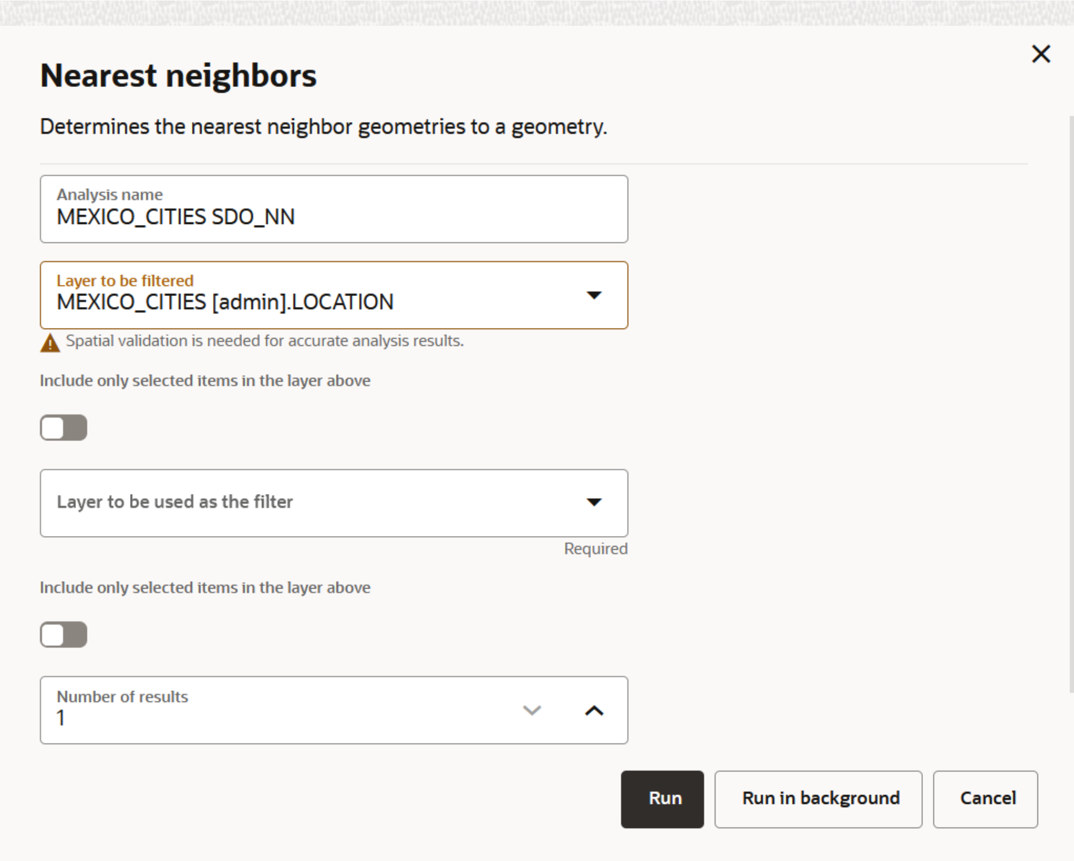
The instructions assume that you have the layer to be filtered and the map layer to be used as a filter displayed on your Active Project page.

1. Click ⋯ against the map layer, whose coordinates needs to be filtered, in the **Layers** tab.
2. Select **Spatial Analysis**.

   The **Spatial Analysis Operations** slider opens as shown in Figure 5-1.
3. Click on the **Filter** tab and select **Return shapes nearest to another**.

   Nearest neighbors slider opens as shown:

Figure 5-6   Nearest Neighbors Analysis



Nearest neighbors

Determines the nearest neighbor geometries to a geometry.

Analysis name: MEXICO_CITIES SDO_NN

Layer to be filtered: MEXICO_CITIES [admin].LOCATION

⚠ Spatial validation is needed for accurate analysis results.

Include only selected items in the layer above

Layer to be used as the filter

Required

Include only selected items in the layer above

Number of results: 1

4. Enter **Analysis name**.
5. Select the **Layer to be filtered**.

> **Note:**
>
> Ensure that you have run spatial validations on the map layer to be filtered and the map layer to be used as the filter in order to obtain accurate analysis results.

6. Enter **Number of results**.
7. Click **Run**.

   The Analysis result is listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.
8. Drag and drop the analysis result on the map view.

   This creates a new map layer highlighting the N-nearest neighbor geometries for a geometry.

5.4 Summarize By Region Analysis

Spatial Studio supports descriptive analysis where you can obtain the summary of data points (such as count, average, sum, minimum, and maximum) on a region based dataset.

To perform summarize by region analysis, you can perform the following steps.

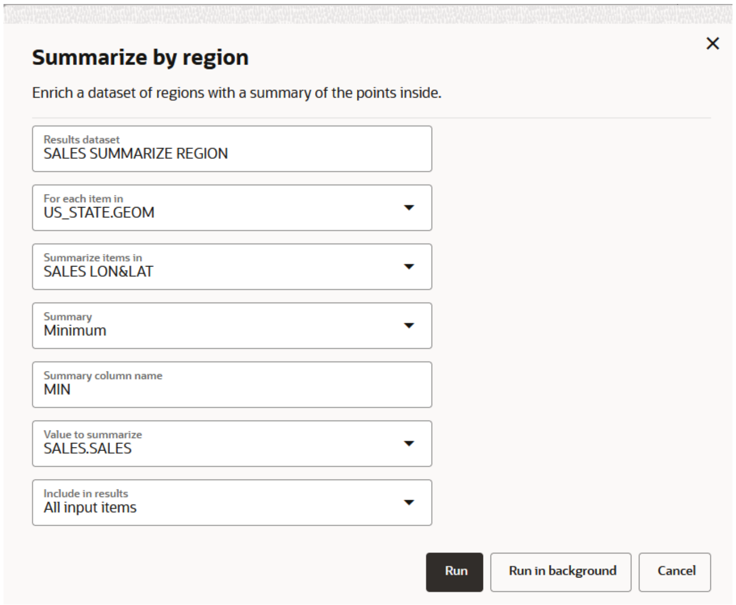
The instructions assume that you have a point map layer displayed over a region map layer on your Active Project page.

1. Click ⋯ against the map layer, whose coordinates needs to be filtered, in the **Layers** tab.
2. Select **Spatial Analysis**.

   The **Spatial Analysis Operations** slider opens as shown in Figure 5-1.
3. Click the **Analytics** tab and select **Summarize By Region**.

   The **Summarize by region** slider opens as shown:

Figure 5-7 Summarize By Region



Summarize by region

Enrich a dataset of regions with a summary of the points inside.

Results dataset: SALES SUMMARIZE REGION

For each item in: US_STATE.GEOM

Summarize items in: SALES LON&LAT

Summary: Minimum

Summary column name: MIN

Value to summarize: SALES.SALES

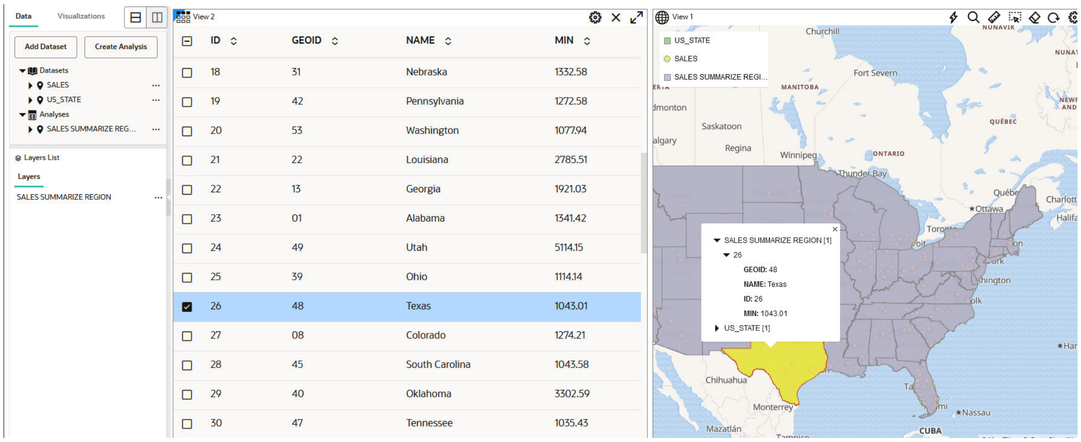
Include in results: All input items

4. Optionally, change the default name for the new analysis **Results dataset**.
5. Select the region based map dataset from the **For each item in** drop-down list.
6. Select the point map layer from the **Summarize items in** drop-down list.
7. Select the **Summary** option.
8. Optionally, change the **Summary column name**.
9. Click **Run**.

   The Analysis result is listed under **Analyses** in the **Data** elements panel on the left pane in the Active Project page.
10. Drag and drop the analysis result on a table or map visualization.

    You can view the summary results as shown:

Figure 5-8 Summarize By Region Visualization



☐	ID	GEOID	NAME	MIN
☐	18	31	Nebraska	1332.58
☐	19	42	Pennsylvania	1272.58
☐	20	53	Washington	1077.94
☐	21	22	Louisiana	2785.51
☐	22	13	Georgia	1921.03
☐	23	01	Alabama	1341.42
☐	24	49	Utah	5114.15
☐	25	39	Ohio	1114.14
☑	26	48	Texas	1043.01
☐	27	08	Colorado	1274.21
☐	28	45	South Carolina	1043.58
☐	29	40	Oklahoma	3302.59
☐	30	47	Tennessee	1035.43

SALES SUMMARIZE REGION [1]
26
GEOID: 48
NAME: Texas
ID: 26
MIN: 1043.01
US_STATE [1]

5.5 Creating Lines to Connect Latitude/Longitude Pairs

The **Create lines from start/end points** transform operation creates a line connecting two pairs of latitude and longitude coordinates on a map layer.

To perform this transformation analysis, ensure that a dataset comprising two pairs of latitude and longitude coordinates (one represents the starting points and the other, ending points) in each row is added in the Active Project page. The **Create lines from start/end points** analysis takes the column names of these two pairs of latitude and longitude coordinates as input and generates the line geometry connecting the starting and ending points.

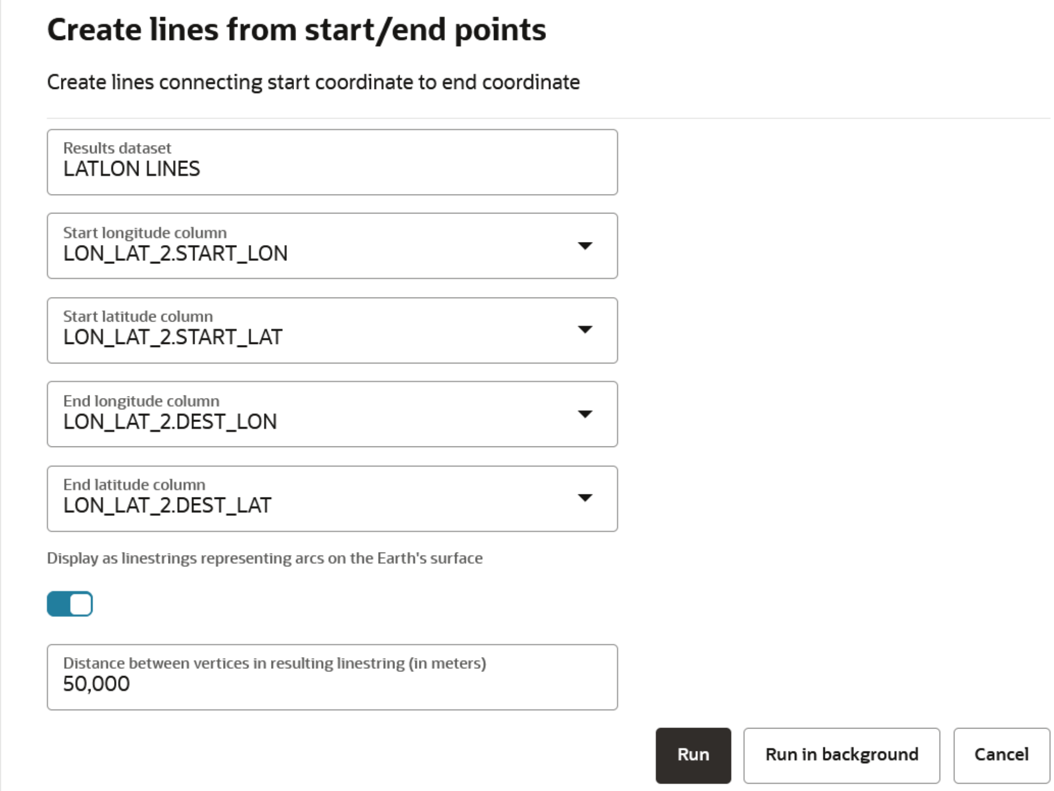
Perform the following steps to run the **Create lines from start/end points** spatial analysis.

1. Click ··· against the map layer whose coordinates needs to be filtered in the **Layers** tab.
2. Select **Spatial Analysis**.

   The **Spatial Analysis Operations** slider opens as shown in Figure 5-1.
3. Click the **Transform** tab and select **Create lines from start/end points**.

   Create lines from start/end points slider opens as shown:

Figure 5-9 Configuring Lat/Lon Line Analysis



Create lines from start/end points

Create lines connecting start coordinate to end coordinate

Results dataset: LATLON LINES

Start longitude column: LON_LAT_2.START_LON

Start latitude column: LON_LAT_2.START_LAT

End longitude column: LON_LAT_2.DEST_LON

End latitude column: LON_LAT_2.DEST_LAT

Display as linestrings representing arcs on the Earth's surface

Distance between vertices in resulting linestring (in meters): 50,000

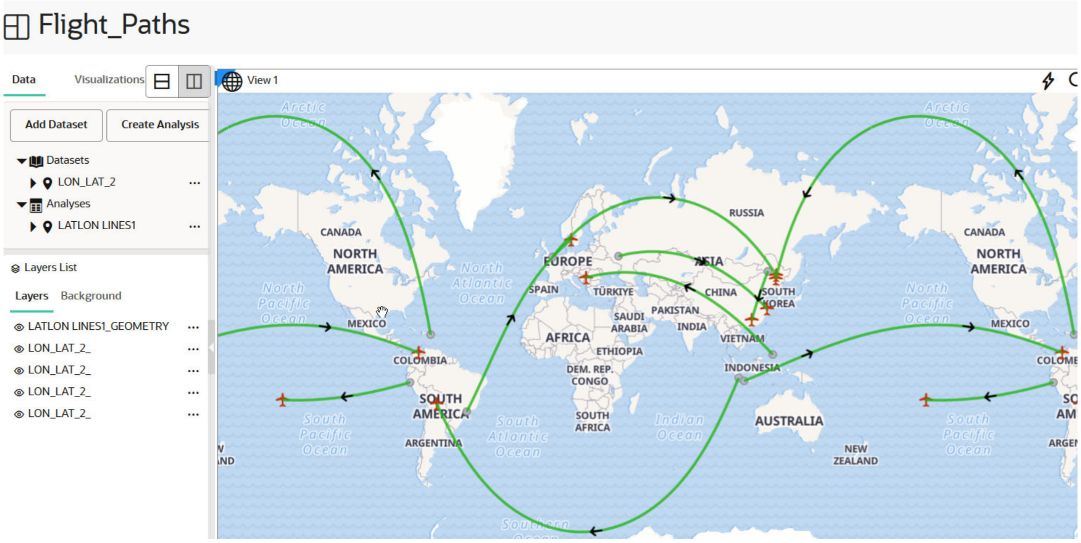
4. Optionally, modify the resulting datasets name in **Results dataset**.
5. Select the **Start longitude column**.
6. Select the **Start latitude column**.
7. Select the **End longitude column**.
8. Select the **End latitude column**.
9. Optionally, switch `ON` the **Display as linestrings representing arcs on the Earth's surface** toggle.

   This factor takes into consideration that the earth is spherical and accordingly projects the connecting line between the two sets of coordinates on the map layer. It is very useful for large distances between two coordinates and it is recommended that you use this option.
10. Optionally, modify the **Distance between vertices in resulting linestring (in meters)** (only if you have included the **Display as linestrings representing arcs on the Earth's surface** option in the preceding step).
11. Click **Run**.

    The Analysis results are listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.
12. Drag and drop the following layers on the map - starting points, ending points, and finally the `GEOMETRY` (that connects the starting and ending points) analysis on the map view.

    The following figure shows an example of the **Create lines from start/end points** spatial analysis:

Figure 5-10 Visualizing Latitude/Longitude Line Analysis



5.6 Finding the Shortest and Quickest Route

Using the **Driving route** spatial analysis operation, you can find and store the shortest or fastest driving route between two points.

The route analysis supports the following modes:

- **Pairwise Routing:** In this mode, each input dataset contains both the starting and ending point geometries for the route.
- **One-to-many Routing:** In this mode, the route is determined between the starting point geometries in the dataset to a single end point. This end point can be defined by one of the following methods:
  - **Map Pins:** You can previously pin a location on the map by directly adding a pin (Adding a Pin on a Map) or by using the search option (Searching Locations and Features on a Map).
  - **Input coordinates:** You can manually provide the longitude and latitude coordinates when configuring the route analysis.

Also, note the following:

- The route analysis can be performed only on datasets with point geometries.
- You can choose to include one or more of the following parameters in the resulting output:
  - Route Geometry
  - Distance
  - Time
- The results of the analysis (route geometry, distance and (or) time) are stored directly into the input dataset.
- The analysis can be used multiple times on the same dataset by specifying different column names for storing the results.

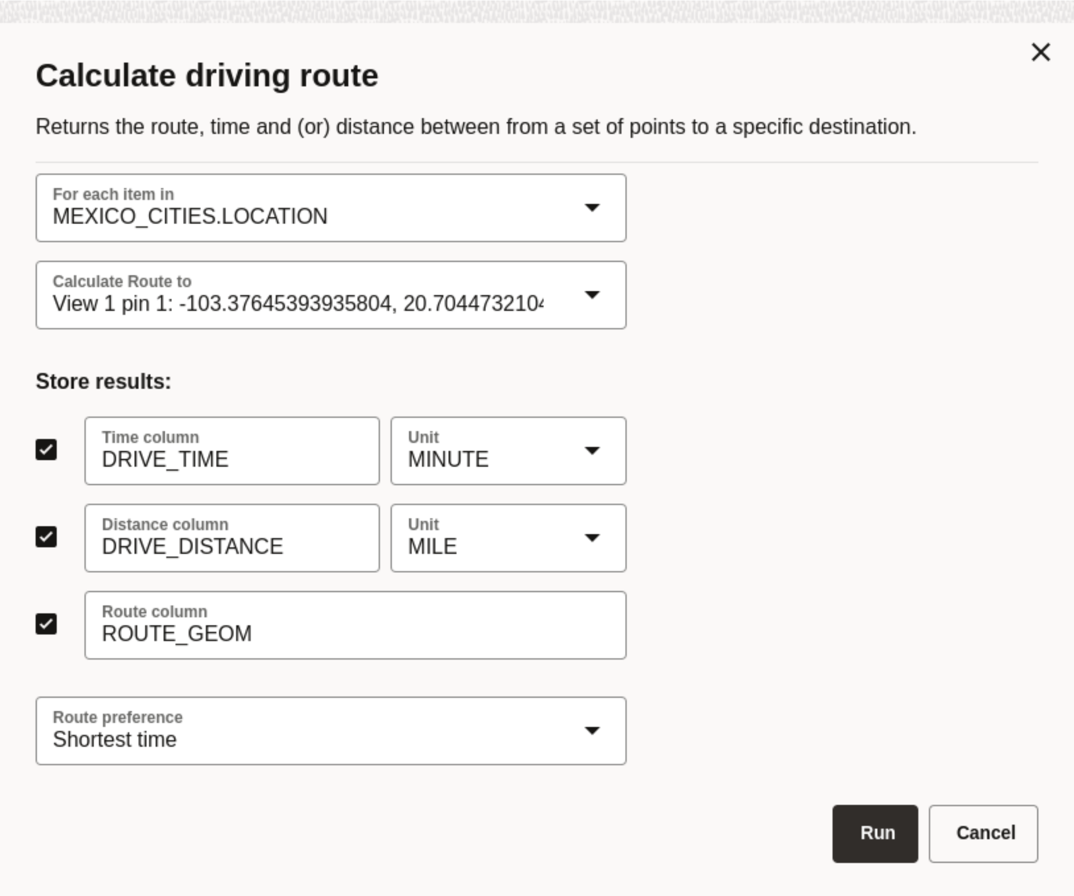
Perform the following steps to run the **Driving route** spatial analysis.
The instructions assume that you have a dataset with point geometries displayed on your Active Project page and the destination pin is already placed on the map.

1. Click ⋯ against the map layer containing the starting point geometries for the route.
2. Select **Spatial Analysis**.

   The **Spatial Analysis Operations** slider opens as shown in Figure 5-1.
3. Click the **Analytics** tab and select **Driving route**.

   Calculate driving route slider opens as shown:

Figure 5-11 Route Analysis Configuration



Calculate driving route

Returns the route, time and (or) distance between from a set of points to a specific destination.

For each item in: MEXICO_CITIES.LOCATION

Calculate Route to: View 1 pin 1: -103.37645393935804, 20.704473210

Store results:

☑ Time column: DRIVE_TIME — Unit: MINUTE

☑ Distance column: DRIVE_DISTANCE — Unit: MILE

☑ Route column: ROUTE_GEOM

Route preference: Shortest time

4. Select the input dataset in the **For each item in** drop-down.

   Note that this drop-down will only list datasets with point geometries that are added to the project.
5. Select the destination end point in the **Calculate Route to** drop-down.

   Note that this drop-down allows you to choose the end point against the following headers:

   - **Point geometry columns:** Lists other point geometry columns in the input dataset. This is primarily used for pairwise routing (from the start to the end points of each feature in the same dataset).
   - **Map Pins:** Lists the map pins that are already added on the map. See Adding a Pin on a Map and Searching Locations and Features on a Map for more information on dropping a location pin on the map.
   - **Input coordinates:** Manually enter the longitude and latitude coordinates.

   Using either map pins or input coordinates results in the routes being calculated from each starting point geometry in the input dataset to a single end point.

6. Select one or more of the following checkbox options and specify the corresponding column name to store the results of the analysis.
    - **Time column**
    - **Distance column**
    - **Route column**

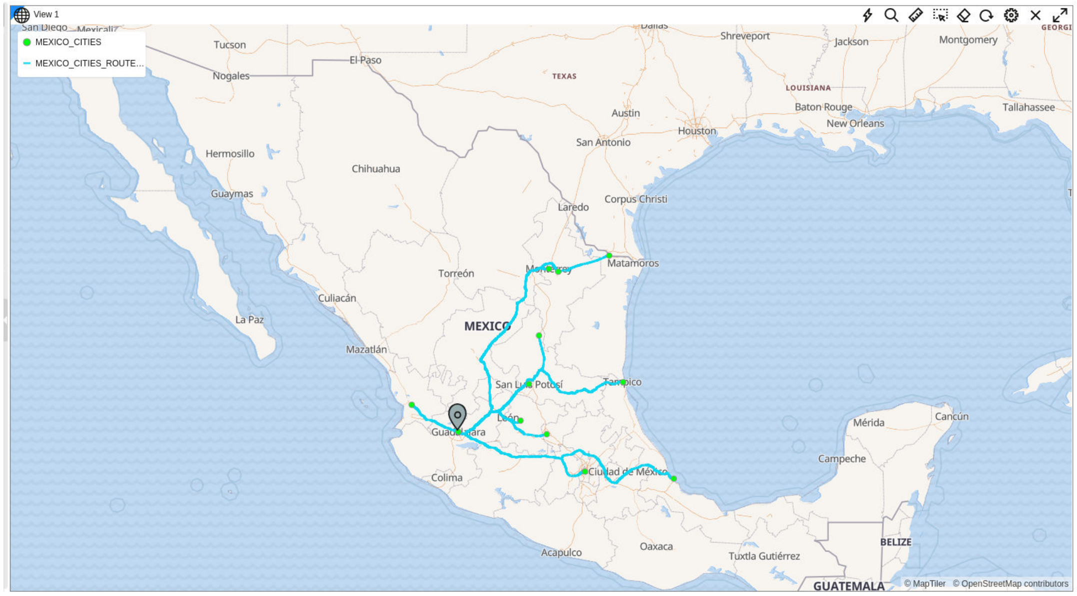
    Note that at least one of the preceding columns must be included in the results.

    Optionally, select the **Unit** for Time and Distance columns.
7. Select the **Route preference**.
8. Click **Run** to run the analysis.

    On completion, the input dataset gets updated with the extra columns chosen to store the results.

    The following figure shows the results of the shortest route analysis (from each input point to the destination pin) on map visualization.

Figure 5-12 Spatial Route Analysis Visualization



5.7 Creating an Isochrone Map for Analysis

You can create isochrone (driving-time) polygons, which show the areas that can be reached within a specified distance or time, for a set of input locations.

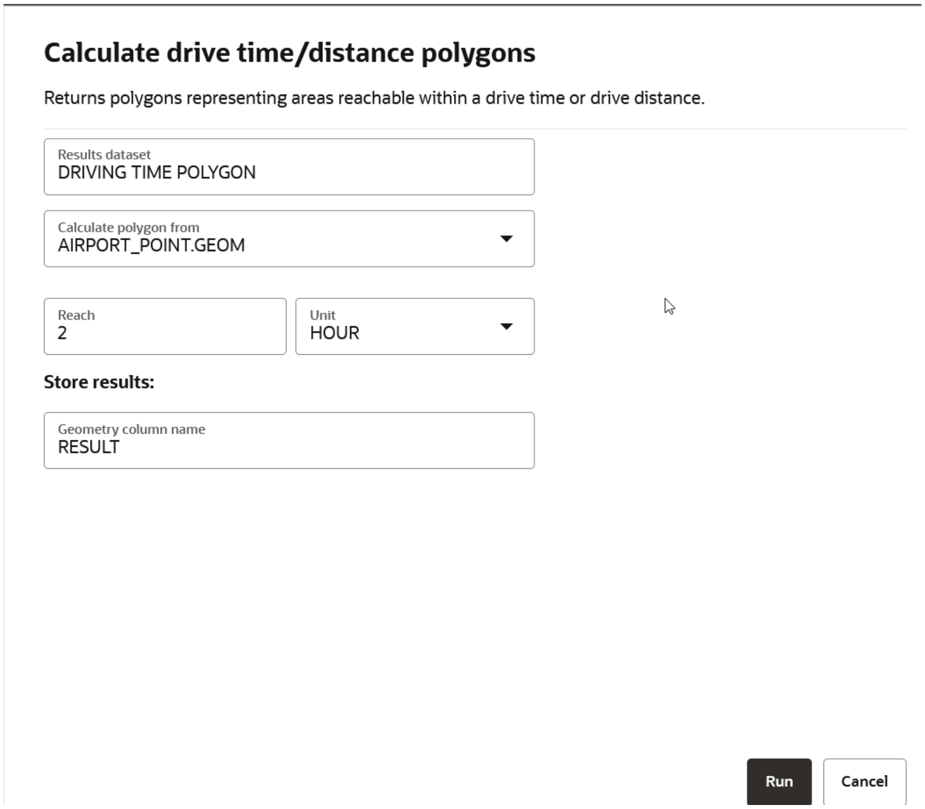
Perform the following steps to run the **Driving reach** spatial analysis.

1. Click ••• against the map layer, which contains the input locations, in the **Layers** tab.
2. Select **Spatial Analysis**.

    The **Spatial Analysis Operations** slider opens as shown in Figure 5-1.
3. Click the **Analytics** tab and select **Driving reach**.

    Calculate drive time/distance polygons slider opens as shown:

Figure 5-13   Reach Time Configuration



Calculate drive time/distance polygons

Returns polygons representing areas reachable within a drive time or drive distance.

Results dataset: DRIVING TIME POLYGON

Calculate polygon from: AIRPORT_POINT.GEOM

Reach: 2

Unit: HOUR

Store results:

Geometry column name: RESULT

4. Optionally, modify the resulting dataset name in **Results dataset**.
5. Specify the input geometries from the **Calculate polygon from** drop-down.

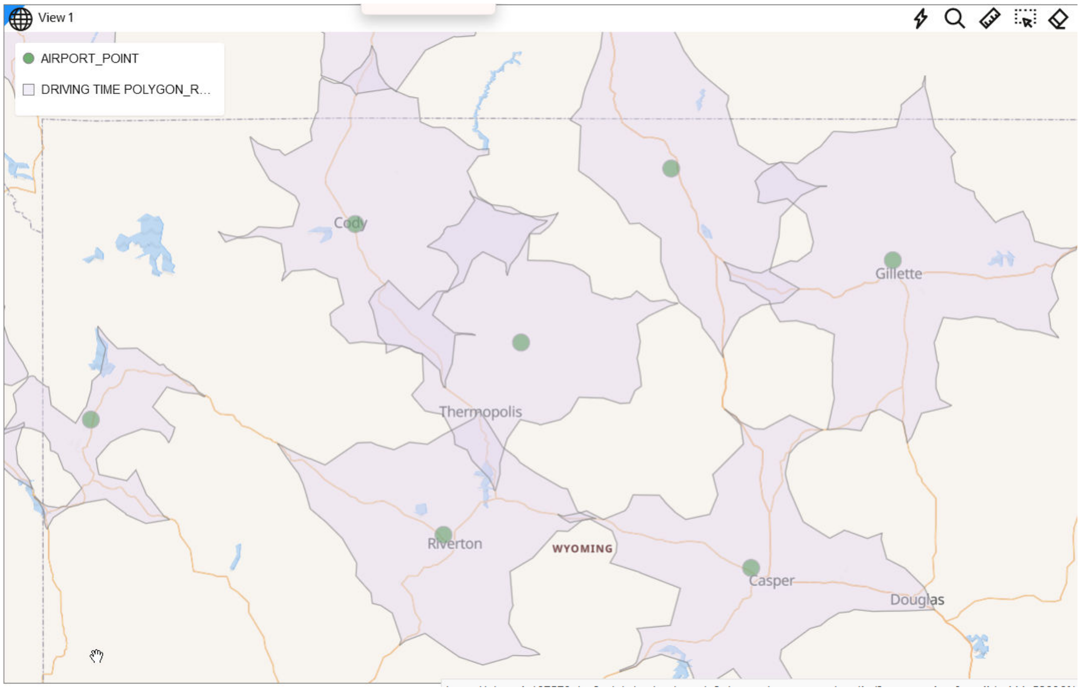
   You can choose one of the following options:

   - **Point geometries**: Select the specific input geometry column of the dataset.
   - **Input coordinates**: Enter manually the **Longitude** and **Latitude** coordinates.
   - **Pins on the map**: This option appears if you have one or more pins created on the map.
6. Specify the **Reach** distance or time as required.
7. Select the **Unit** for the specified **Reach**.
8. Optionally, modify the **Geometry column name** in which the resulting polygon geometries will be stored.
9. Click **Run**.

   The job to run the analysis gets initiated. Once the job completes, the Analysis result dataset gets listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.
10. Drag and drop the geometry column from the **Results dataset** on the map view.

    The following figure shows an example of **Driving reach** spatial analysis. The polygons shows the areas that are within two hour reach from the input locations (shown in green).

Figure 5-14 Isochrone Map Analysis



5.8 Densify Geometry Analysis

The **Densify Geometry** transform operation densifies the input geometry by adding more points based on an interval value.

This analysis is useful when visualizing large distances between two coordinates.
To perform this analysis, ensure that a dataset comprising the input geometries (lines or polygons) is added in the Active Project page.

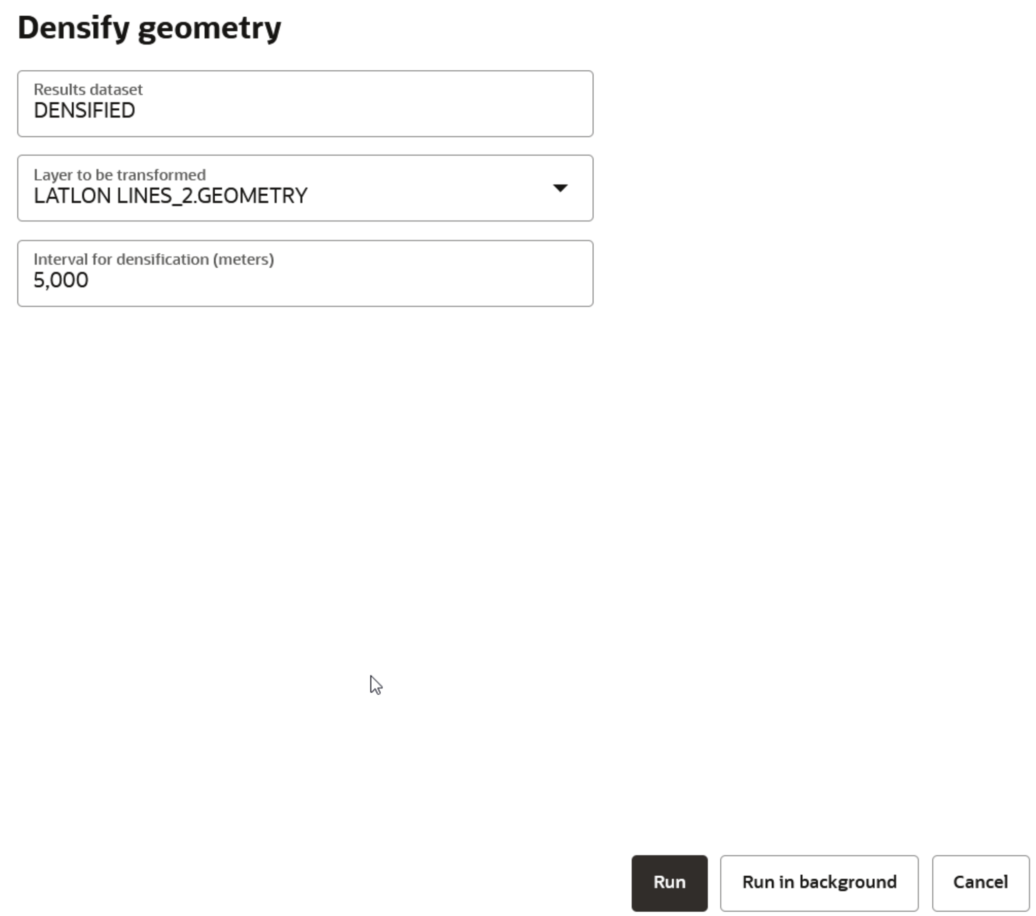
Perform the following steps to run the **Densify Geometry** spatial analysis.

1. Click ••• against the map layer whose coordinates needs to be filtered in the **Layers** tab.
2. Select **Spatial Analysis**.

   The **Spatial Analysis Operations** slider opens as shown in Figure 5-1.
3. Click the **Transform** tab and select **Densify Geometry**.

   Densify Geometry slider opens as shown:

Figure 5-15   Configuring Densify Geometry



Densify geometry

Results dataset
DENSIFIED

Layer to be transformed
LATLON LINES_2.GEOMETRY

Interval for densification (meters)
5,000

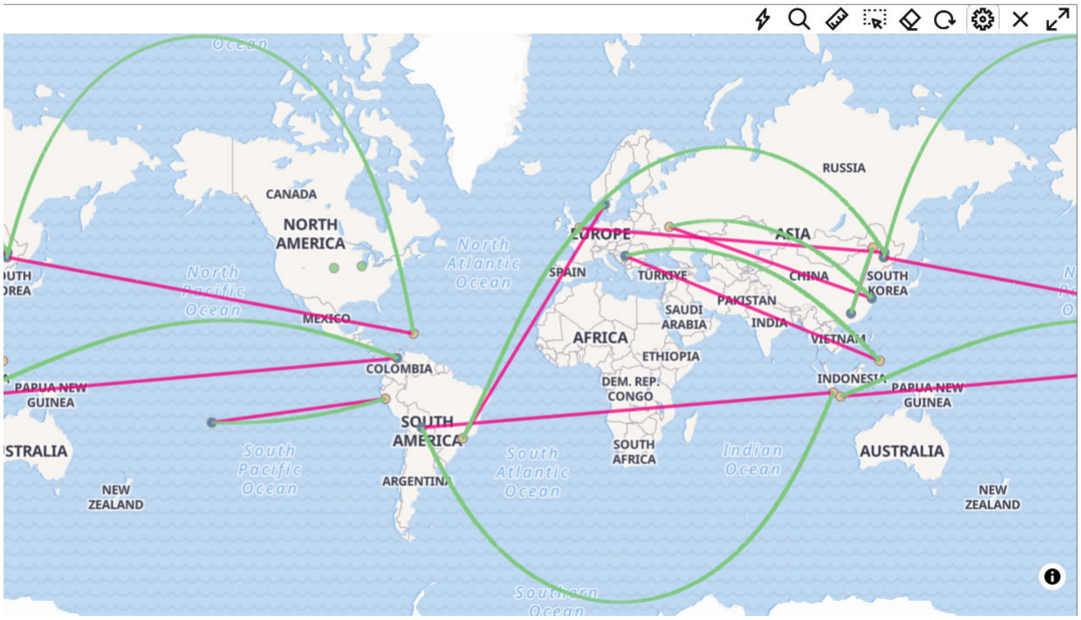
4. Optionally, modify the **Results dataset** name.
5. Select the **Layer to be transformed**.
6. Optionally, modify the **Interval for densification**.

   If the interval is set to too small a value, then the densified geometry may contain a very large number of vertices. This can cause an adverse effect on storage and performance when visualizing or further analyzing them.
7. Click **Run**.

   The Analysis results are listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.
8. Drag and drop the densified geometry column from the result dataset.

   The following figure shows an example of the **Densify Geometry** spatial analysis. Considering that the earth is spherical, the densified geometry (in green) is projected as a curve.

Figure 5-16 Visualizing Densify Geometry Analysis



5.9 Editing a Spatial Analysis

You can edit an existing spatial analysis to modify certain essential parameters.

However, only the following list of spatial analysis operations allow their parameters to be modified after creation:

Filter

- `SDO_FILTER`
- `SDO_NN_V2`
- `SDO_RELATE`
- `SDO_WITHIN_DISTANCE`

Combine

- Spatial Join

Transform

- `SDO_BUFFER`
- `SDO_MBC`
- `SDO_UTIL.AT_BEARING`
- `SDO_UTIL.SIMPLIFY`
- `SDO_SAM.SIMPLIFY_GEOMETRY`

Measure

- `SDO_GEOM.SDO_AREA`
- `SDO_GEOM.SDO_DIAMETER`
- `SDO_GEOM.SDO_LENGTH`

- `SDO_GEOM.WITHIN_DISTANCE`
- `SDO_GEOM.SDO_MAXDISTANCE`
- `SDO_GEOM.SDO_MAX_MBR_ORDINATE`
- `SDO_GEOM.SDO_MBC_RADIUS`
- `SDO_GEOM.SDO_MIN_MBR_ORDINATE`

Analytics

- Summarize within distance
- Summarize by region

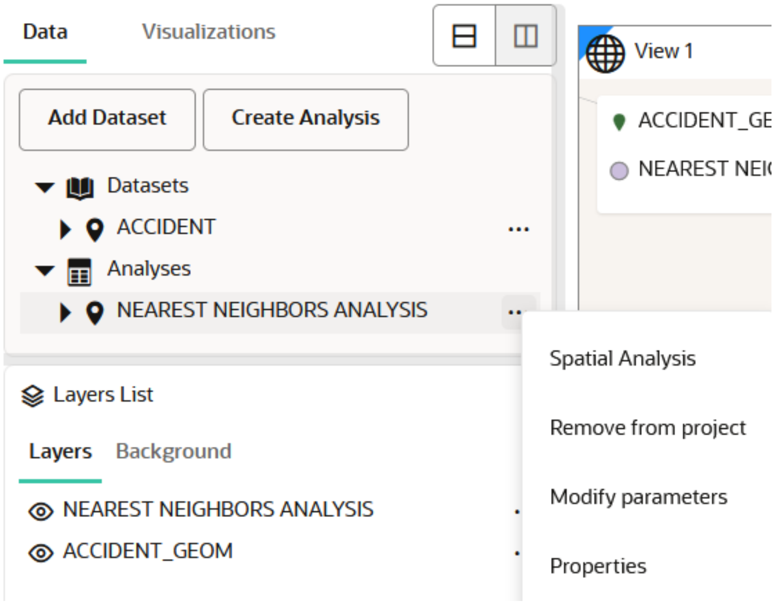
To modify the parameters in a spatial analysis, you must perform the following steps.

The instructions assume that the analysis to be edited is present in the Active Project page.

1. Click ••• against the analysis to be edited under **Analyses** tab in the **Data** elements pane of the Active Project page.
2. Select **Modify Parameters** as shown:

   > **Note:**
   >
   > **Modify Parameters** in the context menu will be disabled for spatial analysis operations that cannot be modified.

   Figure 5-17 Modify Spatial Analysis Parameters

   The slider displaying the original definition for the specific spatial analysis opens.
3. Modify the required parameters and click **Run**.

   The analysis gets updated and the updates can be visualized in the map view.

6

REST API in Oracle Spatial Studio

Oracle Spatial Studio provides a rich RESTful API that can be accessed not only from its web application user interface (UI), but also from the command line or programmatically from any other server or web applications.

Introduction

When you login to the Spatial Studio web application, the application UI is constantly sending and receiving application data using the REST API endpoints. The URLs to access the endpoints typically start with *<studio-base-URL>/api/v1*. The base URL is the entry point to Spatial Studio, such as `https://localhost:4040/spatialstudio`. When you first login to the Spatial Studio web application, the browser sends several AJAX requests to load various metadata from the server. The REST API endpoints are always in use by the web application when you perform different actions such as listing of the existing projects to which you have access, setting your various preferences, listing running tasks, and so on.

For instance, to get the detailed information about the currently logged in user, the web application sends an HTTP GET request to the URL: `https://localhost:4040/spatialstudio/api/v1/user`. This is provided the base URL is `https://localhost:4040/spatialstudio`. Although the response to such requests is typically in JSON format, there are other requests that return other types of data such as compressed vector tiles (when displaying geometry datasets on a map), or images (when displaying GeoRaster datasets).

The OpenAPI 3.0 specification for all the REST endpoints is available in the form of a YAML specification in Spatial Studio OpenAPI Specification for the REST API Endpoints. Note, however, many of the requests require a (sometimes quite complex) JSON payload, which are currently not part of the automatically generated OpenAPI YAML specification. This will be documented in a future release of Spatial Studio. Detailed description on the JSON request payload for the most common use cases are provided in the subsections of this chapter.

About Access Tokens

Apart from the Spatial Studio UI, almost all of the REST API endpoints can also be accessed from the command line using tools such as cURL, or from an external application programmatically. In both cases, you must first obtain an access token from Spatial Studio, as the token needs to be presented to the server. Also, when accessing the REST endpoints through an access token, the URLs will always start with the pattern `<studio-base-URL>/`**`oauth`**`/v1`. The only difference in the URL is that the path segment `api` is replaced with `oauth`. All other interaction behavior with the REST API endpoints from the Spatial Studio UI, external tools, or other applications remain the same.

An access token always includes the unique identity of the Spatial Studio user who generated the token. This user is considered the owner of the token. The owner identity is always verified when any REST endpoint is accessed through a token. See Generating an Access Token for the different types of access tokens that can be generated in Spatial Studio.

All the examples in the following subsections assume that you have obtained the proper type of access token. It is recommended you obtain the least privileged access token that will meet the requirements. For instance, a `READ ONLY` token is sufficient if you are not required to invoke a state-changing operation (such as deleting an analysis dataset). Similarly, if your requirement is only to consume and display your datasets in another mapping application, then consider using a **Streaming-only** access token, which cannot be used to query any other information from the server.

> **Note:**
>
> Generating Access Tokens Programmatically

About Access-Generator Tokens

Effective with Spatial Studio Release 23.2.1, you can create the access tokens programmatically without logging into the Spatial Studio UI. This allows better and safer management and distribution of access tokens, since these tokens are created only for short term usage, as and when needed by the application.

To programmatically create an access token, your application must first have an **Access-Generator Token**. It is a permanent token that is auto-created for each Spatial Studio user by the system. The purpose of this token is to create regular (but short-lived) access tokens which can be used to interact with Studio's extensive set of REST APIs. The access-generator token itself cannot be used to invoke any of the Studio's REST APIs (except the one that creates regular tokens).

See Copying the Access-Generator Token to obtain the access-generator token.

As the access-generator token is permanently associated with a valid Spatial Studio user, ensure the following:

- Keep the token always secure. For instance, the token must not be exposed in the JavaScript code of a web page.
- A typical workflow is to store and use the access-generator token in the backend of your application. Also, for each user session create a regular access token which can be used in your JavaScript code to interact with a Spatial Studio server as needed.

Also, the examples in the following sections assume that the Spatial Studio server is running and accessible at the URL `https://localhost:4040/spatialstudio`.

- Using cURL with Spatial Studio REST APIs
  `cURL` is a powerful command line tool available on many platforms for sending and receiving URL requests to a remote server.
- Accessing Spatial Studio REST API Programmatically
  You can programmatically interact with the Spatial Studio REST API endpoints from another application.

6.1 Using cURL with Spatial Studio REST APIs

`cURL` is a powerful command line tool available on many platforms for sending and receiving URL requests to a remote server.

When accessing or invoking a REST endpoint, the curl command follows a specific format.

For example, consider the following request to retrieve the Spatial Studio version:

HTTP GET Request

```
curl -k https://localhost:4040/spatialstudio/oauth/v1/softwareVersion \
 --header "Authorization: Bearer <MY_TOKEN>"
```

The options used in the preceding request are explained as follows:

- *-k*: To indicate that the `cURL` request must accept the self-signed SSL certificate used by a Quick Start Spatial Studio instance.
- *--header*: To set the Spatial Studio access token as a bearer token header in the request. Note that the keywords **Authorization:** (including the colon and whitespace) and **Bearer** must be entered as is, with the entire value for the `-- header` option enclosed in double quotes. The variable *<MY_TOKEN>* represents the actual token string which must be provided in one unbroken line.

Note that the URL in the request uses `oauth/v1` as path segments. If you accidentally use `api/v1`, then the response returns the web application login page in HTML.

The following sections explain with a few examples on how to invoke a REST API endpoint using `cURL`:

- Listing Available Datasets
- Example Workflow With the Spatial Studio REST Endpoints

6.1.1 Listing Available Datasets

The following request lists all the datasets available to the user who is “embedded” inside the access token:

HTTP GET Request

```
curl -k https://localhost:4040/spatialstudio/oauth/v1/datasets \
 --header "Authorization: Bearer <MY_TOKEN>”
```

The preceding request will return a JSON document containing all the datasets that are owned or created by the token owner, as well as any dataset that was marked as public (by its owner) which are accessible to any other application user. The JSON response includes a JSON object that describes every aspect of the dataset, such as `id`, `name`, `type`, `source` table name (if applicable), as well as its columns and a host of other metadata.

Note that the access token used in the preceding request must be a **general-purpose** one (either `read-only` or `read-write`, depending on your specific use case), as opposed to a **dataset streaming-only** token. This is because a stream-only access token cannot be used to query any metadata from the Spatial Studio server. As a result, if you pass in a stream-only token in the preceding request, you will not get the desired response.

Alternatively, you can also provide an additional query parameter, **fields**, to filter the data that is returned for each dataset. For instance, if you prefer only the unique `id` and `name` of all the available datasets in the response, then the request is as follows:

Request with Query Parameter:

```
curl -k https://localhost:4040/spatialstudio/oauth/v1/datasets?fields=id,name
\
 --header "Authorization: Bearer <MY_TOKEN>”
```

Response:

```
{"items":[
{
  "id" : "3ee71ae5ba84cc5afd0728643e878f29",
  "name" : "LANDSAT5_IMAGES"
},
{
  "id" : "d06d0b711e10997c1c886b731b1c45b8",
  "name" : "AIRPORT_POINT"
},
{
  "id" : "fd6f55d0773dcda639e07b00e5ba431a",
  "name" : "INTERSTATES"
},
{
  "id" : "5b68bd621ee6f58af0bd0cb20f600a38",
  "name" : "NY_INDIAN_TERRITORIES"
}]
}
```

In the preceding response:

- Each dataset is represented as an element in the **items** array.
- Each item (dataset) contains both the `id` and the `name` of a dataset. The `id` returned in the response is the unique ID of the dataset. Note that Spatial Studio assigns a globally unique `id` to all the objects you create, such as datasets, projects, connections or data sources, and even columns inside a dataset. In most cases, the REST API uses only these unique `id`s when referencing a user created object such as a dataset or connection.

Related Topics

- Generating an Access Token

6.1.2 Example Workflow With the Spatial Studio REST Endpoints

You can perform different workflows with the Spatial Studio REST Endpoints. For example, consider a workflow consisting of the following steps:

1. Create a new Spatial Studio dataset from an existing table containing latitude/longitude coordinates.
2. Instruct Spatial Studio to perform a reverse geocoding task on the underlying database table of the dataset.
   This task will update the table with additional columns representing the nearest address information as a result of the reverse geocoding operation.
3. Verify that the table is updated with the address columns by checking the data in a table row.

You can potentially automate these steps by running the workflow steps in a script. Also, note that the workflows are certainly not limited to this particular scenario. You can also, for instance, automate the process of creating a spatial analysis, obtaining a CSV report of the analysis, and so on.

The following sections enable you to perform the preceding example workflow by interacting with the REST endpoints of Spatial Studio using the `cURL` tool.

- Creating a New Dataset From an Existing Table
- Reading a Single Row of Data From a Dataset
- Performing Reverse Geocoding

- Checking the Reverse Geocoding Task Status
- Verifying the Result of Reverse Geocoding

6.1.2.1 Creating a New Dataset From an Existing Table

The Spatial Studio datasets are created from existing tables, views or models in a database connection.

The following request creates a new Spatial Studio dataset from an existing table.

HTTP POST Request

```
curl -k -X POST https://localhost:4040/spatialstudio/oauth/v1/datasets \
 --header "Authorization: Bearer <MY_TOKEN>" \
 --header "Content-Type: application/json" \
 --data '{
  "objectType": "dataset",
  "name": "MY_LOCATIONS",
  "refId": "<MY_CONN_ID>",
  "data": {
    "dataSourceId": "$MY_CONN_ID",
    "nodePath": "database://{data}{schema}{<MY_CONN_ID>}/{marker}{TableMarker}
{<MY_CONN_ID>-table}/{dataset}{DatabaseTable}{MY_LOCATIONS}",
    "description": "",
    "dataSourceType": "database",
    "lastModifiedTime": "'$DATE'"
  }
}'
```

The preceding request creates a dataset from *MY_LOCATIONS* table. Also, note the following:

- The `-X POST` option make this a HTTP POST request. This is required when invoking a state-changing action (creating a new dataset on the server). You will also need an access token with the READ and WRITE permissions (changing the server's state is considered a WRITE operation).
- The `--data` option is used to send a JSON payload as part of the REST request. In this example an env variable `$DATE` (`export DATE=date`) is used for the required `lastModifiedTime` field.
- The string *<MY_CONN_ID>* represents the `id` of the data source or connection where the table exists.
- For formatting purposes, the request is shown split into multiple lines. The backslash `\` ensures that all the lines are concatenated and treated as a single unbroken command.

The response includes the new dataset `id`, which is used in subsequent requests.

Response

```
{
  ...
   "id" : "5c3b3a6d98eab545a0f9bd66e3d07886",
  ...
}
```

Although you will receive the JSON response almost instantly, note that there will be additional server-side tasks (for example, statistics gathering) that still continue to run. These background tasks may take a few seconds or more depending on the size of the source table. There are REST endpoints to query and check the status of such tasks. But for the purpose of creating a new dataset, you can safely ignore them.

You can also send a host of other commands that prepare your newly created dataset, such as creating a latitude/longitude index, updating its statistics, setting a key column, and so on.

6.1.2.2 Reading a Single Row of Data From a Dataset

The following request reads a single row of data from a dataset.

HTTP GET Request

```
curl -k "https://localhost:4040/spatialstudio/oauth/v1/datasets/rows/
5c3b3a6d98eab545a0f9bd66e3d07886?limit=1" \
 --header "Authorization: Bearer <MY_TOKEN>"
```

The following response returns a single row of data for the specified dataset (with the given id).

Response

```
{
  ...
   "items" : [
      {
         "LAT" : 35.53222623,
         "LON" : -101.5576172,
         "NAME" : "Amarillo Warehouse”
      }
   ],
  ...
}
```

6.1.2.3 Performing Reverse Geocoding

You can reverse geocode the dataset created in the earlier section using the following request.

HTTP PUT Request

```
curl -k -X PUT "https://localhost:4040/spatialstudio/oauth/v1/enrichment/
reversegeocode/5c3b3a6d98eab545a0f9bd66e3d07886?datasourceid=
<MY_CONN_ID>&roadsonly=true&lat=LAT&lon=LON" \
 --header "Authorization: Bearer <MY_TOKEN>" \
 --header "Content-Type: application/json" \
 --data '{
  "street": "STREET",
  "housenumber": "HOUSE_NUMBER",
  "settlement": "SETTLEMENT",
  "municipality": "MUNICIPALITY",
  "region": "REGION",
  "postalcode": "POSTAL_CODE",
  "country": "COUNTRY"
}'
```

The preceding request uses the coordinate columns (`LAT` and `LON`) and also the `--data {key:value, …}` option that specifies which address-related columns must be created and populated. In this sample request, all the attributes are created. `value` determines the resulting column name.

The resulting `task_id` of the reverse-geocoding task running in the background is returned in the response.

Response

```
{
   "task_id" : "a2743564e066153f4a14ac29000727b1"
}
```

6.1.2.4 Checking the Reverse Geocoding Task Status

Using the `task_id` returned in the earlier section, you can obtain the status of the reverse geocoding task.

The following request returns the state or status of a specified task (such as `ONGOING` or `DONE`).

HTTP GET Request

```
curl -k https://localhost:4040/spatialstudio/oauth/v1/tasks/
a2743564e066153f4a14ac29000727b1 \
 --header "Authorization: Bearer <MY_TOKEN>"
```

Response

```
{
 ...
   "state" : "DONE",
 ...
}
```

Once the task returns the state `DONE`, then you can perform Verifying the Result of Reverse Geocoding.

6.1.2.5 Verifying the Result of Reverse Geocoding

Once the reverse geocoding task completes with status `DONE`, then you can use the following request to view a row of data from the dataset table. This is to verify that the table contains additional address-related columns populated by the reverse geocoding operation performed by Spatial Studio in the backend.

HTTP GET Request

```
curl -k "https://localhost:4040/spatialstudio/oauth/v1/datasets/rows/
5c3b3a6d98eab545a0f9bd66e3d07886?limit=1" \
 --header "Authorization: Bearer <MY_TOKEN>"
```

The JSON response contains a single table row with the added columns.

Response

```
{
  ...
  "items": [
    {
      "COUNTRY": "US",
      "HOUSE_NUMBER": "2403",
      "LAT": 35.53222623,
      "LON": -101.5576172,
      "MUNICIPALITY": "Carson",
      "NAME": "Amarillo Warehouse",
      "POSTAL_CODE": "79068",
      "REGION": "TX",
      "SETTLEMENT": "Panhandle",
      "STREET": "County Road D"
    }
  ],
  ...
}
```

6.2 Accessing Spatial Studio REST API Programmatically

You can programmatically interact with the Spatial Studio REST API endpoints from another application.

A typical use case is to consume a Spatial Studio dataset or analysis, and showing its contents (geometries and attributes) on a map that you are creating either from scratch or in an existing web mapping application (such as a map region inside your Oracle Apex application). To implement this, you must first understand the ways Spatial Studio can serve its datasets for mapping purposes.

Spatial Studio can serve its geometry datasets in two formats - **GeoJSON** and **Vector Tiles**, with each format using its own REST endpoint. The endpoint that applies for GeoRaster datasets, returns its contents as image tiles. Table 6-1 summarizes all the relevant REST endpoints Spatial Studio uses to serve the data of the datasets.

Table 6-1 Dataset Format Specific Endpoint

Format	Endpoint
Vector Tiles (for table/view/analysis datasets containing geometry or lat/lon indexed columns)	`https://localhost:4040/spatialstudio/oauth/v1/vt/<DATASET_ID>/<GEOM_COLUMN_NAME>/{z}/{x}/{y}.mvt` Ensure to substitute the string *`<DATASET_ID>`* with the `id` of the target dataset and *`<GEOM_COLUMN_NAME>`* with the `name` (not `id`) of the geometry column.
GeoJSON (for geometry type datasets)	`https://localhost:4040/spatialstudio/oauth/v1/jsonstream/<DATASET_ID>?geo=<GEOM_COLUMN_NAME>` • If the dataset has only one geometry column, then the **geo** query parameter can be omitted. • Also, ensure to substitute the string *`<DATASET_ID>`* with the `id` of the target dataset and *`<GEOM_COLUMN_NAME>`* with the `name` (not `id`) of the geometry column.

Table 6-1 (Cont.) Dataset Format Specific Endpoint

Format	Endpoint
Image Tiles (for GeoRaster datasets)	`https://localhost:4040/spatialstudio/oauth/v1/rt/<COLUMN_ID>/{z}/{x}/{y}.png` Note that this requires *`<COLUMN_ID>`* and not *`<DATASET_ID>`*. Also, replace *`<COLUMN_ID>`* with the image column `id` of the GeoRaster dataset. See Displaying a Spatial Studio GeoRaster Dataset as Image Tiles for more information on how to obtain the image column `id` of GeoRaster datasets. This is different from the REST endpoints for Vector Tiles or GeoJSON data, which require the `id` of the dataset and the `name` of the geometry column.

- Displaying a Spatial Studio Dataset in a Standalone MapLibre JavaScript Map as Vector Tiles
- Displaying a Spatial Studio Dataset as GeoJSON
- Displaying a Spatial Studio GeoRaster Dataset as Image Tiles

6.2.1 Displaying a Spatial Studio Dataset in a Standalone MapLibre JavaScript Map as Vector Tiles

This section explains how to create a simple one-page HTML page that can display a vector tiles of a dataset in a standalone JavaScript web mapping application written using the open source MapLibre GL JS API library.

Any mapping APIs must meet the following criteria:

- Support displaying vector tiles or GeoJSON data from an external source.
- Support setting a custom HTTP header on its Vector Tile or GeoJSON requests. This is needed in order to pass an access token to Spatial Studio.

The following example displays the public *Submarine Cables* dataset that was loaded into an Oracle database table from which a Spatial Studio dataset was created. The access token was obtained from the same Studio server with the type *Dataset streaming only*. The sample code is as shown:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="utf-8">
    <title>Display vector dataset from Spatial Studio</title>
    <meta name="viewport" content="initial-scale=1,maximum-scale=1,user-
scalable=no">
    <script src="https://unpkg.com/maplibre-gl@2.1.9/dist/maplibre-gl.js"></
script>
    <link href="https://unpkg.com/maplibre-gl@2.1.9/dist/maplibre-gl.css"
rel="stylesheet">
    <style>
        body { margin: 0; padding: 0; }
        #map { position: absolute; top: 0; bottom: 0; width: 100%; }
    </style>
</head>
<body>
```

```
<div id="map"></div>
<script>
    const spatialStudio = {
        // the base URL for accessing Spatial Studio dataset's vector tiles
using an access token
        baseUrl : 'https://localhost:4040/spatialstudio/oauth/v1',
        // a stream-only access token issued by Spatial Studio
        accessToken: 'eyJ0eXAiOiJzZ3R...HV3koQsYF_MkKQ'
    };

    const map = new maplibregl.Map({
        container: 'map',
        // For demo purpose we will simply create a background map based on
the OpenStreetMap from Map Tiler. Note that you must obtain your own API key
from maptiler.com. Any Mapbox style basemap works here.
        style: ' https://api.maptiler.com/maps/openstreetmap/style.json?
key=YOUR_KEY',
        zoom: 1,
        center: [-122.5, 37.5],

        // This function is used to set the Spatial Studio access token when
requesting the vector tiles of a dataset.
        transformRequest: (url, resourceType) => {
            if (resourceType === 'Tile' &&
url.startsWith(spatialStudio.baseUrl)) {
                return {
                    url: url,
                    headers: {'Authorization': 'Bearer ' +
spatialStudio.accessToken}
                }
            }
        }
    });

    map.on('load', function () {
        // Adds the vector tiles for the Spatial Studio dataset with the id
"c5e166cdf86a1605ff9fbaa9d04b7378" to
        // the MapLibre map as a source object.
        map.addSource('spatial-studio-vector-tiles', {
            'type': 'vector',
            'tiles': [
                spatialStudio.baseUrl + '/vt/c5e166cdf86a1605ff9fbaa9d04b7378/
GEOM/{z}/{x}/{y}.mvt'
            ],
            'minzoom': 0,
            'maxzoom': 10
        });

        // Adds the layer definition for the dataset. Note that vector tiles
generated by Spatial Studio always includes only one dataset,
        // and the layer name is always 'LAYER'.
        map.addLayer(
            {
                'id': 'submarine-cables',
                'type': 'line',
                'source': 'spatial-studio-vector-tiles',
                'source-layer': 'LAYER',
                'layout': {
                    'line-cap': 'round',
                    'line-join': 'round'
                },
                'paint': {
                    'line-opacity': 0.6,
                    'line-color': 'rgb(53, 175, 109)',
                    'line-width': 3
                }
            }
        );
    });

    map.addControl(new maplibregl.NavigationControl());

    // Adds a simple popup on hover
    var popup = new maplibregl.Popup({
        closeButton: false,
        closeOnClick: false
    });

    // Defines what happens when you mouse over a feature of the dataset.
    map.on('mouseenter', 'submarine-cables', function (e) {
        // Changes the cursor style as a UI indicator.
        map.getCanvas().style.cursor = 'pointer';

        var coordinates = e.features[0].geometry.coordinates.slice();
        if (Array.isArray(coordinates[0])){
            // Uses the first vertex of the linestring feature under hover as
the anchor point for the popup.
            coordinates = coordinates[0];
        }

        // NAME is one of the columns of the dataset. You have access to all
the columns of a dataset here.
        var description = e.features[0].properties.NAME;

        // Ensures that if the map is zoomed out such that multiple
        // copies of the feature are visible, the popup appears
        // over the copy being pointed to.
        while (Math.abs(e.lngLat.lng - coordinates[0]) > 180) {
            coordinates[0] += e.lngLat.lng > coordinates[0] ? 360 : -360;
        }

        // Populates the popup with custom HTML contents and sets its
coordinates
        // based on the feature found under the mouse pointer. Finally the
popup is added to the map.
        popup.setLngLat(coordinates).setHTML(description).addTo(map);
    });

    map.on('mouseleave', 'submarine-cables', function () {
        map.getCanvas().style.cursor = '';
        popup.remove();
    });
```

```
</script>

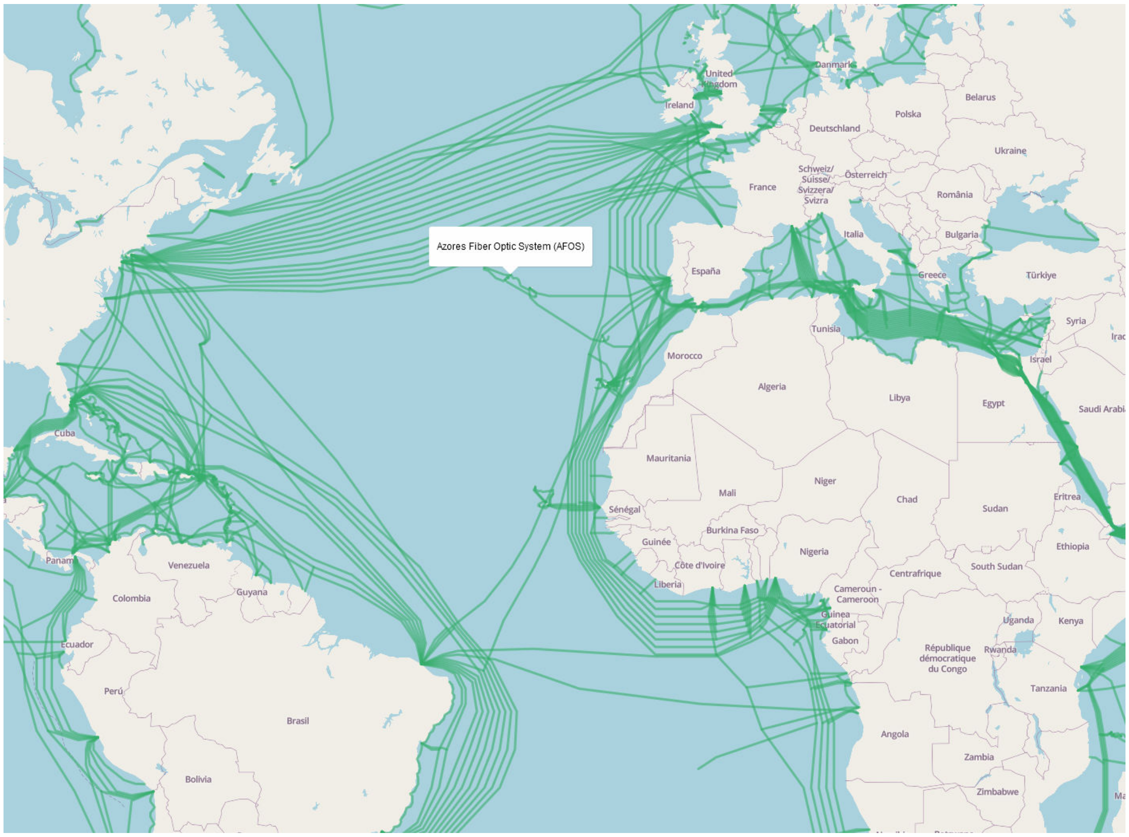
</body>
</html>
```

Note the following related to the preceding code:

- Replace the `baseURL` and `accessToken` as it applies to your installation. Also, the access token should be of the type *Dataset stream only*.
- Similarly, replace the dataset `id` string to your own.
- The access token is set as a request header through MapLibre API's `transformRequest` option when constructing a MapLibre `Map` object. This option provides MapLibre API with a callback that will be invoked whenever it sends a vector tile request to the Spatial Studio server.
- A MapLibre *vector* type Source object is created and added to its `Map` object. From this source object a map layer is defined and added to the map as well.
- You have full access to all the columns of the dataset once its data are displayed on the map.
- You can always customize the popup behavior and the contents as they are standard MapLibre GL JS API classes.

When you save the code to a web server and open its URL in a browser window, a similar map as shown will be displayed. The green lines on the map are the features of the Spatial Studio dataset containing submarine cables.

Figure 6-1 Displaying Vector Tiles of a Dataset in the MapLibre Application



6.2.2 Displaying a Spatial Studio Dataset as GeoJSON

To load the public *Submarine Cables* dataset as GeoJSON from Spatial Studio and display it in the MapLibre application, you must make the following changes to the HTML code shown in Displaying a Spatial Studio Dataset in a Standalone MapLibre JavaScript Map as Vector Tiles:

- When adding the Spatial Studio token, the `transformRequest` function must look for requests of the type *Source* instead of *Tile*.
- The map source and layer definitions must change to use the *geojson* type.

The following show the corresponding changed blocks of code:

```
        transformRequest: (url, resourceType) => {
            if (resourceType === 'Source' &&
url.startsWith(spatialStudio.baseUrl)) {
                return {
                    url: url,
                    headers: {'Authorization': 'Bearer ' +
spatialStudio.accessToken}
                }
            }
        }

        map.addSource('spatial-studio-geojson-data', {
            'type': 'geojson',
            'data': spatialStudio.baseUrl + '/jsonstream/
c5e166cdf86a1605ff9fbaa9d04b7378'
        });

        map.addLayer(
            {
                'id': 'submarine-cables',
                'type': 'line',
                'source': 'spatial-studio-geojson-data',
                'layout': {
                    'line-cap': 'round',
                    'line-join': 'round'
                },
                'paint': {
                    'line-opacity': 0.6,
                    'line-color': 'rgb(53, 175, 109)',
                    'line-width': 3
                }
            }
        );
```

6.2.3 Displaying a Spatial Studio GeoRaster Dataset as Image Tiles

Similar to how the geometry dataset from Spatial Studio can be displayed in a standalone MapLibre map, GeoRaster datasets from Spatial Studio can also be easily added to your MapLibre map. As mentioned in the earlier sections, the REST endpoint for returning the image tiles of a GeoRaster dataset requires the image column’s `id` as part of the REST endpoint URL. Unlike easily finding out the `id` of a dataset from its properties dialog, in this case, you must use a `cURL` command to obtain the image column `id`. For example:

```
curl -k "https://localhost:4040/spatialstudio/oauth/v1/datasets/<DATASET_ID>/
columns?datasetFields=georasterColumns&columnFields=id,name" \
 --header "Authorization: Bearer <MY_TOKEN>"
```

The preceding REST endpoint returns the metadata of all the columns in the specified dataset. The query parameters, `datasetFields` and `columnFields` are used to filter the response so that only the fields matching the given names are returned to the client. In this case, the requirement is to obtain the `georasterColumns` field, which indicates the name of the dataset's GeoRaster image columns (that store raster image data). For the individual columns in that dataset, only the `name` and `id` are required.

The request returns a similar response:

```
{
  "georasterColumns": [
    "IMAGE"
  ],
  "columnDetails": [
    {
      "id": "09b60f1da4c6808d753c57393c6f899f",
      "name": "IMAGE_ID"
    },
    {
      "id": "7223184218fc39ac149c91155a9f9242",
      "name": "MIN_X_RES$"
    },
    {
      "id": "e56426442075b028018175740b64449d",
      "name": "IMAGE"
    },
    {
      "id": "c254f40e6ea6f14f4899c8801b485b24",
      "name": "MAX_X_RES$"
    },
    {
      "id": "5c4d7c6963f7234adc97fafc52c0c04c",
      "name": "DESCRIPTION"
    }
  ]
}
```

In the preceding response, the `id` of the image column is *`e56426442075b028018175740b64449d`*, which is then used in the following example code to display a Spatial Studio GeoRaster dataset on a standalone MapLibre application.

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="utf-8">
    <title>Display GeoRaster imagery from Spatial Studio</title>
    <meta name="viewport" content="initial-scale=1,maximum-scale=1,user-
```

```
scalable=no">
    <script src="https://unpkg.com/maplibre-gl@2.1.9/dist/maplibre-gl.js"></
script>
    <link href="https://unpkg.com/maplibre-gl@2.1.9/dist/maplibre-gl.css"
rel="stylesheet">
    <style>
        body { margin: 0; padding: 0; }

        .container {
            position: absolute;
            width: 100%;
            height: 100%;
        }
        .control {
            background-color: #a9cce3 ;
            width: 100%;
            height: 100px;
            margin: 5px auto;
        }
        .map_container {
            position: absolute;
            top: 100px;
            bottom: 0;
            width: 100%;
            margin: 5px auto;
        }
    </style>
</head>
<body>

<div class="container">
    <div class="control">
        <form>
          <fieldset>
                <legend>GeoRaster display settings</legend>
                <p>
                    <input type="checkbox" name="nodata_flag"
id="nodata_flag">
                    <label for="nodata_flag">Show NODATA values as
transparent</label>
                </p>
          </fieldset>
        </form>
    </div>

    <div class="map_container" id="map"></div>
</div>


<script>
    // basic information about the remote Spatial Studio instance that is
serving the GeoRaster images.
    const spatialStudio = {
        // the base URL for accessing Spatial Studio dataset's GeoRaster
image tiles using an access token
        baseUrl : 'https://localhost:4040/spatialstudio/oauth/v1',
        rasterTileEndpoint: '/rt/e56426442075b028018175740b64449d/{z}/{x}/
{y}.png',
        // a stream-only access token issued by Spatial Studio
        accessToken: 'eyJ0eXAiOiJzZ3R...qOdHV3koQsYF_MkKQ'
    };

    const sourceId = 'spatial-studio-raster-tiles1';

    const map = new maplibregl.Map({
        container: 'map',
        // Gets the OpenStreetMap basemap from maptiler.com. You must change
to use your own maptiler API key and agree to their terms of usage.
        style: 'https://api.maptiler.com/maps/openstreetmap/style.json?
key=YOUR_KEY,
        zoom: 6,
        center: [-90.241936, 33.911399],

        //This option sets a Spatial Studio access token when requesting the
image tiles of a GeoRaster dataset.
        transformRequest: (url, resourceType) => {
            if (resourceType === 'Tile'&&
url.startsWith(spatialStudio.baseUrl)){
                return {
                    url: url,
                    headers: {'Authorization': 'Bearer ' +
spatialStudio.accessToken}
                }
            }
        }
    });

    // Controls the visual appearances of the GeoRaster images generated by
Studio. This is appended to the Studio tile request URLs.
    let geoRasterVisualProperties = {"reprojection":
{"mode":"NN","medianfilter":false},"transpnodata":false,"virtualmosaic":
{"resolfilter":true,"nodata":true,"fillgap":true,"commonpointrule":"HIGH"},"ba
nds":{"red":1,"green":2,"blue":3,"alpha":-1}};

    map.on('load', function () {
        // Adds the image tiles for the Spatial Studio GeoRaster dataset with
the specified column id (not dataset id) "e56426442075b028018175740b64449d" to
        // the map.
        //
        map.addSource(sourceId, {
            'type': 'raster',
            'tiles' : [
                   spatialStudio.baseUrl + spatialStudio.rasterTileEndpoint +
'?visualProperties=' + JSON.stringify(geoRasterVisualProperties)
                ],
            'minzoom': 5,
            'maxzoom': 20,
            'tileSize' : 256,
            // this tells MapLibre API that the dataset only has GeoRaster
images within this bounding box
            'bounds': [-90.4895407500805, 32.3190270753724,
-89.9586424931126, 35.2761555998833]
```

```
        });

        // Defines and adds a layer from the above Map source.
        map.addLayer(
            {
                'id': 'my_georaser_layer',
                'type': 'raster',
                'source': sourceId,
                'paint':  {
                    'raster-opacity': 0.72,
                    'raster-hue-rotate': 0,
                    'raster-brightness-min': 0,
                    'raster-brightness-max': 1,
                    'raster-saturation': 0,
                    'raster-contrast': 0,
                    'raster-fade-duration': 300
                }
            }
        );
    });

    map.addControl(new maplibregl.NavigationControl());

    // Toggles the display of GeoRaster NODATA values between transparent or
not.
    // This is done by changing the visual properties object's "nodata"
field,
    // then reloading the GeoRaster images from Spatial Studio using the new
properties.
    function toggleNODATA(flag) {
        if (geoRasterVisualProperties.transpnodata === flag) {
            return; // do nothing since we are already using the input value
        }

        geoRasterVisualProperties.transpnodata = flag;

        // update map source so that future tile requests will generate tiles
with the new visual properties.
        const sourceObj = map.getSource(sourceId);
        const newTileUrl = spatialStudio.baseUrl +
spatialStudio.rasterTileEndpoint + '?visualProperties=' +
JSON.stringify(geoRasterVisualProperties);

        sourceObj.tiles = [newTileUrl];
        // Remove all the existing, cached tiles of the GeoRaster source
        map.style.sourceCaches[sourceId].clearTiles();
        // Reloads the GeoRaster image tiles for the current viewport
(map.transform -> viewport)
        map.style.sourceCaches[sourceId].update(map.transform);
        // Force a map repaint
        map.triggerRepaint();
    }

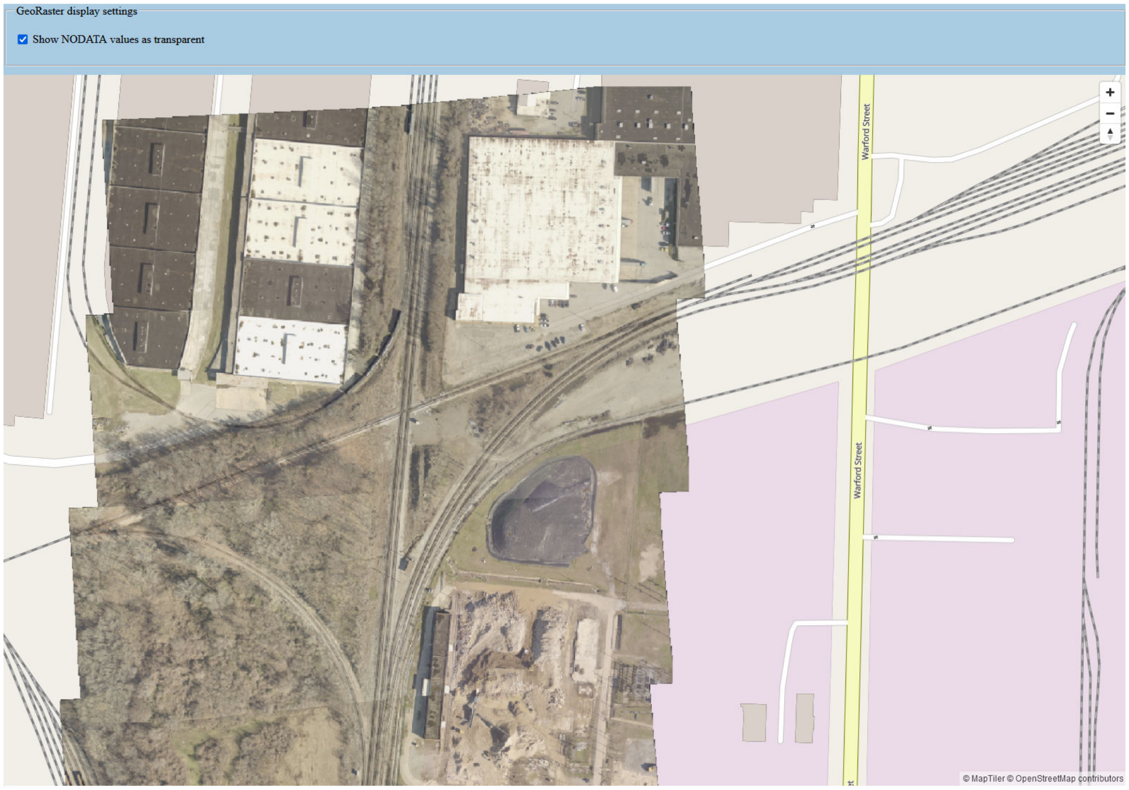
    // add callback to the nodata checkbox
    const nodataCheckbox = document.querySelector('#nodata_flag');
    nodataCheckbox.addEventListener('change', () => {
        if(nodataCheckbox.checked){
            toggleNODATA(true);
        } else {
            toggleNODATA(false);
        }
    });

</script>

</body>
</html>
```

The following shows the output map with the GeoRaster (high resolution images) overlaid on top of the OpenStreetMap. When you toggle the **Show NODATA values as transparent**, the GeoRaster images will display its *NODATA* area either as black or transparent pixels.

Figure 6-2   Displaying a GeoRaster Dataset in the MapLibre Application



GeoRaster display settings

☑ Show NODATA values as transparent

Note the following on the preceding GeoRaster image:

- The overall pattern remains similar to how geometry datasets are displayed. You only need to change the Spatial Studio REST endpoint and how the MapLibre Source and Layer objects are defined.
- You can fine-tune the generated image tiles by supplying a visual properties payload as part of the image tile request.

- Spatial Studio takes care of all the backend processes such as querying the GeoRaster table or virtual mosaic based on the browser’s image tile requests, applying the specified visual properties, and sending the result images back to the browser.

7

Embedding a Published Project in Third-Party Web Applications

Using an embedded JavaScript framework, you can embed a project published in Spatial Studio in a third-party web application (such as an APEX application).

> **Note:**
>
> You can embed a project published in Spatial Studio in a third-party web application only if the application does not use (or is not dependent on) the Oracle JET framework.

Spatial Studio provides a Oracle JET Web Component that can be embedded in external web applications. This web component can load and show a published project with most of the styling capabilities that are built in the Spatial Studio server. Also, it provides methods and events for interaction.

- Prerequisites for Embedding a Published Project
  Learn the prerequisite tasks required for embedding a published project in your web application.
- Basic Usage of the Spatial Studio Web Component
  Learn how to embed the Spatial Studio web component in an HTML page to load and view your published project in your web application.
- Interactive Usage with the Spatial Studio Web Component
  Describes the methods supported for interacting with the Spatial Studio web component for embedding.
- Embedding a Published Project in an APEX Application
  You can load the Spatial Studio web component in an APEX Application and render the map visualization.

7.1 Prerequisites for Embedding a Published Project

Learn the prerequisite tasks required for embedding a published project in your web application.

1. Create and publish a project in Spatial Studio.

   The published project gets displayed on the **Projects** page under **Published Projects**.
2. Obtain the published project id.
   a. Click **URL** in the context menu of the published project.
   b. Copy the `projectId` value that is included in the URL.
3. Obtain an access token in Spatial Studio (see About Tokens in Spatial Studio).
   a. Generate an access token of type **Embedding Published Projects token**.

   b. Copy and store the newly created access token value.

4. Optionally, perform the following if you wish to interact with the component features selection.
   a. Verify that a **Key** column is assigned in all the related datasets used in the published project.
   b. Copy all the corresponding `datsetIds`.
      i. Navigate to the **Datasets** page.
      ii. Click open the context menu on the related datasets and click **Properties**. The `datasetId` is displayed in a property field.
5. Optionally, configure your Spatial Studio instance to use a CA-signed SSL certificate.

   Embedding a published project from Spatial Studio inside your web application typically involves cross-domain requests. Therefore, browsers will not load the project contents served from Spatial Studio if your Spatial Studio instance does not have a CA-signed certificate, and your web application has one. In such a scenario, it is recommended that you configure your Spatial Studio instance to use a properly signed SSL certificate. See Using a CA-Signed SSL Certificate in the Quick Start Installation for more information.

7.2 Basic Usage of the Spatial Studio Web Component

Learn how to embed the Spatial Studio web component in an HTML page to load and view your published project in your web application.

The following shows the basic usage of the Spatial Studio web component for embedding in JavaScript code. Note that the `<script>` tag references `embeddable.js` in your HTML file.

```
<script src="https://<host_name>:4040/spatialstudio/api/v1/embeddable.js"></
script>

<div style="width:100%; height: 75vh;">
    <spatial-studio-project
        id="spatial-studio-project-1"
        server-url="https://<host_name>:4040/spatialstudio/"
        project-id="7c6301f4fdcc1f3dee64f05f84d5f96c"
        token="eyJ.…."
        project-header="off"
        layers-list="on">
    </spatial-studio-project>
</div>
```

Table 7-1 Supported Attributes for Embedding the Spatial Studio Web Component

Attribute Name	Description
`id`	Unique ID for element identification and access to its methods.
`server-url`	URL of the Spatial Studio server.
`project-id`	The published project ID to be loaded.
`token`	The oauth token generated in the Spatial Studio application.
`project-header`	`"on"` or `"off"` to show the project header.

Table 7-1 (Cont.) Supported Attributes for Embedding the Spatial Studio Web Component

Attribute Name	Description
`layers-list`	`"on"` or `"off"` to show the layers list and all the styling panels.

7.3 Interactive Usage with the Spatial Studio Web Component

Describes the methods supported for interacting with the Spatial Studio web component for embedding.

- clearFilters
- filterFeatures
- selectFeatures
- features_selected

7.3.1 clearFilters

Method Name: `clearFilters(layerId: string)`

Description: To clear all the filters for a given **layerId**.

Example:

```
const spatialStudioProjectElement = document.getElementById('spatial-studio-
project-1');

const layerId = 'abcd1234';

spatialStudioProjectElement.clearFilters(layerId);
```

7.3.2 filterFeatures

Method Name: `filterFeatures(layerId: string, columnName: string, values: any[])`

Description: To filter feature for a given **layerId**, **columnName** and an array of **values**.

Example:

```
const studioProjectElement = document.getElementById('spatial-studio-
project-1');

const layerId = 'abcd1234';
const columnName = 'COUNTRY_NAME';
const values = ['Canada, 'Ireland', 'Japan'];

studioProjectElement.filterFeatures(layerId, columnName, values);
```

7.3.3 selectFeatures

Method Name: `selectFeatures(datasetId: string, featureKeys: any[])`

Description: To select and highlight features by **datasetId** and an array of **featureKeys**.

Example:

```
const studioProjectElement = document.getElementById('spatial-studio-
project-1');

const datasetId = "7e4c89462b580ae2f253adf5c8bff711";
const selectedFeatureIds = [1, 3, 10];

studioProjectElement.selectFeatures(datasetId, selectedFeatureIds);
```

7.3.4 features_selected

Event Name: `features_selected`

Description: Event is triggered when the features selection is changed, most commonly when the user selects features in the maps or tables. The `DatasetSelectedFeatures` object which contains an array of feature keys for a dataset is defined as shown:

```
DatasetSelectedFeatures: {
    datasetId         : string,
    featureKeys       : Array<string | number>
}
```

Example: The following code example gets a reference to a web element, adds a listener to the web component, and defines a callback:

```
const studioProjectElement = document.getElementById('spatial-studio-
project-1');
studioProjectElement.addEventListener('features_selected', (event) => {
    const selectionObjects = event.detail.value;
    console.log(JSON.stringify(selectionObjects));
});
```

7.4 Embedding a Published Project in an APEX Application

You can load the Spatial Studio web component in an APEX Application and render the map visualization.

1. Sign in to your APEX workspace (see Signing In to Your Workspace).
2. Create a target application (see Creating Applications) into which you want to embed the Spatial Studio web component.

3. Add a **Static Content** region to the target application and edit its content to include the web component as shown by the following code:

```
<script src="https://<host_name>:4040/spatialstudio/api/v1/embeddable.js?
ex=kobinding"></script>

<div style="width:100%; height: 50vh;">
    <spatial-studio-project
        id="spatial-studio-project-1"
        server-url="https://<host_name>:4040/spatialstudio/"
        project-id="d241e77f3e46420a8509ce86ba44f00b"
        token="eyJ0eXAiOiJz..."
        project-header="off"
        layers-list="on">
    </spatial-studio-project>
</div>

// Setup css variables that conflict between APEX and Studio
<style>
    body {
        --sgtech-bg: var(--rbr-blue);
        --oj-heading-text-color: white;

        --ut-region-header-text-color: white;
        --ut-region-border-color: white;
        --ut-footer-text-color: white;

        max-width: 100%;

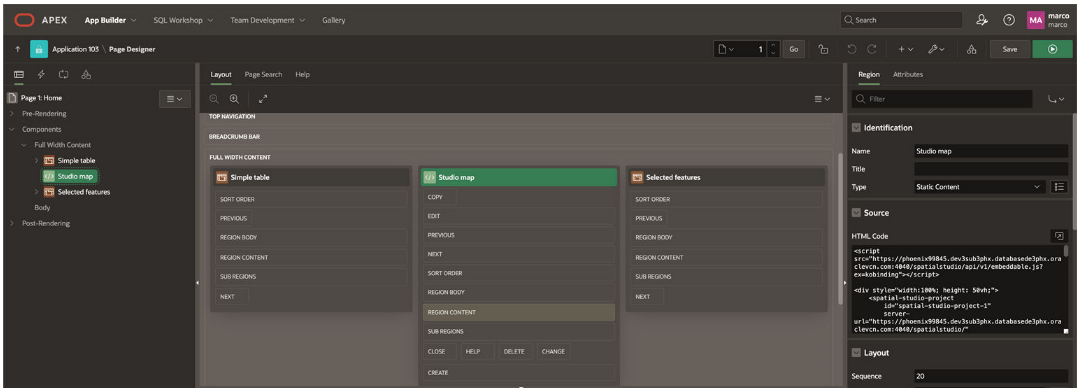
        --oj-core-spacing-3x: 0px;
        --ut-region-body-padding-y: 0px;
        --ut-region-body-padding-x: 0px;
    }

    div.sgtech-home-container {
        max-height: 100%;
    }
</style>
```

Since the APEX environment already has a `KnockoutJS` mechanism running, ensure to use the query parameter `?ex=kobinding` to exclude the own execution of `KnockoutJS`.

The following figure show the static content region wrapped with the preceding **HTML Code** in the APEX application.

Figure 7-1 Static Content Configuration



Name: Studio map
Title:
Type: Static Content

HTML Code:

```
<script
src="https://phoenix99845.dev3sub3phx.databasede3phx.ora
clevcn.com:4040/spatialstudio/api/v1/embeddable.js?
ex=kobinding"></script>

<div style="width:100%; height: 50vh;">
    <spatial-studio-project
        id="spatial-studio-project-1"
        server-
url="https://phoenix99845.dev3sub3phx.databasede3phx.ora
clevcn.com:4040/spatialstudio/"
```

Sequence: 20

4. Optionally, you can add an interactive code inside a script block next to the `<spatial-studio-project>` code for the same **Static Content** type region:

```
<script>
    const studioProjectElement = document.getElementById('spatial-studio-
project-1');

    studioProjectElement.addEventListener('features_selected', (event) =>
{
        const selectionObjects = event.detail.value;
        console.log(JSON.stringify(selectionObjects));
    }
</script>
```

5. Optionally, you can add a **Dynamic Action** to an Interactive Grid table with an executable JavaScript code.

   The following script shows an example to obtain the selected records from an interactive grid with id **TABLEREGION** and filter the corresponding features in the map.

```
const spatialStudioProjectElement = document.getElementById('spatial-
studio-project-1');

const grid =
apex.region('TABLEREGION').widget().interactiveGrid('getViews', 'grid');
const model = grid.model;
const selectedRecords = grid.getSelectedRecords();

const COLUMN_NAME = 'REP_NAME';
const LAYER_ID = 'c61ad9c582a8e173a83765e1ccb261fe';

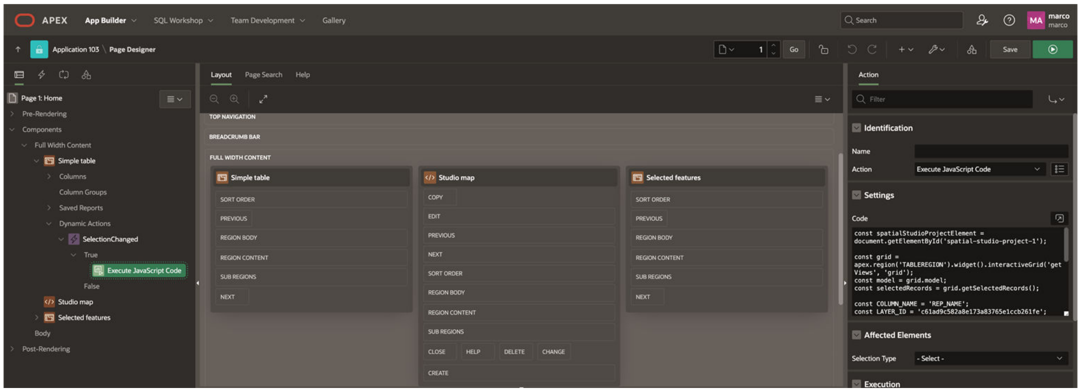
if (selectedRecords.length > 0){
    const selectedRepNames = selectedRecords.map(currentSelectedRecord => {
        return model.getValue(currentSelectedRecord, COLUMN_NAME)
    });

    const VALUES = selectedRepNames;

    spatialStudioProjectElement.filterFeatures(LAYER_ID, COLUMN_NAME,
VALUES);
} else {
    spatialStudioProjectElement.clearFilters &&
spatialStudioProjectElement.clearFilters(LAYER_ID);
}
```

The following figure show the preceding script JavaScript code wrapped to a Dynamic Action in the APEX application.

Figure 7-2   Dynamic Actions Configuration



Name

Action: Execute JavaScript Code

Code

```
const spatialStudioProjectElement =
document.getElementById('spatial-studio-project-1');

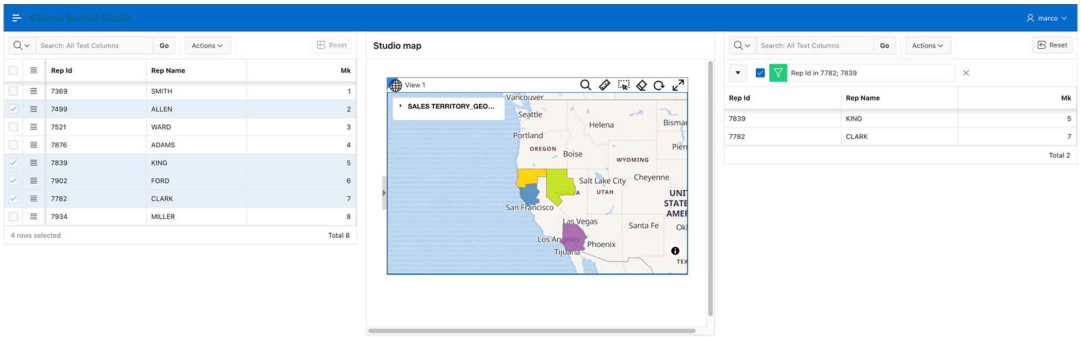
const grid =
apex.region('TABLEREGION').widget().interactiveGrid('get
Views', 'grid');
const model = grid.model;
const selectedRecords = grid.getSelectedRecords();

const COLUMN_NAME = 'REP_NAME';
const LAYER_ID = 'c61ad9c582a8e173a83765e1ccb261fe';
```

Selection Type: - Select -

The following figure show the resulting map visualization using the Spatial Studio web component in the APEX application.

Figure 7-3   Map Visualization in APEX



☐	Rep Id	Rep Name	Mk
☐	7369	SMITH	1
✓	7499	ALLEN	2
☐	7521	WARD	3
☐	7876	ADAMS	4
✓	7839	KING	5
✓	7902	FORD	6
✓	7782	CLARK	7
☐	7934	MILLER	8

4 rows selected   Total 8

☑ Rep Id in 7782; 7839

Rep Id	Rep Name	Mk
7839	KING	5
7782	CLARK	7

Total 2

8

Spatial Studio Accessibility Information

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

It includes the following.

- About Oracle Spatial Studio Accessibility
- Oracle Spatial Studio Features that Support Accessibility
- Highly Visual Features of Oracle Spatial Studio

8.1 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/`

8.2 Oracle Spatial Studio Features that Support Accessibility

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

- Keyboard Access with Spatial Studio
- Screen Reader Readability with Spatial Studio
- Flexibility in Font and Color Choices with Spatial Studio
- No Audio-only Feedback with Spatial Studio
- No Dependency on Blinking Cursor and Animation with Spatial Studio
- Screen Magnifier Usability with Spatial Studio

8.2.1 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.

8.2.2 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.

8.2.3 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.

8.2.4 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.

8.2.5 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.

8.2.6 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.

8.3 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

Spatial Studio OpenAPI Specification for the REST API Endpoints

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 all RESTful API end points of the Oracle 
Spatial Studio
    application.
  version: "1.0"
paths:
  /v1/plugins/resource/{pluginId}/{segment}:
    get:
      operationId: getResource
      parameters:
      - name: pluginId
        in: path
        required: true
        schema:
          type: string
      - name: segment
        in: path
        required: true
        schema:
          type: array
          items:
            type: object
            properties:
              path:
                type: string
              matrixParameters:
                type: object
                properties:
                  empty:
                    type: boolean
                additionalProperties:
                  type: array
                  items:
                    type: string
      responses:
        default:
          description: default response
          content:
            '*/*': {}
  /v1/object/{type}/{name}/metadata:
    get:
      operationId: getMetadata
      parameters:
      - name: type
        in: path
        required: true
        schema:
          type: string
      - name: name
        in: path
        required: true
        schema:
          type: string
      - name: scope
        in: query
        schema:
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /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/object_body_field/{type}/{id}:
    put:
      operationId: updateBodyField
      parameters:
      - name: type
```

```
          in: path
          required: true
          schema:
            type: string
        - name: id
          in: path
          required: true
          schema:
            type: string
        - name: name
          in: query
          schema:
            type: string
        - name: value
          in: query
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              '*/*': {}
    /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/systemStatus:
      get:
        operationId: getSystemStatus
        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/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/{typeString}:
      get:
        operationId: getSGTechSettings
        parameters:
        - name: typeString
          in: path
          required: true
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
    /v1/requirejsconfig.js:
      get:
        operationId: getRequireJSConfig
        responses:
          default:
            description: default response
```

```
          content:
            text/javascript:
              schema:
                type: string
  /v1/settings/test/elocationurl:
    post:
      operationId: testElocationURL
      parameters:
      - name: url
        in: query
        schema:
          type: string
      requestBody:
        content:
          '*/*':
            schema:
              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/header_fields/{id}:
    put:
      operationId: updateDomainObjectHeaderFields
      parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      requestBody:
        content:
          '*/*':
            schema:
              type: string
      responses:
```

```
      default:
        description: default response
        content:
          application/json: {}
/v1/contextPath:
  get:
    operationId: getApplicationContextPath
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/repository/connect:
  post:
    operationId: connectToMetaDataSchema
    requestBody:
      content:
        application/json:
          schema:
            type: object
            additionalProperties:
              type: object
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/object_body_fields/{type}/{id}/{csf}:
  get:
    operationId: getDomainObjectFields
    parameters:
    - name: type
      in: path
      required: true
      schema:
        type: string
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: csf
      in: path
      required: true
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/extensionpoints:
  get:
    operationId: getFronendExtensionPoints
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/repository/status:
  get:
    operationId: getMetaDataSchemaStatus
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/extensions:
  get:
    operationId: getFronendExtensions
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/acl/{id}:
  post:
    operationId: addOneAccess
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: user_id
      in: query
      schema:
        type: string
    - name: actions
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  delete:
    operationId: removeACL
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: user_id
      in: query
      schema:
        type: string
    - name: actions
      in: query
      schema:
            type: string
        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/{datasetId}/dbobject:
    post:
      operationId: createDBObject
      parameters:
      - name: datasetId
        in: path
        required: true
        schema:
          type: string
      requestBody:
```

```
      content:
        application/x-www-form-urlencoded:
          schema:
            type: object
            properties:
              objectName:
                type: string
              objectType:
                type: string
                enum:
                - TABLE
                - VIEW
              createDataset:
                type: boolean
              datasetName:
                type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/adhocdatasets/{datasetId}:
  patch:
    operationId: editAdhocDataset
    parameters:
    - name: datasetId
      in: path
      required: true
      schema:
        type: string
    requestBody:
      content:
        application/x-www-form-urlencoded:
          schema:
            type: object
            properties:
              query:
                type: string
              name:
                type: string
              description:
                type: string
                default: ""
              operator:
                type: string
              parameters:
                type: string
              datasetIds:
                type: string
              keyColumn:
                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: ""
              operator:
                type: string
              parameters:
                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/uploads/csvs/{uploadToken}/rows:
  get:
    operationId: getCSVRows
    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/cacheStats/roundtrip:
  get:
    operationId: getCoherenceRoundTripStats
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/cacheStats/summary:
  get:
    operationId: getCoherenceStatsSummary
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/cacheStats/details:
  get:
    operationId: getCoherenceStatsDetails
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/cesium/3dtileset/{doid}/{segment}:
  get:
    operationId: do3DTileset
    parameters:
    - name: doid
      in: path
      required: true
      schema:
        type: string
    - name: segment
      in: path
      required: true
      schema:
        type: array
        items:
          type: object
          properties:
            path:
              type: string
            matrixParameters:
              type: object
              properties:
                empty:
                  type: boolean
              additionalProperties:
                type: array
                items:
                  type: string
    responses:
      default:
        description: default response
        content:
          application/octet-stream: {}
/v1/cesium/czml/{doid}:
  get:
    operationId: doCZMLRequest
    parameters:
    - name: doid
      in: path
      required: true
      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}:
  get:
    operationId: getCesiumMapStyleObject
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  put:
    operationId: updateCesiumMapStyle
    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: deleteCesiumMapStyle
    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/cesium/czml/{doid}:
  get:
    operationId: doGetCZML
    parameters:
    - name: doid
      in: path
      required: true
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/public/cesium/3dtileset/{doid}/{segment}:
  get:
    operationId: doGetTileset
    parameters:
    - name: doid
      in: path
      required: true
      schema:
        type: string
    - name: segment
      in: path
      required: true
      schema:
        type: array
        items:
          type: object
          properties:
            path:
              type: string
            matrixParameters:
              type: object
              properties:
                empty:
                  type: boolean
              additionalProperties:
                type: array
                items:
                  type: string
    responses:
      default:
        description: default response
        content:
          application/octet-stream: {}
/v1/dataset_column_values/{datasetId}:
  get:
    operationId: getDatasetColumnValues
    parameters:
    - name: datasetId
      in: path
      required: true
      schema:
        type: string
    - name: columns
      in: query
      schema:
        type: string
    - name: filter
```

```
          in: query
          schema:
            type: string
        - name: maxRows
          in: query
          schema:
            type: integer
            format: int32
        - name: distinct
          in: query
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
    /v1/public/dataset_column_values/{datasetId}:
      get:
        operationId: getDatasetColumnValuesPublic
        parameters:
        - name: datasetId
          in: path
          required: true
          schema:
            type: string
        - name: columns
          in: query
          schema:
            type: string
        - name: filter
          in: query
          schema:
            type: string
        - name: maxRows
          in: query
          schema:
            type: integer
            format: int32
        - name: distinct
          in: query
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
    /v1/datasets/records/{id}:
      post:
        operationId: insertDatasetRow
        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: deleteDataSetTableRow
        parameters:
        - name: id
          in: path
          required: true
          schema:
            type: string
        requestBody:
          content:
            '*/*':
              schema:
                type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
      patch:
        operationId: patchDatasetRows
        parameters:
        - name: id
          in: path
          required: true
          schema:
            type: string
        requestBody:
          content:
            '*/*':
              schema:
                type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
    /v1/datasets/same_table_datasets/{id}:
      get:
        operationId: getSameTableDatasets
        parameters:
        - name: id
          in: path
          required: true
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
    /v1/datasets/spatiotemporal/{id}:
      get:
        operationId: getSpatioTemporalDescriptor
        parameters:
        - name: id
          in: path
          required: true
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
      post:
        operationId: activateSpatioTemporal
        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: deactivateSpatioTemporal
        parameters:
        - name: id
          in: path
          required: true
          schema:
            type: string
        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/columns/geom_col_metadata_status/{id}/{geomColumnId}:
      get:
        operationId: checkGeomColOrLLIndexedMetadata
        parameters:
        - name: id
          in: path
          required: true
          schema:
            type: string
        - name: geomColumnId
          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/columns/rectifygeometries/{id}:
    put:
      operationId: runSingleGeoColumnRectifyGeomtries
      parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: geoColumnId
        in: query
        schema:
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/datasets/columns/geovalidations/{id}:
    get:
      operationId: getGeoColumnsValidationResults
      parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: geoColumnId
        in: query
        schema:
          type: string
      - name: jetResponse
        in: query
        schema:
          type: boolean
      responses:
        default:
          description: default response
          content:
            application/json: {}
    put:
      operationId: runSingleGeoColumnValidations
      parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: geoColumnId
        in: query
        schema:
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
    delete:
      operationId: clearSingleGeoColumnValidations
      parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: geoColumnId
        in: query
        schema:
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/datasets/unique_constraint/exists/{id}:
    get:
      operationId: existsUniqueConstraint
      parameters:
      - name: id
        in: path
        required: true
```

```
          schema:
            type: string
        - name: columnNames
          in: query
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
  /v1/datasets/unique_constraint/{id}:
    put:
      operationId: createUniqueConstraint
      parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      - name: newColumnIds
        in: query
        schema:
          type: string
      - name: oldColumnIds
        in: query
        schema:
          type: string
      - name: setNotNullable
        in: query
        schema:
          type: boolean
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/datasets/body_fields/{id}:
    put:
      operationId: updateDatasetOrColumnBodyFields
      parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      requestBody:
        content:
          '*/*':
            schema:
              type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
```

```
/v1/datasets/columns_geotags/{id}:
  get:
    operationId: getColumnGeoTags
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  put:
    operationId: updateColumnGeoTags
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    requestBody:
      content:
        '*/*':
          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/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
      - name: reuse_bt_index
        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/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/valid_key_columns/{id}:
    get:
      operationId: validateKeyColumnNames
      parameters:
      - name: id
```

```
          in: path
          required: true
          schema:
            type: string
        - name: columns
          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/{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/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/row/{id}:
      delete:
        operationId: deleteDataSetRow
        parameters:
        - name: id
          in: path
          required: true
          schema:
            type: string
        - name: row_key
          in: query
          schema:
            type: string
        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:
      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
        requestBody:
          content:
            application/json:
              schema:
                type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
    /v1/datasets/batchdelete:
      delete:
        operationId: deleteDataSetBatch
        requestBody:
          content:
            '*/*':
              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/urlstatistics:
      get:
        operationId: getGeoJsonUrlStats
        parameters:
        - name: url
          in: query
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
    /v1/datasets/page/{id}:
      get:
        operationId: getDatasetRowPage
        parameters:
        - name: id
          in: path
          required: true
          schema:
            type: string
        - name: column
          in: query
          schema:
            type: string
        - name: value
          in: query
          schema:
            type: string
        - name: pageSize
          in: query
          schema:
            type: integer
            format: int32
        - name: sortCriteria
          in: query
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
```

```
/v1/datasets/{datasetId}/synonym/allowed:
  get:
    operationId: isSynonymAllowed
    parameters:
    - name: datasetId
      in: path
      required: true
      schema:
        type: string
    - name: synonymName
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/distinctvalues/{id}:
  get:
    operationId: getDistinctValues
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: column
      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/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
    - name: setAsKey
      in: query
      schema:
        type: boolean
    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/{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/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/migrate/{id}:
  put:
    operationId: migrateDataSource
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: uploadToken
      in: query
      schema:
        type: string
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    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/wallet/{walletId}/services:
  get:
    operationId: getWalletServices
    parameters:
    - name: walletId
      in: path
      required: true
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/enrichment/geocodefailedrows/{id}:
  put:
    operationId: geocodeDataSetFailedRows
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/enrichment/geocode/fix_ambiguous/{id}:
  post:
    operationId: fixSigleAmbiguousMatch
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: row_key
      in: query
      schema:
        type: string
    - name: selected_match
      in: query
      schema:
        type: integer
        format: int32
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/enrichment/reversegeocode/{id}:
  put:
    operationId: reverseGeocodeDataSet
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: datasourceid
      in: query
      schema:
```

```
                type: string
            - name: roadsonly
              in: query
              schema:
                type: boolean
            - name: geometrypoint
              in: query
              schema:
                type: string
            - name: latlonindex
              in: query
              schema:
                type: string
            - name: lat
              in: query
              schema:
                type: string
            - name: lon
              in: query
              schema:
                type: string
            requestBody:
              content:
                '*/*':
                  schema:
                    type: string
            responses:
              default:
                description: default response
                content:
                  application/json: {}
          delete:
            operationId: clearReverseGeocoding
            parameters:
            - name: id
              in: path
              required: true
              schema:
                type: string
            responses:
              default:
                description: default response
                content:
                  application/json: {}
        /v1/enrichment/{id}/tasks:
          get:
            operationId: getGeocodingTasksIds
            parameters:
            - name: id
              in: path
              required: true
              schema:
                type: string
            - name: taskStates
              in: query
              schema:
```

```
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/enrichment/geocode/temptable/{id}:
    delete:
      operationId: removeTempTable
      parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/enrichment/geocode/{id}:
    put:
      operationId: geocodeDataSet
      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: clearGeocoding
      parameters:
      - name: id
        in: path
        required: true
        schema:
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/enrichment/geocode/result/{id}:
    get:
      operationId: getGeocodedResults
      parameters:
```

```
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: resultType
      in: query
      schema:
        type: string
    - name: orderby
      in: query
      schema:
        type: string
    - name: offset
      in: query
      schema:
        type: integer
        format: int32
    - name: limit
      in: query
      schema:
        type: integer
        format: int32
    - name: totalResults
      in: query
      schema:
        type: boolean
    - name: jetResponse
      in: query
      schema:
        type: boolean
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/enrichment/geocode/fix/{id}:
  post:
    operationId: geocodeSingleItem
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: row_key
      in: query
      schema:
        type: string
    requestBody:
      content:
        '*/*':
          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/rt/{id}/{z}/{x}/{y}.png:
  get:
    operationId: streamRasterTile
    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
    - name: visualProperties
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          image/png: {}
/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/public/jsonstream/{id}:
  get:
    operationId: streamDatasetAsGeoJsonPublic
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: geo
      in: query
      schema:
        type: string
    - name: p
      in: query
      schema:
        type: string
    - name: filter
      in: query
      schema:
        type: string
    - name: vizType
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  post:
    operationId: streamDatasetAsGeoJsonPublic2
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: geo
      in: query
      schema:
        type: string
    - name: p
      in: query
      schema:
        type: string
    - name: vizType
      in: query
      schema:
        type: string
    requestBody:
      content:
        application/json:
          schema:
            type: string
    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
    - name: p
      in: query
      schema:
        type: string
    - name: filter
      in: query
      schema:
        type: string
    - name: vizType
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
  post:
    operationId: streamDatasetAsGeoJson2
    parameters:
    - name: id
      in: path
      required: true
      schema:
        type: string
    - name: geo
      in: query
      schema:
        type: string
    - name: p
      in: query
      schema:
        type: string
    - name: vizType
      in: query
      schema:
        type: string
    requestBody:
      content:
        application/json:
          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/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/enrichment/geotag/attributes:
      get:
        operationId: getGenFormAttributes
        parameters:
        - name: type
          in: query
          schema:
            type: string
            default: ""
        responses:
          default:
            description: default response
            content:
              application/json: {}
    /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/h3/{id}/{geo}/{name}:
      post:
        operationId: createHexAnalysis
        parameters:
        - name: id
          in: path
          required: true
          schema:
            type: string
        - name: geo
          in: path
          required: true
          schema:
            type: string
        - name: name
          in: path
          required: true
          schema:
            type: string
        - name: col
          in: query
          schema:
            type: string
        responses:
          default:
            description: default response
            content:
              application/json: {}
    /v1/uploads/kmls/{uploadToken}/rows:
      get:
        operationId: getKMLRows
        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/mvsuggest:
        get:
          operationId: getRequest
          responses:
            default:
              description: default response
              content:
                application/json: {}
        post:
          operationId: postRequest
          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/mapstyles/{id}:
        get:
          operationId: getMapStyleObject
          parameters:
          - name: id
            in: path
            required: true
            schema:
              type: string
          responses:
            default:
              description: default response
              content:
                application/json: {}
        put:
          operationId: updateMapStyle
```

```
    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: 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:
  get:
    operationId: getMapStyleList
    parameters:
    - name: fields
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/oauth2/authorize:
  get:
    operationId: doAuthorize
    parameters:
    - name: response_type
      in: query
      schema:
        type: string
    - name: client_id
      in: query
      schema:
        type: string
    - name: scope
      in: query
      schema:
        type: string
    - name: state
      in: query
      schema:
        type: string
    - name: redirect_uri
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/oauth2/token:
  post:
    operationId: doToken
    parameters:
    - name: Authorization
      in: header
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/ordsToken/{datasource}:
  get:
    operationId: getOrdsToken
    parameters:
    - name: datasource
      in: path
      required: true
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json:
            schema:
```

```
              type: string
/v1/datasets/polygon_operations:
  post:
    operationId: mergeSourcePolygonsAndInsertIntoTargetDataset
    parameters:
    - name: action
      in: query
      schema:
        type: string
    requestBody:
      content:
        '*/*':
          schema:
            type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/polygon_operations/columns_nullable/{datasetId}:
  get:
    operationId: getDatasetColumnNullableStatus
    parameters:
    - name: datasetId
      in: path
      required: true
      schema:
        type: string
    - name: tgtDSrcId
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/polygon_operations/validate/{key}:
  get:
    operationId: validateNewDatasetKey
    parameters:
    - name: key
      in: path
      required: true
      schema:
        type: string
    - name: tgtDSrcId
      in: query
      schema:
        type: string
    - name: tgtDsetId
      in: query
      schema:
        type: string
    - name: tgtKeyColId
      in: query
      schema:
        type: string
    - name: tgtGeomColId
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/datasets/polygon_operations/validatenewtable:
  get:
    operationId: validateNewTable
    parameters:
    - name: targetConnId
      in: query
      schema:
        type: string
    - name: newTableName
      in: query
      schema:
        type: string
    - name: newKeyColName
      in: query
      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/purge/{id}:
  delete:
    operationId: purgeVectorTileCache
    parameters:
    - name: id
```

```
      in: path
      required: true
      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: 15
    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:
  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/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/projects/analyze/{file_type}:
  get:
    operationId: analyzeUploadedProject
    parameters:
    - name: file_type
      in: path
      required: true
      schema:
        type: string
    - name: file_name
      in: query
      schema:
        type: string
    - name: upload_token
      in: query
      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/public/datasets/rows/{id}:
  get:
    operationId: getDatasetRows_1
    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/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/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/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/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/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/{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/{uploadToken}/charsets:
  get:
    operationId: getShapefileEncodingCharsets
    parameters:
    - name: uploadToken
      in: path
      required: true
      schema:
        type: string
    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/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
    - name: charset
      in: query
      schema:
        type: string
    responses:
      default:
        description: default response
        content:
          application/json: {}
/v1/uploads/spreadsheets/{uploadToken}/headersRow:
  get:
    operationId: getSpreadsheetHeaders
    parameters:
    - name: uploadToken
      in: path
      required: true
      schema:
        type: string
    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
    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: {}
  put:
    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/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/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/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/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:
  get:
    operationId: getTableNames
    parameters:
    - name: datasource
      in: query
      schema:
        type: string
    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: {}
    delete:
      operationId: abortTaskById
      parameters:
      - name: taskId
        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/cesiumtileset/{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/uploads/czml/{uploadToken}/stats:
    get:
      operationId: getCZMLDataStats
      parameters:
      - name: uploadToken
        in: path
        required: true
        schema:
          type: string
      - name: filename
        in: query
        schema:
          type: string
      - name: setCZMLDir
        in: query
        schema:
          type: boolean
      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/user/preferences:
    get:
      operationId: getUserPreferences
      responses:
        default:
          description: default response
          content:
            application/json: {}
    put:
      operationId: updateUserPreferences
      requestBody:
        content:
          application/json:
            schema:
              type: object
              additionalProperties:
                type: string
      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: {}
    post:
      operationId: createAccessToken
      parameters:
      - name: name
        in: query
        schema:
          type: string
      - name: validTime
        in: query
        schema:
          type: integer
          format: int64
      - name: scope
        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/user:
    get:
      operationId: getCurrentUser
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/user/invalidateSession:
    get:
      operationId: invalidateSession
      parameters:
      - name: redirectURL
        in: query
        schema:
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/user/logout:
    post:
      operationId: logout
      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: {}
  /v1/oac/datasets:
    get:
      operationId: getOACDatasetsNames
      parameters:
      - name: dataSourceId
        in: query
        schema:
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
    post:
      operationId: storeUploadedFileInDB_1
      requestBody:
        content:
          '*/*':
            schema:
              type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
  /v1/oac/datasets/{dataset}/stats:
    get:
      operationId: getOACDataset
      parameters:
      - name: dataset
        in: path
        required: true
        schema:
          type: string
      - name: dataSourceId
        in: query
        schema:
          type: string
      - name: offset
        in: query
        schema:
          type: integer
          format: int64
      - name: limit
        in: query
        schema:
          type: integer
          format: int64
      - name: importMode
        in: query
        schema:
          type: string
      responses:
        default:
          description: default response
          content:
            application/json: {}
```

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Vendor: The Apache Software Foundation

Version: 4.4.16

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logback-core

Vendor: QOS.ch

Version: 1.3.14

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Version 2.1, February 1999

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The full snowball package is available from
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analysis/common/src/java/org/apache/lucene/analysis/de/GermanLightStemmer.java
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jsdiff
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Version: 1.3.14

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Logback-classic:
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analysis/common/src/resources/org/apache/lucene/analysis/hi/stopwords.txt,
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analysis/common/src/java/org/apache/lucene/analysis/fi/FinnishLightStemmer.java
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analysis/common/src/java/org/apache/lucene/analysis/pt/PortugueseLightStemmer.java
analysis/common/src/java/org/apache/lucene/analysis/ru/RussianLightStemmer.java
analysis/common/src/java/org/apache/lucene/analysis/sv/SwedishLightStemmer.java

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Contains a portion of d3-color https://github.com/d3/d3-color

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protobuf-java

Vendor: Google

Version: 4.28.2

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SnakeYAML

Vendor: SnakeYAML.org

Version: 2.3

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slf4j-api

Vendor: QOS.ch

Version: 2.0.7

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Nimbus JOSE+JWT

Vendor: Connect2id

Version: 9.37.3

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Nimbus OAuth 2.0 SDK with OpenID Connect extensions

Vendor: Connect2id Ltd

Version: 11.10.1

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http://knockoutjs.com/

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### Knockout ES5 plugin

https://github.com/SteveSanderson/knockout-es5

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### topojson-client

https://github.com/topojson/topojson-client

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### mersenne-twister.js

https://gist.github.com/banksean/300494

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### NoSleep.js
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```
https://github.com/richtr/NoSleep.js

> NoSleep.js v0.5.0 - git.io/vfn01
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https://github.com/EricSmekens/jsep

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https://github.com/mapbox/earcut

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https://github.com/mourner/rbush

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https://github.com/BinomialLLC/basis_universal

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### KTX-Parse

https://github.com/donmccurdy/KTX-Parse/

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https://github.com/nodeca/pako

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### protobuf

https://github.com/dcodeIO/ProtoBuf.js

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https://github.com/cure53/DOMPurify

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### GraphemeSplitter

https://github.com/orling/grapheme-splitter

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https://github.com/dy/bitmap-sdf

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### URI.js

http://medialize.github.io/URI.js/

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===============================================================================

The initial code for shuffling an array (originally in class
"org.apache.commons.math3.random.RandomDataGenerator", now replaced by
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
available here:
  http://citeseerx.ist.psu.edu/viewdoc/download;?doi=10.1.1.173.1898&rep=rep1&type=pdf

===============================================================================
License statement for the direction numbers in the resource files for Sobol sequences.
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Quartz Job Scheduler

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Supercluster 3.0.2

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ajv 6.5.3

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lucene-backward-codecs

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core/src/java/org/apache/lucene/util/compress/LZ4.java is a Java implementation of the LZ4 (https://github.com/lz4/lz4/tree/dev/lib) compression format for Lucene's DataInput/DataOutput abstractions.

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The full snowball package is available from
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analysis/common/src/resources/org/apache/lucene/analysis/hi/stopwords.txt,
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See http://members.unine.ch/jacques.savoy/clef/index.html.

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mapbox-gl-rtl-text

Vendor: Mapbox

Version: 0.3.0

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port/cpl_float.cpp

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frmts/pdf/pdfdataset.cpp (method PDFiumRenderPageBitmap())

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Assignee: Esri.
Assignors/Inventors: Maurer, Thomas (Redlands, CA); Gao, Peng (Redlands, CA); Becker, Peter (Redlands, CA).

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