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**Base IMIS
Deployment Manual
(Linux Environment)**

Integrated Municipal Information System (IMIS)

Innovative Solution Pvt. Ltd (ISPL)

Base IMIS Deployment Manual

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Deploying Base IMIS on a server with the Linux operating system involves a series of steps and procedures. The steps mentioned below provide a guideline on the deployment process.

1. BASIC REQUIREMENTS

The deployment manual is based on the specific system requirements mentioned below and any deviations will require adjustments to the deployment process. The specific system requirements mentioned below are recommended to ensure a smooth and error-free deployment process. The web-application and database are recommended to be deployed and maintained in two separate servers of identical specifications. However, both the web application and database can be maintained on the same server with minor modification to the deployment process.

1.1 Server Requirements

The minimum server requirements recommended for the successful deployment and implementation of IMIS are mentioned below:

Operating System

The deployment of Base IMIS is carried out on a Linux Server running Ubuntu 22.04 LTS “Jammy Jellyfish”. This is the recommended server and operating system specifications.

Disk Space

The recommended minimum disk space for IMIS is 100 GB during the initial deployment. However, depending on the volume of the data and media files (images, GIS information, etc.) of the system, this requirement can be scaled up or scaled down as required.

RAM

The recommended minimum RAM is 8 GB during the initial deployment. However, depending on the size and complexity of the GIS data and spatial processing, expected traffic and number of users, this requirement can be further scaled up. Additionally, further scaling down the RAM is not recommended.

CPU

A minimum of 4 cores CPU is recommended for Base IMIS. However, depending on the size and complexity of the GIS data and spatial processing, expected traffic and number of users, this requirement can be further scaled up. Additionally, further scaling down the CPU cores is not recommended.

Network Bandwidth

A minimum network bandwidth of 100 Mbps speed with 500 GB to 1 TB monthly data transfer is recommended. However, depending on the number of users of the system and expected traffic, this requirement can be further scaled up or down as required.

1.2 Software Requirements

The software requirements for IMIS are mentioned below and its corresponding installation procedures are mentioned in sections below.

Web Server

The webserver recommended and currently used in this deployment manual is Nginx (V 1.22.0). However, the Apache web servers can also be used with modifications.

PHP

IMIS is developed using PHP version ≥ 8 . This is the recommended version of PHP and any upgrades/downgrades require modifications to both the deployment process and source code.

Database

IMIS is designed and developed with PostgreSQL (V 14) database. For GIS data storage and processing, the PostGIS extension (V3) is used.

Geoserver

IMIS currently uses Geoserver (V2.21.0) for rendering and displaying spatial data maintained in the system. This specific version of Geoserver is recommended to ensure bugs/issues do not arise in the system.

1.3 Deployment Engineer Requirements

The recommended skillset for the deployment engineer conducting the deployment of IMIS is mentioned below. These skillsets are critical to ensure smooth and error free deployment and maintenance of IMIS.

- Linux Server with Ubuntu OS
- Docker Container Concepts
- Docker-Compose tool for multi-container applications
- Networking concepts and Port configurations
- Firewall concepts and rules
- PostgreSQL

- PostGIS extension of PostgreSQL
- Geoserver
- Shell scripting knowledge

Apart from the deployment engineer, the minimum recommended skillset for the development/ maintenance team is mentioned below:

- PHP language
- Laravel Framework
- PostgreSQL
- PostGIS extension of PostgreSQL
- NPM package manager
- Git version control
- Geoserver
- JavaScript
- jQuery
- Open Layers (OL)
- Technical Documentation

2. SECURED SERVER SETUP

The following steps are recommended to be carried out to ensure the server is secure and protected from external access/ intrusions and disruptions.

2.1 User Access Management

The root user is not recommended to be used for the server setup. Hence, a new user must be created. To add a new user and grant them superuser privileges, these steps are to be followed:

```
# adduser <<username>>
```

If root access is not available:

```
# sudo adduser <<username>>
```

Password prompt is displayed. Re-type the password to confirm password. Then fill out the user information as prompted. Press "Y" to continue.

```
Changing the user information for laravel
Enter the new value, or press ENTER for the default
  Full Name []:
  Room Number []:
  Work Phone []:
  Home Phone []:
  Other []:
```

Add the user "<<username>>" to the "sudo" group to grant them superuser privileges:

```
usermod -aG sudo <<username>>
```

If root access is not available:

```
sudo usermod -aG sudo <<username>>
```

[Note: Ensure all commands are carried out through this user, as the docker build and docker compose commands require a UID and GID of 1000, which is assigned to the first user created in the OS]

2.2 Firewall Setup

To configure the firewall (ufw) to allow SSH connections:

See which applications are registered with ufw/firewall.

```
ufw app list
```

There should be "OpenSSH" in the list.

Allow OpenSSH through the firewall and enable the firewall.

[Note: Since the firewall blocks all connections except those explicitly allowed in the firewall rules, it is crucial to verify that the rules are accurate before enabling the firewall. Incorrect or missing rules could result in losing access to the server, so proceed with caution. For more information: [UFW Essentials guide.](#)]

```
ufw allow OpenSSH
```

```
ufw enable
```

Type Y and press ENTER to proceed. This will activate the firewall.

To check the status of the firewall and ensure that SSH connections are allowed, type:

```
ufw status
```

2.3 Secure SSH Setup

It is recommended to configure all servers used for the deployment of the IMIS to use secure SSH (Secure Shell) authentication for remote access and server management. To enhance security, password-based login should be disabled, and only SSH key-based authentication should be allowed. This approach reduces the risk of unauthorized access by relying on cryptographic key pairs, which are significantly more secure than traditional passwords, thereby safeguarding the system against brute-force attacks and other vulnerabilities.

2.4 SSL Setup

SSL is recommended to ensure data security and prevent attacks. To secure your application with SSL, an SSL certification is required with the following certificates:

- private.pem (private key)
- fullchain.pem (full certificate)

SSL is required for both the application and the geoserver as well, thus two SSL certificates are required for IMIS. Additionally, to implement SSL, the corresponding domain/sub-domain names are also required for the web application and geoserver, that

is mapped to the corresponding IP addresses of the servers. This procedure should be carried out at the end of the deployment process, after the deployment process is completed.

Configure Nginx for SSL in Docker

Modify Nginx configuration in Dockerfile to enable HTTPS. For more details refer to Annex: SSL Configuration in Docker section below.

Configure GeoServer to Use SSL

Configure GeoServer to use SSL; otherwise, it may create issues while displaying layers and styles. For more details refer to Annex: SSL Configuration in Geoserver below.

2.5 Data Backup Recommendation

The 3-tier backup strategy is recommended to ensure protection of data and ensure quick recovery in case of data loss. The 3-tier backup strategy is mentioned below:

Tier 1: Primary Backup (On-Site Daily Backup)

The Primary Backup is to be carried out daily, which is stored on-site (local server or external storage device). This provides quick access to the data for immediate recovery.

Tier 2: Secondary Backup (Off-site or Cloud Backup)

The Secondary Backup is to be carried out weekly, which is stored in a remote location or a separate cloud server. This protects the data from local disasters and data loss from main servers. This ensures a copy of the data is present even when the main server and primary backups are lost.

Tier 3: Tertiary Backup (Archival)

The Tertiary Backup is to be carried out monthly, which is stored in a highly secure and often offline or low-access environment. This enables long term retention of historical data, geo-redundancy of data and resilience against large scale incidents.

3. DOCKER SETUP

The Web-Application is deployed using Docker and its containerized approach. To manage multiple docker containers and their configurations, docker-compose has been implemented. The necessary steps to be followed to deploy the Web-Application are mentioned below. The docker image provided will automatically install the required software packages such as nginx server, PHP, Composer, Laravel, etc.

[Note: The web-application can also be deployed through the conventional process, however the docker approach is recommended to ensure a smooth deployment process.]

3.1 Docker Installation

First, update the existing list of packages:

```
sudo apt update
```

Next, install a few prerequisite packages which let `apt` use packages over HTTPS:

```
sudo apt install apt-transport-https ca-certificates curl software-properties-common
```

Download the GPG key and save it to a keyring file:

```
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /usr/share/keyrings/docker-archive-keyring.gpg
```

Add the Docker repository to APT sources:

```
echo "deb [arch=$(dpkg --print-architecture) signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
```

Update the existing list of packages again for the addition to be recognized:

```
sudo apt update
```

Make sure the Docker repo is being installed instead of the default Ubuntu repo:

```
sudo apt-cache policy docker-ce
```

A similar output will be shown, although the version number for Docker may be different:

Output of apt-cache policy docker-ce:

```
docker-ce:
```

```
Installed: (none)
```

```
Candidate: 5:24.0.5-1~ubuntu.22.04~jammy
```

```
Version table:
```

```
5:24.0.5-1~ubuntu.22.04~jammy 500
```

```
500 https://download.docker.com/linux/ubuntu jammy/stable amd64 Packages
```

```
5:24.0.4-1~ubuntu.22.04~jammy 500
```

```
500 https://download.docker.com/linux/ubuntu jammy/stable amd64 Packages
```

Notice that `docker-ce` is not installed, but the candidate for installation is from the Docker repository for Ubuntu 22.04 (`jammy`).

Finally, install Docker:

```
sudo apt install docker-ce
```

Docker should now be installed, the daemon started, and the process enabled to start on boot. Check that it's running:

```
sudo systemctl status docker
```

If the docker is inactive, start docker using following command:

```
sudo systemctl start docker
```

3.1.1 Sudo Access to Docker Group/User

To create the docker group and add the user:

Create a docker group.

```
sudo groupadd docker
```

Add the user to the docker group.

```
sudo usermod -aG docker {USER}
```

To ensure that group membership is re-evaluated, it's necessary to either log out and log back in, or use the following command:

```
su -s {USER}
```

Confirm that the user is now added to the docker group by typing:

```
groups
```

Add the user to the docker group.

```
sudo usermod -aG docker {username}
```

3.2 Docker Compose Installation

Use the following command to download:

```
mkdir -p ~/.docker/cli-plugins/
```

```
curl -SL https://github.com/docker/compose/releases/download/v2.3.3/docker-  
compose-linux-x86_64 -o ~/.docker/cli-plugins/docker-compose
```

Next, set the correct permissions so that the `docker compose` command is executable:

```
chmod +x ~/.docker/cli-plugins/docker-compose
```

To verify that the installation was successful, run:

```
docker compose version
```

[Note: For Docker Compose, use "docker compose" (spaces) in version 2 (recommended), while "docker-compose" (hyphens) was used in the deprecated version 1.]

A similar output will be shown:

```
Docker Compose version v2.3.3
```

Docker Compose is now successfully installed on the system. Refer to Annex 8.2 for the detailed overview of the Docker Folder.

In the next section, you'll see how to set up a `docker-compose.yml` file and get a containerized environment up and running with this tool.

3.3 Permission Issues Troubleshooting

Issue 1: Got permission denied while trying to connect to the Docker daemon socket at `unix:///var/run/docker.sock`: permission denied

Solution: Run the following command to give permission to `docker.sock` file:

```
sudo chmod 666 /var/run/docker.sock
```

Issue 2: WARNING: Error loading config file: `/home/user/.docker/config.json` - `stat /home/user/.docker/config.json: permission denied`

Solution: To fix this problem, either remove the `~/.docker/` directory (it is recreated automatically, but any custom settings are lost), or change its ownership and permissions using the following commands:

```
sudo chown "$USER":"$USER" /home/"$USER"/.docker -R
sudo chmod g+rwX "$HOME/.docker" -R
```

3.4 Docker Configuration – Template Repository

The docker configuration files are maintained in the GitHub organization's repository (`deployment_documentation.git`). The following steps should be followed to create a copy of the repository and set up the required configurations.

Navigate to the folder where the project files will be stored:

```
# cd /<<folder-location>> /imis/  
# cd /home/<<username>>/imis/
```

The provided repository contains docker configuration folders and files within the sub-directory named `docker_config`. **[Note: Please fork the repository while cloning.]**

Git clone or copy the docker compose image folder, use the following command:

```
# git clone https://github.com/<docker\_repo\_name>.git .
```

[Note: The period after the git clone URL clones the repository directly into the folder without creating a separate new folder]

It is recommended to have only the docker-config folders in the server, and remove the rest of the folders that are cloned from the `deployment_documentation` repository.

```
# rm -r deployment_manual  
# rm -r blank_database  
# rm -r geoserver_setup
```

The folder structure for the repository is provided in Annex Docker Folder Overview.

A few changes are required to the default configuration files, which are mentioned in the section Docker Configuration File Changes.

4. APPLICATION SETUP

4.1 Application Source Code

The application source code is also maintained in the same GitHub organization under the web-app repository. This source code must be cloned inside the “src” folder present in the Docker configuration template repository. This folder will contain the project files.

```
#cd docker_config/src
```

Create a new folder inside the src directory.

```
# mkdir base-imis
# cd base-imis
```

[Note: If a different folder name is set within the src directory for the project folder, it is necessary to update the docker-compose.yml file as well.]

Git pull the new repository into the "src/base-imis" folder.

```
# git clone https://github.com/<application\_repo\_name>.git .
```

[Note: The period after the git clone URL command clones the repository directly into the folder without creating a separate new folder]

Create the .env file by creating a copy of the existing example env file:

```
cp .env.example .env
```

Ensure the necessary changes are carried out to the variables set in the environment file. By default, the env file will not have the values set, but will have placeholders in the format [variable_name]. The values such as database connection and geoserver details are crucial and further explain in sections below.

4.2 Docker Configuration File Changes

The template provided in the repository is a ready-to-deploy configuration setup, however the different paths to different configurations are dependent on the server setup.

- i. Filename: docker-compose.yml

Under the volumes heading, update the name of the project folder. By default, the folder name is set as base-imis. This is required to be done on all the services, as this variable links the project folder with the docker container folder.

If SSL is present, ensure the ssl folder with the corresponding files are present inside the docker configuration folder and the corresponding path is correct.

Additionally, if the default ports are not being used, the corresponding updates must also be carried out.

ii. Filename: dockerfiles/nginx/default.conf

Under the server block, update the server_name variable as per the requirements. Also comment/uncomment the required server blocks as per the use of SSL.

Once the configuration files are updated to match the proper paths and parameters, building the project and keep it running using the following command:

```
# docker compose up -d --build (Docker Compose version 2)
# docker-compose up -d --build (Docker Compose version 1)
```

For Docker Compose, use "docker compose" (spaces) in version 2 (recommended), while "docker-compose" (hyphens) is used in the deprecated version 1.

[Note: Be sure to type the above command instead of copying it, as copying might not register hyphens properly. There is a double hyphen before "build."]

4.3 Dependency Installation

Install Composer dependencies:

```
# docker compose run --rm composer install
```

If a problem arises in the lock file, grant permission.

```
# chmod -R 777 composer.lock
```

If dependency issues arise, run the command below to help get dependencies installed without modification; however, it should be used with caution.

```
# docker compose run --rm composer install --ignore-platform-reqs
```

Install the JavaScript dependencies specified in the package.json file by executing

```
# docker compose run --rm npm install
```

This command runs the npm run watch command inside the Docker container:

```
# docker compose run --rm npm run watch
```

[Note: A frequent issue that can arise is the following during the npm run watch command: Module not found: Error: Package path ./swiper-bundle.min.js is not exported from package /var/www/html/imis/node_modules/swiper. To solve this issue, go to /project_folder/src/base-imis/node_modules/swiper/package.json, and add the line "./swiper-bundle.min.js": "./swiper-bundle.min.js", to the “exports” section of this file.]

After installing the dependencies, you need to set the proper permissions on the files.

```
# chmod -R 777 storage
```

Then generate the app key.

```
# docker compose run --rm artisan key:generate
```

Cache configuration:

```
# docker compose run --rm artisan config:cache  
# docker compose run --rm artisan route:cache  
# docker compose run --rm artisan view:cache
```

Or run optimize:clear

```
#docker compose run --rm artisan optimize:clear
```

4.4 Folder Setup

Two folders need to be created manually to store building survey KML files sent via mobile application and the emptying receipts and house images as well. They can be done by running the following commands:

```
# cd into project file  
# cd storage/app/public  
# mkdir building-survey-kml
```

```
# mkdir emptyings  
# cd emptyings  
# mkdir houses  
# mkdir receipts
```

Then, provide the following permissions to enable write access:

```
# cd storage/app/public  
# chmod -R 777 building-survey-kml  
# chmod -R 777 emptyings
```

Go to Annex 7.4 for git commands that could be useful for the maintenance process and Annex 7.5 for useful Laravel commands.

5. DATABASE SETUP

The database setup and geoserver setup is recommended to be carried out on a different server than the application server. Follow the same steps mentioned in Section 2 regarding the secured setup of the server.

5.1 Postgres Installation

PostgreSQL VERSION = 14

Enable port 5432 of the server:

```
sudo ufw allow 5432
```

To install PostgreSQL, first refresh the server's local package index:

```
sudo apt update
```

Check which version of postgres is available in default repositories.

```
sudo apt-cache search postgresql | grep postgresql
```

Then, install the Postgres package along with a -contrib package that adds some additional utilities and functionality:

```
sudo apt install postgresql-14 postgresql-contrib
```

Press Y when prompted to confirm installation. Press Enter to accept any defaults to continue if prompted to restart any services. On successful installation, the PostgreSQL service starts automatically and can be verified as below.

```
systemctl status postgresql
```

5.2 User and Permission Management

After installing and ensuring PostgreSQL is running, create a user and a dB, and grant permissions of the dB to the user.

Connect to the PostgreSQL instance as the postgres user:

```
sudo -u postgres psql
```

Create a database in the postgresql terminal:

```
create database [database_name];
```

Create a user with encrypted password for postgresql:

```
create user [user_name] with password 'mypass';
```

Grant the created user permissions on the database:

```
grant all privileges on database [database_name] to [user_name];
```

[Note: The username and db name are taken in small letters. testDB changes into mydatabase and myUser turns into myuser]

To exit from PostgreSQL instance as the postgres user type:

```
\q
```

5.3 PostgreSQL Configuration

Configure PostgreSQL in postgresql.conf file which is generally location in: /etc/postgresql/\${VERSION}/main/postgresql.conf

PostgreSQL VERSION in use = 14

To open the file use nano command: (If root access is not available use sudo command)

```
cd /etc/postgresql/14/main/  
nano postgresql.conf  
  
OR
```

```
nano /etc/postgresql/14/main/postgresql.conf
```

Uncomment the following line in the postgresql.conf file:

```
listen_addresses = 'localhost'
```

and change it to:

```
listen_addresses = '*'
```

Open the pg_hba.conf file and add the following line to the end of the file: (Generally file location is: /etc/postgresql/\${VERSION}/main/pg_hba.conf)

To open the file use nano command: (If root access is not available use sudo command)

```
cd /etc/postgresql/14/main
nano pg_hba.conf
OR
nano /etc/postgresql/14/main/pg_hba.conf
```

Add the following line to the end of the file:

```
host    all         all         server_ip/32    md5
```

Replace server_ip with the IPv4 address of the web application server and database server as well.

Once these steps are completed, the user will have full access to the database.

5.4 PostGIS Extension Installation

The PostGIS Extension is required for spatial data processing and analysis.

Install the extension (postgis-V3):

```
sudo apt install postgis postgresql-14-postgis-3
```

Then create an extension in db either through the pgAdmin interface or run the following command in the postgres command line:

```
sudo -u postgres psql (postgres command line)

\connect base_imis

CREATE EXTENSION postgis;
```

Check if the extension has been installed successfully:

```
SELECT PostGIS_version();
```

Restart the PostgreSQL service:

```
systemctl restart postgresql
```

5.5 Blank Database Import

A blank database of the IMIS is maintained in the GitHub organization under the repository `deployment_documentation`. This blank database is imported into PostgreSQL through pgAdmin. The database server (PostgreSQL) must be connected through pgAdmin initially: For the steps refer to Section [Connect to db through pgadmin](#).

5.5.1 Importing Blank Database

- Step 1 :** Download the blank database from the GitHub repository.
- Step 2 :** Open pgAdmin and connect to your PostgreSQL server.
- Step 3 :** Navigate to your server's "Databases" folder.
- Step 4 :** First enable the PostGIS extension by running the following query in pgAdmin: `CREATE extension postgis;`
- Step 5 :** Then, right-click on the target database where you want to import the schema and data, and then select "Restore..." from the context menu.
- Step 6 :** Under the "Format" section, choose "Custom or Tar" from the dropdown menu. This format allows you to import both schema and data together. Browse the file by clicking on the "..." button in the "Filename" field.
- Step 7 :** Select the correct format of the file you are restoring, dump or backup.
- Step 8 :** Go to "Data Options" tab, under the "Do not save" section, check the box labeled "Owner".
- Step 9 :** Click "Restore".
- Step 10 :** If prompted, enter the password for the database superuser.

Step 11 : Update the .env file in the web-application server with the corresponding values of the database, such as database name, credentials, etc.

The restoration process will start, and pgAdmin will import the schema and data into the target database. The time it takes to complete depends on the size of the database dump. Explore the tables and other database objects to verify that the schema and data have been imported.

Note: When restoring a PostgreSQL database, permission issues could arise if the original owner specified in the backup does not exist on the target system. To overcome this issue, Exclude Ownership Restoration as mentioned in. This corresponds to the `-no-owner`` flag, telling pgAdmin not to set ownership of the objects to the original user from the backup.

Once the blank database has been successfully imported, ensure the necessary changes are reflected in the .env file of the application server.

DB_HOST=<database_server_ip>

DB_PORT=5432

DB_DATABASE=<database_name>

DB_USERNAME=<database_username>

DB_PASSWORD=<database_password>

5.6 Database Seeder

The default look-up values for various dropdowns and default roles, permissions and user access can be setup through the seeder. Run the database seeder command:

```
docker-compose run --rm db:seed
```

5.7 Importing Data into IMIS

The blank database provided does not contain any data apart from the look up values updated through the seeder. The initial dataset obtained from the survey must be cleaned and processed into individual SQL dump files, that follows the naming standards and data types as mentioned in the data dictionary. The table names, field names and data types must exactly match the data dictionary/ database.

5.7.1 Data Importing Sequence

As the IMIS is developed based on a relational database, the import sequence of the datasets must be followed strictly to ensure that there are no issues during the importing process. The import sequence is provided below:

S.N.	Schema Name	Table Name	Type
1	layer_info	citypolys	spatial
2	layer_info	landuses	spatial
3	layer_info	waterbodys	spatial
4	layer_info	wardboundary	spatial
5	layer_info	grids	spatial
6	layer_info	wards	spatial
7	layer_info	ward_overlay	spatial
8	layer_info	sanitation_system	spatial
9	utility_info	roads	spatial
10	utility_info	water_supplys	spatial
11	fsm	treatment_plants	spatial
12	utility_info	sewers	spatial
13	utility_info	drains	spatial
14	layer_info	places	spatial
15	layer_info	low_income_communities	spatial
16	building_info	buildings	Spatial
17	fsm	containments	Spatial
18	building_info	build_contains	Non-Spatial
19	building_info	owners	Non-Spatial
20	fsm	toilets	Spatial

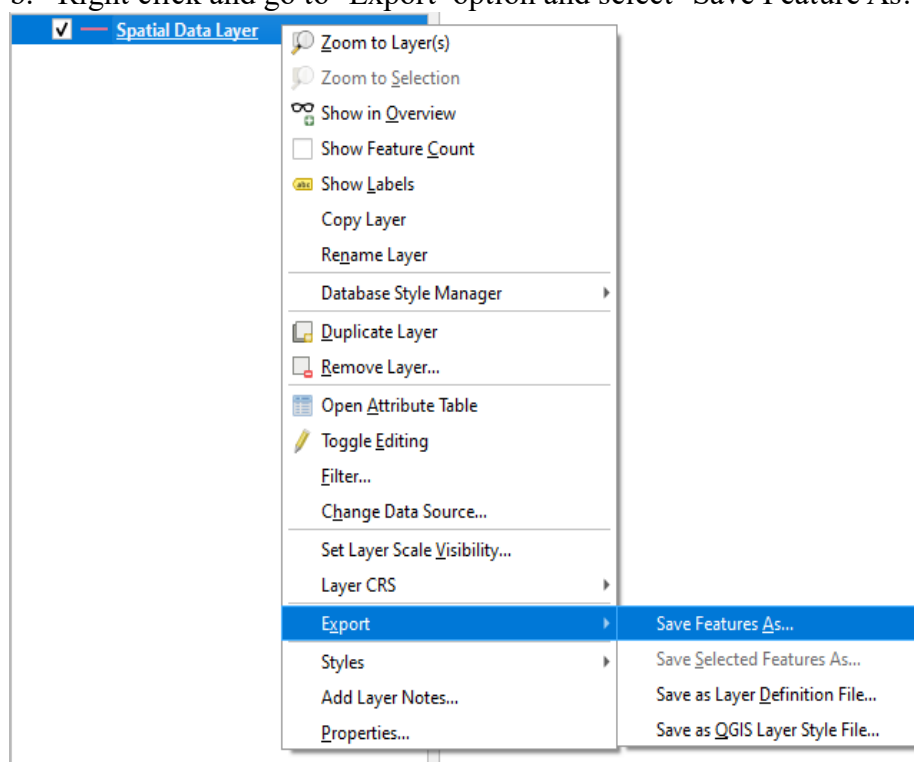
21	fsm	build_toilets	Non-Spatial
----	-----	---------------	-------------

5.7.2 Importing Spatial Data

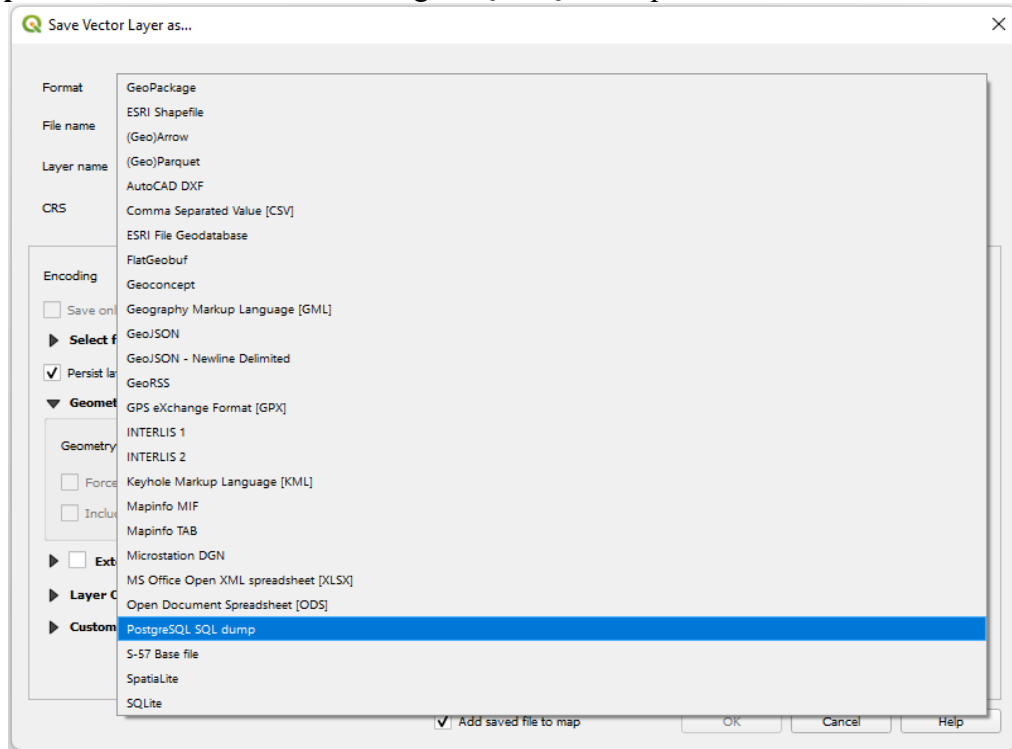
To import any table, follow the data dictionary and prepare data layers in QGIS with proper column name then import data into PostgreSQL database.

Step 1 : Data Preparation: Create PostgreSQL SQL Dump file (repeat the same process for all the spatial data), ensure the table name, field names and data formats matches exactly with the data dictionary/database.

- Select the 'Spatial data Layer' with all the required attributes (following the data dictionary)
- Right click and go to 'Export' option and select 'Save Feature As...'



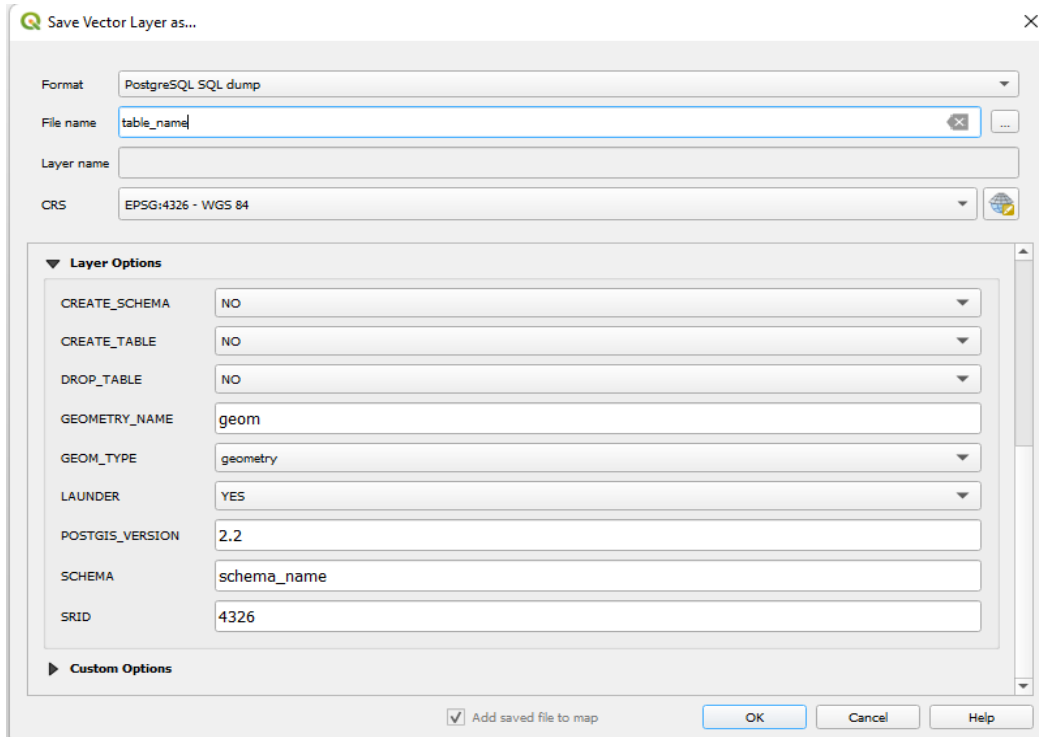
Step 2 : Select the format: 'PostgreSQL SQL Dump'



- a. Select File Location and Give filename same as Table Name.
Example: for table roads:



- b. In Layer Options:
 - i. CREATE_SCHEMA: NO
 - ii. CREATE_TABLE: NO
 - iii. DROP_TABLE: NO
 - iv. GEOMETRY_TYPE: GEOM
 - v. SCHEMA: SCHEMA_NAME
 - vi. SRID: 4326



Save Vector Layer as...

Format: PostgreSQL SQL dump

File name: table_name

Layer name:

CRS: EPSG:4326 - WGS 84

Layer Options

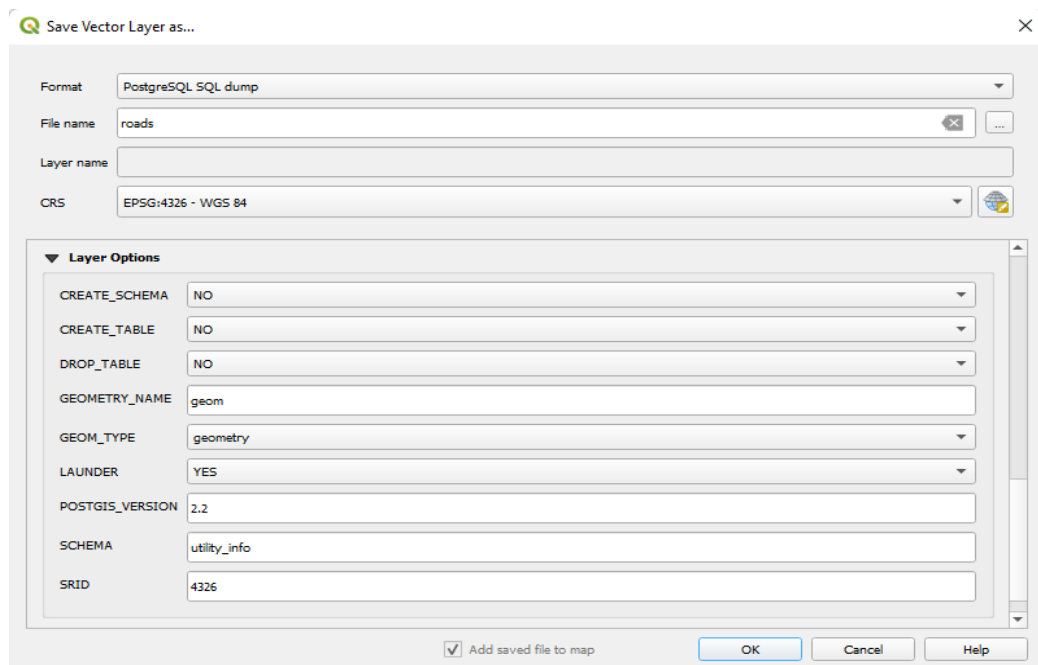
CREATE_SCHEMA	NO
CREATE_TABLE	NO
DROP_TABLE	NO
GEOMETRY_NAME	geom
GEOM_TYPE	geometry
LAUNDER	YES
POSTGIS_VERSION	2.2
SCHEMA	schema_name
SRID	4326

Custom Options

☒ Add saved file to map

OK Cancel Help

c. In Layer Options: For Table 'roads'



Save Vector Layer as...

Format: PostgreSQL SQL dump

File name: roads

Layer name:

CRS: EPSG:4326 - WGS 84

Layer Options


CREATE_SCHEMA	NO
CREATE_TABLE	NO
DROP_TABLE	NO
GEOMETRY_NAME	geom
GEOM_TYPE	geometry
LAUNDER	YES
POSTGIS_VERSION	2.2
SCHEMA	utility_info
SRID	4326

Custom Options

☒ Add saved file to map

OK Cancel Help

Step 3 : Import into database via Pg-Admin.

- Open Pg-Admin.
- Open/Connect to Database
- Right click and open the Query Tool.
- Click on 'Open file' icon  and select the exported SQL Dump File.
- Click on 'Run' Button and execute the commands.

- f. Check if all the data has been imported or not.

5.7.3 Importing Non-Spatial / CSV Data

- Step 1 :** Launch pgAdmin and connect to your PostgreSQL database server.
- Step 2 :** Right-click on the table where you want to import the CSV data.
- Step 3 :** Select 'Import Data' from the right-click menu.
- Step 4 :** In Filename option, navigate to your CSV file's location and select the file.
- Step 5 :** Choose CSV from the format options.
- Step 6 :** If the CSV file has column headers in the first row, check the Header box.
- Step 7 :** Click OK to start the import process.

5.8 Build and Triggers Functions Setup

Functions and Triggers are used in IMIS to automate and streamline database operations that perform specific tasks within the database, such as updating counts in real-time, supporting map tools, and import modules. Triggers are used in IMIS to automatically execute predefined actions in the database, such as updating counts maintaining data consistency, whenever data insertions occur, without manual intervention. This setup improves overall performance by executing predefined actions efficiently, making the system responsive.

Run the following commands to build all the necessary functions and triggers required for the system to function correctly:

Creates Functions and triggers to update count for grids & wards and summarychart

```
docker-compose run --rm artisan buildfunction:updatecount
```

Creates or replace (Or Delete and create) maptool queries if not exists functions

```
docker-compose run --rm artisan buildfunction:maptool
```

Creates Functions to create table when new data is imported for tax payment, watersupply and swmpayment:

```
docker-compose run --rm artisan buildfunction:tax
```

```
docker-compose run --rm artisan buildfunction:watersupply
```

```
docker-compose run --rm artisan buildfunction:swmpayment
```

Create quarters data for FSM KPI dashboards.

```
docker-compose run --rm artisan kpi:cron
```

When importing data in bulk or during the initial setup, it's recommended to disable the trigger, update the count manually, and then re-enable the trigger to ensure accurate data processing without unnecessary overhead during the import process.

5.9 Summary Data Count Update

After importing data, you need to update the count in the summary tables manually, but once the system is up and running, a trigger will automatically update the count each time new data is added.

To update grids & wards count when buildings have changes

```
docker-compose run --rm artisan updatecount:buildings
```

To update grids & wards count when fsm.containments has changes

```
docker-compose run --rm artisan updatecount:containments
```

To update grids & wards count when utility_info.roads has changes

```
docker-compose run --rm artisan updatecount:roadlines
```

To update grids & wards count when fsm.applications has changes

```
docker-compose run --rm artisan updatecount:applications
```

6. GEOSERVER SETUP

6.1 JAVA (openjdk v "11.0.15") Installation

Update the package list:

```
sudo apt update
```

Check if Java is already installed:

```
java -version
```

Install the default Java Runtime Environment (JRE), which will install the JRE from OpenJDK 11:

```
sudo apt install openjdk-11-jre
```

Check if Java is installed:

```
java -version
```

6.2 Tomcat Installation

For security purposes, Tomcat should run under a separate, unprivileged user. Run the following command to create a user called tomcat:

```
sudo useradd -m -d /opt/tomcat -U -s /bin/false tomcat
```

By supplying `/bin/false` as the user's default shell, you ensure that it's not possible to login as tomcat.

Navigate to the `/tmp` directory:

```
cd /tmp
```

Download the archive using `wget` by running the following command:

```
VERSION=9.0.64
```

```
wget https://archive.apache.org/dist/tomcat/tomcat-9/v9.0.64/bin/apache-tomcat-9.0.64.tar.gz
```

Extract the archive you downloaded by running:

```
sudo tar xzvf apache-tomcat-9.0.64.tar.gz -C /opt/tomcat --strip-components=1
```

Now grant tomcat ownership over the extracted installation by running:

```
sudo chown -R tomcat:tomcat /opt/tomcat/
```

```
sudo chmod -R u+x /opt/tomcat/bin
```

[Note: Why not using Tomcat 10+? Tomcat 10.x which is based off Servlet API version 5.0 which in turn is part of Jakarta EE version 9. The `javax.*` package has been renamed to `jakarta.*` package since Jakarta EE version 9. This thus means

that the deployed web application is actually not compatible with Jakarta EE version 9. Geoserver is based on the older JEE version where the javax.* package is still used.]

6.3 Systemd Service Setup

The systemd service that will be created will keep Tomcat quietly running in the background. The systemd service will also restart Tomcat automatically in case of an error or failure.

Tomcat, being a Java application itself, requires the Java runtime to be present, which is installed with the JDK in step 1. Before the service is created, the location of Java is required:

```
sudo update-java-alternatives -l
```

Output

```
java-1.11.0-openjdk-amd64    1111    /usr/lib/jvm/java-1.11.0-openjdk-amd64
```

Note the path where Java resides, listed in the last column, which will be required to define the service.

The tomcat service is placed in a file name tomcat.service, under /etc/systemd/system. Create the file for editing by running:

```
sudo nano /etc/systemd/system/tomcat.service
```

Add the following lines:

```
[Unit]
Description=Tomcat
After=network.target

[Service]
Type=forking

User=tomcat
Group=tomcat

Environment="JAVA_HOME=/usr/lib/jvm/java-1.11.0-openjdk-amd64"
Environment="JAVA_OPTS=-Djava.security.egd=file:///dev/urandom"
```



```
Environment="CATALINA_BASE=/opt/tomcat"
Environment="CATALINA_HOME=/opt/tomcat"
Environment="CATALINA_PID=/opt/tomcat/temp/tomcat.pid"
Environment="CATALINA_OPTS=-Xms512M -Xmx1024M -server -
XX:+UseParallelGC"

ExecStart=/opt/tomcat/bin/startup.sh
ExecStop=/opt/tomcat/bin/shutdown.sh

RestartSec=10
Restart=always

[Install]
WantedBy=multi-user.target
```

Here, the defined service will run Tomcat by executing the startup and shutdown scripts it provides. A few environment variables are also set to define its home directory (which is /opt/tomcat as before) and limit the amount of memory that the Java VM can allocate (in CATALINA_OPTS). Upon failure, the Tomcat service will restart automatically.

Reload the systemd daemon so that it becomes aware of the new service:

```
sudo systemctl daemon-reload
```

To enable Tomcat starting up with the system, run the following command:

```
sudo systemctl enable tomcat
```

Start the Tomcat service by typing:

```
sudo systemctl start tomcat
```

Look at its status to confirm that it started successfully:

```
sudo systemctl status tomcat
```

6.4 Web Interface Access

Tomcat uses port 8080 to accept HTTP requests. Run the following command to allow traffic to that port:

```
sudo ufw allow 8080
```

Access Tomcat by navigating to the IP address of the server:

```
http://your_server_ip:8080
```

6.5 Geoserver (2.21.0) Installation

Navigate to the /tmp directory:

```
cd /tmp
```

Download Geoserver package:

```
VERSION = 2.21.0
```

```
wget https://sourceforge.net/projects/geoserver/files/GeoServer/2.21.0/geoserver-2.21.0-war.zip/download
```

A file named “download” will be downloaded.

Rename the download file to geoserver:

```
mv download geoserver
```

Install ‘unzip’

```
sudo apt install unzip
```

Unzip the downloaded file:

```
unzip geoserver -d geoserver-2.21.0
```

Go into the folder:

```
cd geoserver-2.21.0
```

There should be a geoserver.war file inside this directory. Move the geoserver.war file into /opt/tomcat/webapps folder. After moving this file, there should be a geoserver folder automatically created in the /opt/tomcat/webapps directory.

```
mv geoserver.war /opt/tomcat/webapps/
```

Change the owner of the folder to tomcat:

```
sudo chown -R tomcat:tomcat /opt/tomcat/
```

Restart tomcat:

```
sudo systemctl restart tomcat
```

6.6 Geoserver Interface Access

Access Tomcat by navigating to the IP address of the server:

```
http://your_server_ip:8080/geoserver/web
```

[Note: CORS error (Access to image at '##' from origin '##' has been blocked by CORS policy: No 'Access-Control-Allow-Origin' header is present on the requested resource.) can arise. If such error arises, uncomment the following lines of code in the file web.xml (located at: /tomcat/webapps/geoserver/WEB-INF/):

Go into the folder:

```
sudo nano /opt/tomcat/webapps/geoserver/WEB-INF/web.xml
```

Uncomment the following lines of code:

```
<filter>
<filter-name>cross-origin</filter-name>
<filter-class>org.apache.catalina.filters.CorsFilter</filter-class>
<init-param>
<param-name>cors.allowed.origins </param-name>
<param-value>*</param-value>
</init-param>
```

```
<init-param>
<param-name>cors.allowed.methods</param-name>
<param-value>GET,POST,PUT,DELETE,HEAD,OPTIONS</param-value>
</init-param>
<init-param>
<param-name>cors.allowed.headers</param-name>
<param-value>*</param-value> </init-param>
</filter>
<filter-mapping>

<filter-name>Set Character Encoding</filter-name>
<url-pattern>/*</url-pattern>
</filter-mapping>
```

Restart the tomcat service:

```
sudo systemctl restart tomcat
```

6.7 Geoserver Extensions

Extensions are modules that add functionality to GeoServer. To install a GeoServer extension, download the extensions, select the version of GeoServer that is used and extract them into the WEB-INF/lib of the GeoServer webapp. There are few required geoserver Extensions for IMIS that are mentioned below.

[**Note:** The current Geoserver VERSION in use: 2.21.0]

6.7.1 Authkey Extension

The authkey module for GeoServer allows for a very simple authentication protocol designed for OGC clients that cannot handle any kind of security protocol. For these clients the module allows a minimal form of authentication by appending a unique key in the URL that is used as the sole authentication token. The process of generating an AuthKey is explained in Section: Configuring Authkey in Geoserver

A sample authenticated request looks like:

```
http://localhost:8080/geoserver/topp/wms?service=WMS&version=1.3.0&request=
GetCapabilities&authkey=authkeyhereauthjeyhere
```

Navigate to the /tmp directory:

```
cd /tmp
```

Download the plugin:

```
wget
https://sourceforge.net/projects/geoserver/files/GeoServer/2.21.0/extensions/geoser
ver-2.21.0-authkey-plugin.zip/download
```

Rename downloaded file “download” to “geoserver-cssr”:

```
mv download geoserver-authkey
```

Unzip the file:

```
unzip geoserver-authkey -d geoserver-2.21.0-authkey
```

6.7.2 CSS Extension

The CSS extension module allows to build map styles using a compact, expressive styling language already well known to most web developers: Cascading Style Sheets. CSS is not a part of GeoServer by default but is available as an extension. The CSS extension uses a CSS-derived language instead of SLD.

After successful installation, a new CSS entry appears in the Styles editor.

Navigate to the /tmp directory:

```
cd /tmp
```

Download extension:

```
wget
https://sourceforge.net/projects/geoserver/files/GeoServer/2.21.0/extensions/geoser
ver-2.21.0-css-plugin.zip/download
```

Rename downloaded file “download” to “geoserver-css”:

```
mv download geoserver-css
```

Unzip the file:

```
unzip geoserver-css -d geoserver-2.21.0-css
```

6.7.3 Printing Extension

The printing module allows easy hosting of the Mapfish printing service within a GeoServer instance. The Mapfish printing module provides an HTTP API for printing that is useful within JavaScript mapping applications. User interface components for interacting with the print service are available from the Mapfish and GeoExt projects.

On the first startup after installation, GeoServer should create a print module configuration file in `GEOSERVER_DATA_DIR/printing/config.yaml`. Checking for this file's existence is a quick way to verify the module is installed properly.

Navigate to the `/tmp` directory:

```
cd /tmp
```

Download extension:

```
wget  
https://sourceforge.net/projects/geoserver/files/GeoServer/2.21.0/extensions/geoserver-2.21.0-printing-plugin.zip/download
```

Rename downloaded file “download” to “geoserver-querylayer”:

```
mv download geoserver-printing
```

Unzip the file:

```
unzip geoserver-printing -d geoserver-2.21.0-printing
```

6.7.4 Querylayer Extension

Normally, GeoServer operation allows a filter to be applied on each layer in isolation, based on its attribute and external information (geometry, values) provided by the user. Cross layer filtering is instead the ability to select features from one layer that bear some relationship with features coming from another layer.

The querylayer extension provides three new filter functions namely: querySingle, queryCollection, and collectGeometries, which allows Cross layer filtering. These filter functions can be used directly in CQL filters, OGC filters and SLD, meaning they are available both from WMS and WFS. In IMIS, the querylayer filter functions are used in Map Export Tools.

Download extension:

```
wget  
https://sourceforge.net/projects/geoserver/files/GeoServer/2.21.0/extensions/geoser  
ver-2.21.0-querylayer-plugin.zip/download
```

Rename downloaded file “download” to “geoserver-querylayer”:

```
mv download geoserver-querylayer
```

Unzip the file:

```
unzip geoserver-querylayer -d geoserver-2.21.0-querylayer
```

6.7.5 Installing the Extracted Plugins

Once all the plugins have been unzipped, copy all the extracted plugins into the following folder: (includes all the files and folders from auth, css, printing, and querylayer).

[Note: Extract the contents of the archive into the WEB-INF/lib directory in GeoServer. Make sure you do not create any sub-directories during the extraction process.]

```
cp -r geoserver-2.21.0-{authkey,css,printing,querylayer}/*  
/opt/tomcat/webapps/geoserver/WEB-INF/lib
```

Restart the tomcat service for the extensions to load:

```
sudo systemctl restart tomcat
```

Change the default password of the geoserver to a more secured password:

Default:
Username: admin
Password: geoserver

6.8 Workspace, Stores, Layers and Styles Setup

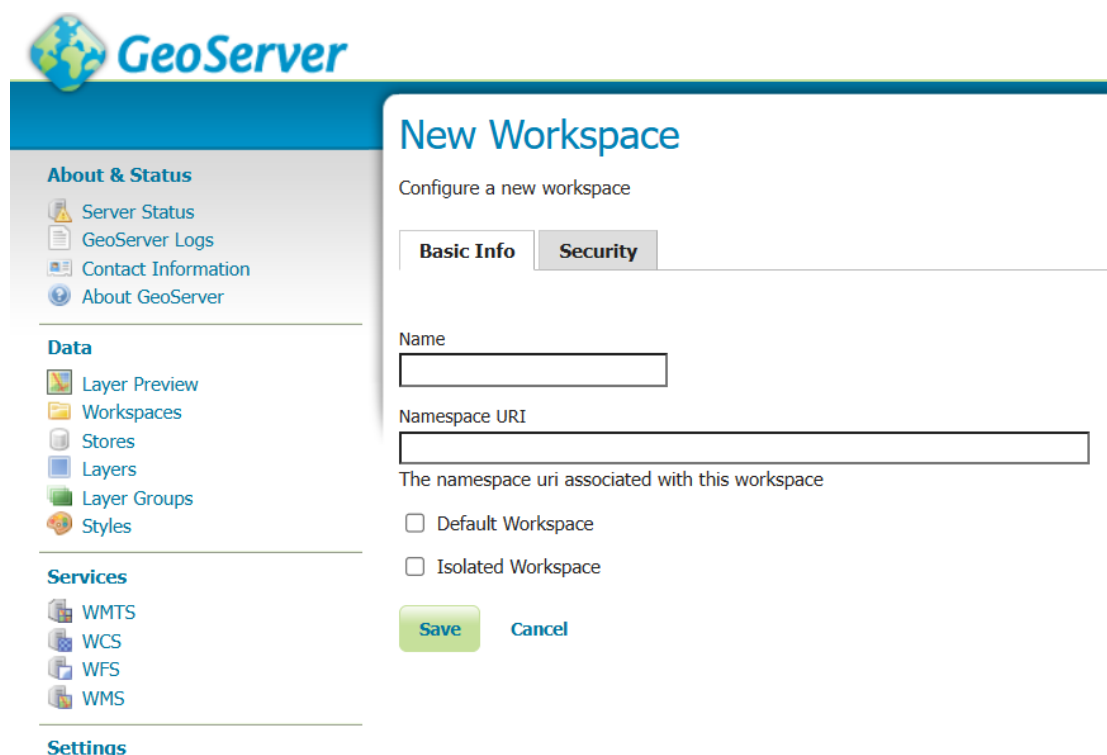
GeoServer includes several styles designed for IMIS. To set up these styles in IMIS, create a workspace and corresponding datastore connecting to the IMIS Database after installing GeoServer. The corresponding information related to the names and other attribute information related to the workspace, stores, layer and styles information including CSS, SLDs, and SQL queries are included and regularly maintained in the technical document section with the filename `geoserver_document.md` within the documentation sub-directory in the GitHub repository named web-app source code. To create a new workspace, store, layer, and styles in a geoserver, follow the steps as mentioned below. Each workspace, store, layer and style must be created to ensure the proper functioning of the map interface. Currently, there is one workspace, nine stores, thirty layers and one hundred and seventeen styles. Each of these must be created as per the `geoserver_document.md` values in the newly setup geoserver. Alternatively, the present workspace is also provided in the GitHub repository under the deployment_documentation in the sub-directory `geoserver_workspace_setup`, which can also be imported into the geoserver through minor modifications to the XML file that is mentioned in Section Importing New Workspace, Store, Layer & Style in Geoserver.

6.8.1 Add New Workspace

After logging into GeoServer, create a new workspace by navigating to the **Workspace** in the left-side menu and selecting **Add new workspace**.



Add a new workspace, for the workspace add the name of the current database that we are working on. For NameSpace URI add the URI that we are currently working on. In our local deployment Namespace URI may be localhost:8000



GeoServer

About & Status

- Server Status
- GeoServer Logs
- Contact Information
- About GeoServer

Data

- Layer Preview
- Workspaces
- Stores
- Layers
- Layer Groups
- Styles

Services

- WMTS
- WCS
- WFS
- WMS

Settings

New Workspace

Configure a new workspace

Basic Info **Security**

Name

Namespace URI

The namespace uri associated with this workspace

☐ Default Workspace

☐ Isolated Workspace

Save **Cancel**

6.8.2 Add New Store

To add a new store in GeoServer, follow the steps mentioned below

- On the left sidebar, select **Stores**.
- This will open the main **Stores** page where existing stores are listed.
- On the **Stores** page, look for the **Add New Store** link or button.
- Click **Add New Store** to open the form for entering the details of the new store.



Stores

Manage the stores providing data to GeoServer

[Add new Store](#) [Remove selected Stores](#)

<< < 1 2 3 > >> Results 1 to 25 (out of 58 items)

Search








<input type="checkbox"/>	Data Type	Workspace	Store Name	Type	Enabled?
<input type="checkbox"/>		nurc	arcGridSample	ArcGrid	✓
<input type="checkbox"/>		nurc	img_sample2	WorldImage	✓
<input type="checkbox"/>		imis_africa	imis_africa_building_info	PostGIS	✓
<input type="checkbox"/>		imis_africa	imis_atrica_layer_info	PostGIS	✓

It will take you to new data source page where we are working with POSTGIS so we will select that:






New data source

Choose the type of data source you wish to configure



Vector Data Sources

-  **Directory of spatial files (shapefiles)** - Takes a directory of shapefiles and exposes it as a data store
-  **GeoPackage** - GeoPackage
-  **PostGIS** - PostGIS Database
-  **PostGIS (JNDI)** - PostGIS Database (JNDI)
-  **Properties** - Allows access to Java Property files containing Feature information
-  **Shapefile** - ESRI(tm) Shapefiles (*.shp)
-  **Web Feature Server (NG)** - Provides access to the Features published a Web Feature Service, and the ability to perform transactions on the server (when supported / allowed).

Raster Data Sources

-  **ArcGrid** - ARC/INFO ASCII GRID Coverage Format
-  **GeoPackage (mosaic)** - GeoPackage mosaic plugin
-  **GeoTIFF** - Tagged Image File Format with Geographic information
-  **ImageMosaic** - Image mosaicking plugin
-  **WorldImage** - A raster file accompanied by a spatial data file

Other Data Sources

-  **WMS** - Cascades a remote Web Map Service
-  **WMTS** - Cascades a remote Web Map Tile Service

After this will direct to the page where we will add details about new vector data source, On this page, you'll first encounter the **Basic Store Info** section.

Basic Store Info

Workspace *

iims_base ▼

Data Source Name *

Description

☒ Enabled

☐ Auto disable on connection failure

- On the Workspace, dropdown select workspace you have created.
- In Data Source Name you need to give the name as given in the GeoServer Documentation in Git Hub Organization.

[**Note:** While adding store for “layer_info” make sure you tick “**Expose Primary Key**” option.]

After this on the connection parameters section:

Connection Parameters

host *
localhost

port *
5432

database
imis_base

schema
public

user *
postgres

passwd

Namespace *
http://192.168.1.79:8000

- On database label, put the database name which you are working on.
- On the schema put the schema name you are working on.
- For the user and password, you will put the credentials used for the pgAdmin.

Once finished, click on the apply and then save.

6.8.3 Add New Layers

To add a new layer in GeoServer, follow the steps below

- On the left sidebar, select Stores.
- This will open the main Layers page where existing Layers are listed.
- On the Layers page, look for the Add New Layer link or button.
- Click Add New Layer to open the form for entering the details of the new Layer.

Layers

Manage the layers being published by GeoServer

[Add a new layer](#) [Remove selected layers](#)

<< < 1 2 3 4 5 > >> Results 1 to 25 (out of 182 items)

<input type="checkbox"/>	Type	Title	Name	Store	Enabled	Native SRS
<input type="checkbox"/>		buildings	imis_africa:buildings_layer	imis_africa_building_info	✓	EPSG:4326
<input type="checkbox"/>		citypolys	imis_africa:citypolys_layer	imis_africa_layer_info	✓	EPSG:4326
<input type="checkbox"/>		containments	imis_africa:containments_layer	imis_base_fsm	✓	EPSG:4326

To add the new layer select the table you want to add layer to.

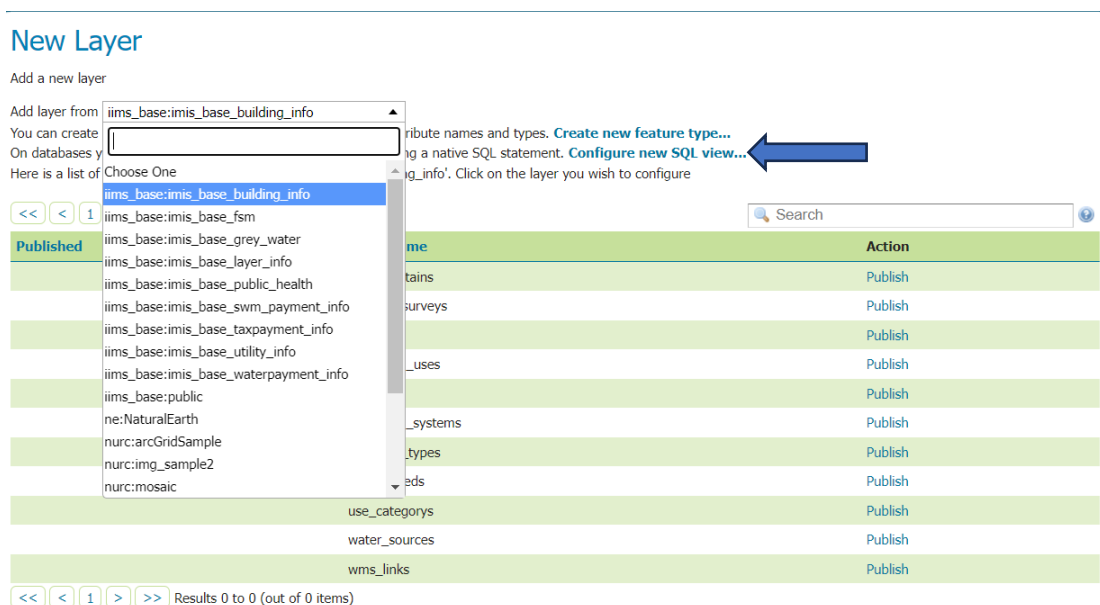


Figure 1 Adding new layer

Once you have chosen the table you can either publish or Configure new SQL view, which you can see in the figure 5.

6.8.4 Create a new SQL view

If you click on the Configure SQL view, In the view name add the table name and in the SQL section add the SQL query and then save. The SQL statement is provided in the GeoServer document in the git hub organization.

Create new SQL view

Define a new SQL view and configure its identified and geometry columns

View Name

buildings_with_owners

SQL statement

```
SELECT building_info.buildings.*,
building_info.owners.owner_name,
building_info.owners.owner_gender,
building_info.owners.owner_contact,
building_info.structure_types.type as
structure_type_type,
building_info.functional_uses.name as
functional_use_name,
building_info.use_categorys.name as
use_category_name,
building_info.sanitation_systems.sanitation_system
as sanitation_system_technology_name,
building_info.water_sources.source as
water_source_source,
fsm.emptyings.house_image as house_image
FROM building_info.buildings
LEFT JOIN building_info.owners
```

SQL view parameters

[Guess parameters from SQL](#) [Add new parameter](#) [Remove selected](#)

On the Coordinate Reference System on the SRS label add to 4326, then on the Bonding Boxes click on Compute from data and compute from native bonds, also the same when using publish. Click on apply and then save.

[Edit Layer](#)

Basic Resource Info

① **Store Name:** imis_base_building_info

① **Native Name:** buildings_with_owners

Name
buildings_with_owners

☒ Enabled

☒ Advertised

Title ☐ (18n)
buildings_with_owners

Abstract ☐ (18n)

Keywords

Current Keywords
features
buildings_with_owners Remove selected

New Keyword

Vocabulary

Add Keyword

Metadata links

No metadata links so far

Add link Note only FGDC and TC211 metadata links show up in WMS 1.1.1 capabilities

Data links

No data links so far

Add link

Coordinate Reference Systems

Native SRS

Declared SRS
EPSG:4326 Find... EPSG:WGS 84...

SRS handling
Force declared

Bounding Boxes

Native Bounding Box

Min X	Min Y	Max X	Max Y
85.334191229478	27.622507652043	85.386994528385	27.671034156531

[Compute from data](#)
[Compute from SRS bounds](#)

Lat/Lon Bounding Box

Min X	Min Y	Max X	Max Y
85.334191229478	27.622507652043	85.386994528385	27.671034156531

[Compute from native bounds](#)

Save Apply Cancel

For more assistance, you can follow the GeoServer tutorials:

Getting Started with GeoServer:

<https://docs.geoserver.org/main/en/user/gettingstarted/index.html>

Managing Layers:

<https://docs.geoserver.org/main/en/user/data/webadmin/layers.html>

Managing Styles:

<https://docs.geoserver.org/main/en/user/styling/webadmin/index.html>

6.8.5 Importing New Workspace, Store, Layer & Style in Geoserver

To streamline the process of importing manually creating the individual workspaces, stores, layers and styles in geoserver, an alternative approach is to import the entire workspace into geoserver directly. The workspace is provided in the GitHub repository.

Download the zip file and follow the instructions provided below to import the existing workspace into geoserver:

Step 1 : After the geoserver has been installed, create a new workspace named “sample_workspace” with appropriate server URL.

Step 2 : Create a store named “sample_datastore” with the following details:

- a. Select the PostGIS (PostGIS Database) option
- b. Set the the Workspace as “sample_worspace”
- c. Set the Data Source Name as “base_imis_building_info”
- d. Set the Host with the IP of the database that has been setup
- e. Set the port that has been used.
- f. Set the database name (base_imis)
- g. Set the Schema as building_info.
- h. Set the database username and password that has been used.
- i. Save the Store

Step 3 : Either through the cmd or any SFTP interface, open to the file:
/opt/tomcat/webapps/geoserver/data/workspaces/sample_workspace/imis_base_building_info/datastore.xml

Step 4 : Copy the following lines of code:

```
<entry key="passwd">crypt1dummyCrypt</entry>
```

Step 5 : Download the provided zip file (Repository: Deployment_Manual, Sub Directory: Geoserver Workspace Setup) and unzip to your local machine.

Step 6 : Navigate to the datastore.xml of each data store and replace the line of code with the line of code copied in Step 4.

Step 7 : Ensure the following lines of code match the values as well

```
<entry key="database">{{DATABASE_NAME}}</entry>
```

```
<entry key="host">{{SERVER_IP}}</entry>
```

```
<entry key="namespace">">{{SERVER_IP}}</entry>
```

Step 8 : Once each datastore’s passwd key and other parameters has been updated, copy the entire workspace folder and paste it into the location:
/opt/tomcat/webapps/geoserver/data/workspaces/

Step 9 : Ensure that the folder name matches the workspace you are importing (base_imis) and that the sub-folder within the folder contains the data stores.

Step 10 :Restart the tomcat service.

Step 11 :If there is any issue with the import of <workspace> or <namespace>, replace the IDs with those from the sample workspace and datastore, or make the <id> field empty to allow GeoServer to regenerate new ones during the import.

Step 12 :Check if the workspace, store, layer and style is present in the geoserver and remove the dummy workspace that was created.

6.9 Configuration for printing module (Config.yaml file)

The config.yaml file is customized accordingly in IMIS that needs to be configured after installing MapFish Print in GeoServer.

The config.yaml file is typically located in the printing directory of the GeoServer data directory:

```
GEOSERVER_DATA_DIR/printing/config.yaml  
(/opt/tomcat/webapps/geoserver/data)
```

Replace the contents of this file with the one provided in the GitHub repository (Deployment Documentation/Geoserver Setup/config.yaml).

Then, replace the <server_ip> with the corresponding server IP of the web application.

After modifying the config.yaml file, restart GeoServer to apply the changes:

```
sudo systemctl restart tomcat
```

To test the Configuration, navigate to the MapFish Print endpoint in GeoServer:

```
http://<geoserver-url>:8080/geoserver/pdf/print.pdf
```

If the following message is displayed in the browser, then the print is working.

Error while generating PDF:

Missing 'spec' parameter

6.10 Authkey, WFS Service Level & .env Configuration for Geoserver

6.10.1 Authkey Configuration

All the requests originating from IMIS should have security authkey token attached to it. Allows a minimal form of authentication by appending a unique key in the URL that is used as the sole authentication token.

The authentication keys are stored in:

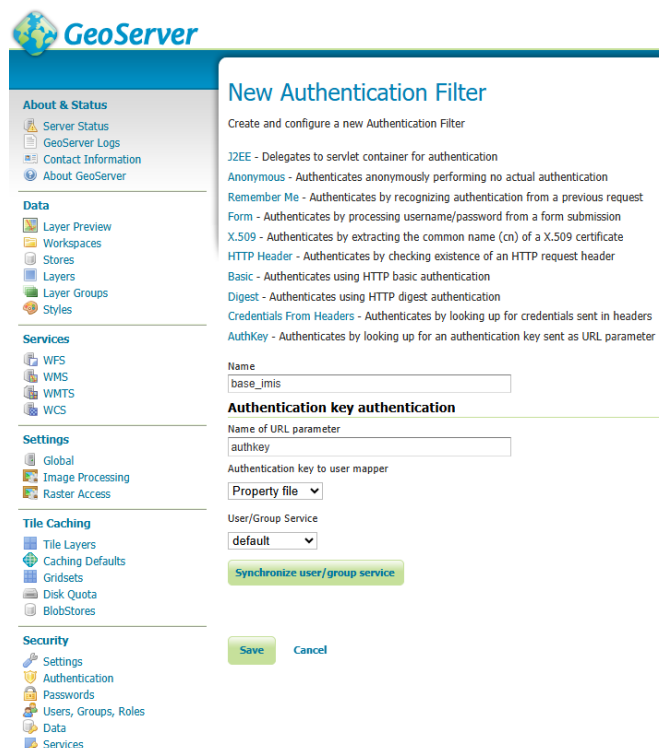
```
$GEOSERVER_DATA_DIR/security/usergroup/default/authkeys.properties
```

The following steps are required to create the authentication key and enable it:

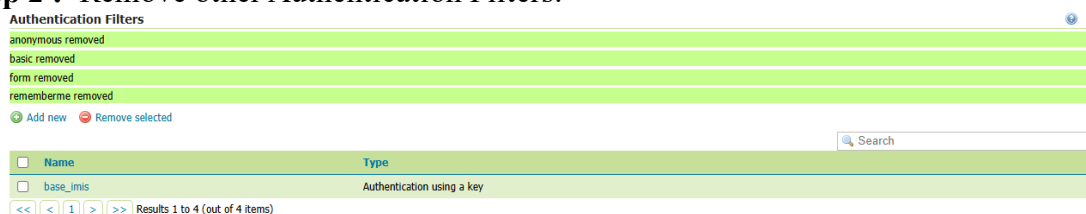
Step 1 : Add a new Authentication filter through the geoserver interface

- a. Navigate to the Authentication Page present under the Security Group in the sidebar.
- b. Select the Add New under the Authentication Filter

- c. Select the AuthKey option
- d. Set the Name as base_imis
- e. Set the Name of URL parameter as authkey
- f. Set the Authentication key to user mapper as Property File
- g. Set the User/Group Service as default
- h. Select the Synchronize user/group service option
- i. Save it

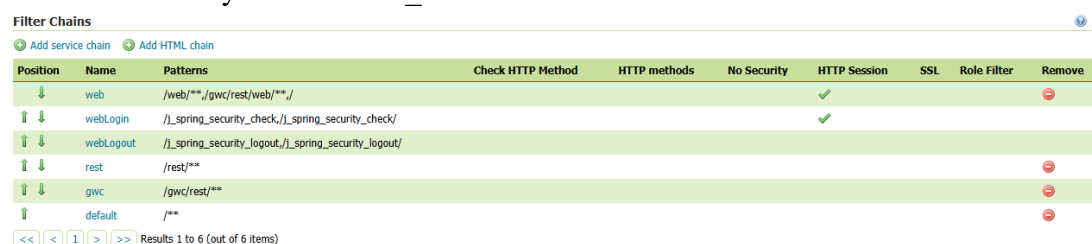


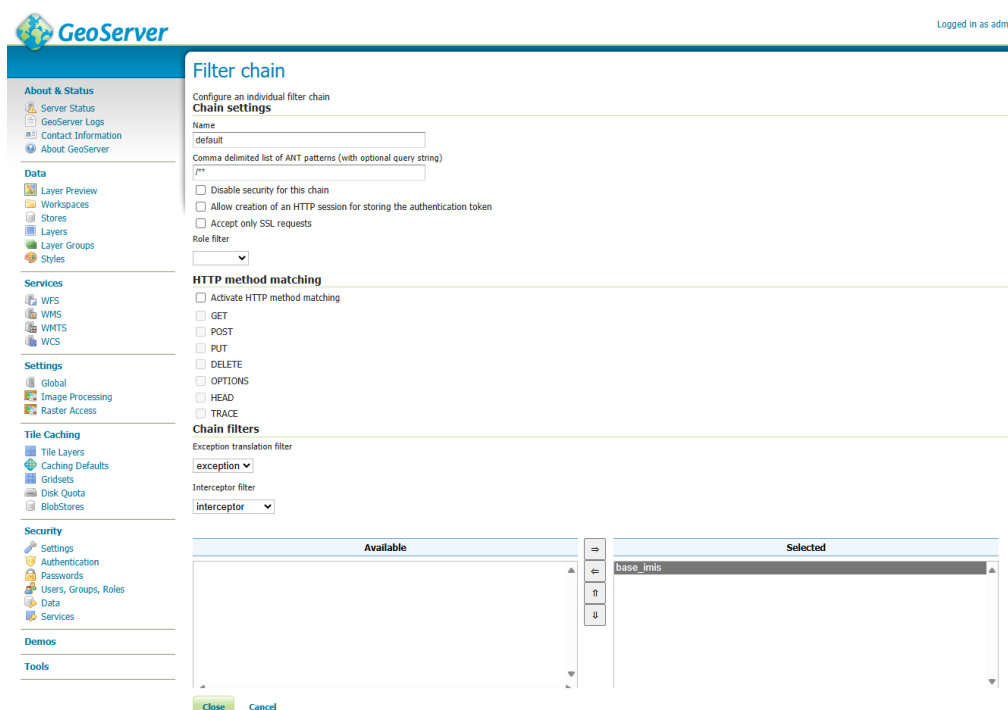
Step 2 : Remove other Authentication Filters.



Step 3 : After removing other authentication filters, go back to the base_imis key and reselect the Synchronize user/group service option to resynchronize the user groups.

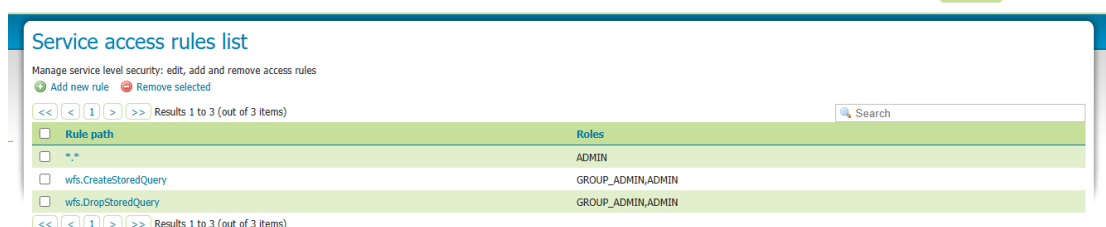
Step 4 : Under the Filter Chains section, alter the existing filter chain Default to include the newly created base_imis.



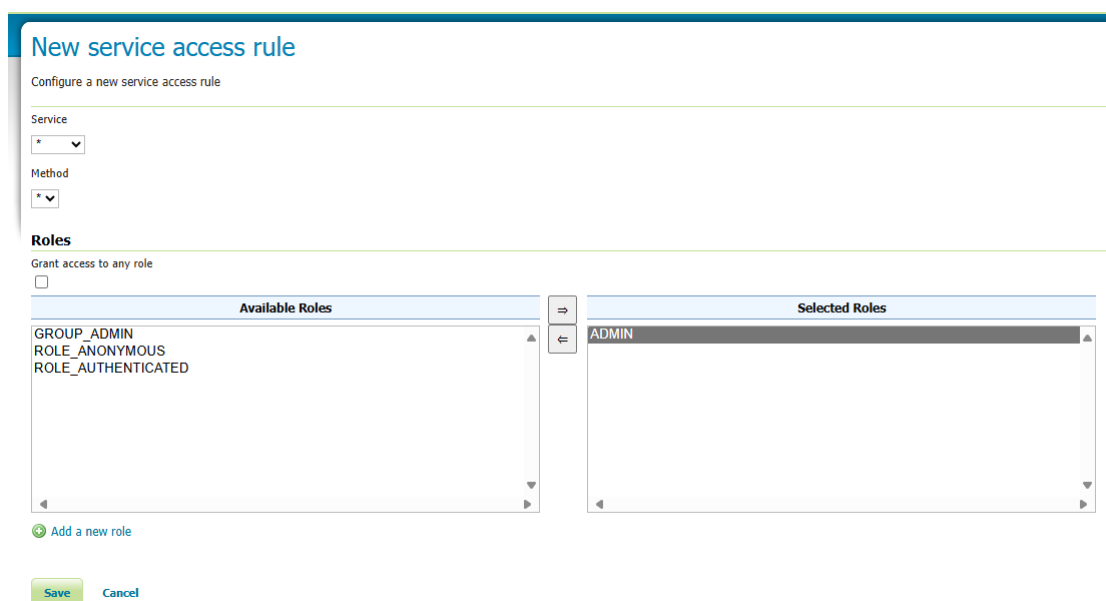


Step 5 : Add New Service Rule

a. Navigate to the Service option in the sidebar



b. Add a new Rule with Selected Role as Admin.

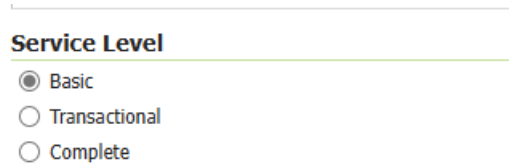


6.10.2 WFS Service Level

The WFS Service Level must be configured to Basic to ensure no unintended data manipulation can be carried out through the WFS. The following steps must be taken:

Step 1 : Navigate to the WFS option under the Services Section in the sidebar

Step 2 : Under the Service Level header, select the Basic option and Save.



Service Level

☒ Basic

☐ Transactional

☐ Complete

6.10.3.ENV configuration

The .env file of the project contains all the necessary details required for the project to access the geoserver that has been setup. The following values must be configured:

`GEOSERVER_WORKSPACE= <workspace_name>`

`GEOSERVER= http://<geoserver_server_ip>:8080/geoserver/`

`GEOSERVER_URL=http://<geoserver_server_ip>:8080/geoserver/<workspace_name>`

`AUTH_KEY=<auth_key>`

[Note: The auth key can be found in the file \$GEOSERVER_DATA_DIR/security/usergroup/default/authkeys.properties after it has been generated.]

7. ANNEX

7.1 Useful Linux Commands

lsb_release -a:

Displays information about the Linux distribution. Output:

```
Distributor ID: Ubuntu
Description:   Ubuntu 22.04.2 LTS
Release:      22.04
Codename:     jammy
```

df -H:

Shows disk space usage in a human-readable format. Reports the used, available, percentage used, and mount point of every disk attached to the system.

free -th:

Checks the current available RAM using a human-friendly format. It displays the total amount of RAM and swap available on the system.

lscpu:

Provides detailed information about the CPU, such as CPU op-mode, vendor id, model name, CPU family, etc. It fetches the CPU architecture's information from sysfs and /proc/cpuinfo.

nproc:

Displays the total number of core processors installed in the Linux system and current processes. Useful for system analysis.

htop:

Displays detailed information about processes used by different users, including priority, nice value, virtual memory, shared memory, etc.

7.2 Docker Folder Overview

- i. Dockerfiles: Folder containing docker files and configs for the docker images included in the docker-compose files. Contains the following at the moment:
 - a. Php - config file and docker file
 - b. Composer - docker file
 - c. Nginx - config file and docker file

The files with “root” in their name are used when the root user is used as the user to deploy the application. Recommended using a different user created solely for the deployment.
- ii. Src: Folder where your Laravel project should be cloned to.
- iii. Docker-compose.root.yml: Docker-compose file that is used when the root user is used to deploy the application.
- iv. Docker-compose.yml: The docker-compose file where all the docker images and commands are written.

7.3 Useful Docker Commands

Command	Action
su laravel	Change user to laravel
docker ps -a	List all the running containers
docker-compose up -d --build	Build the project and keep it running
docker-compose down	Bring down the running containers
docker-compose run --rm composer install	Equivalent to composer install
docker-compose run --rm composer update	Equivalent to composer update

<code>docker-compose run --rm artisan {artisan-command}</code>	Equivalent to php artisan {artisan-command} E.g. <code>docker-compose run --rm artisan migrate</code>
<code>docker-compose run --rm npm install</code>	Equivalent to <code>npm install</code>
<code>docker-compose run --rm npm update</code>	Equivalent to <code>npm update</code>
<code>docker-compose run --rm npm run production</code>	Equivalent to <code>npm run production</code>
<code>docker logs nginx-imis</code>	Get nginx logs
<code>docker exec -it php-imis sh</code>	Enter php container shell
<code>docker system df</code>	displays information regarding the amount of disk space used by the docker daemon
<code>docker system prune --volumes</code>	remove or delete unused objects or data, it might be images, container, volume, or network as these objects are not removed unless we explicitly remove those objects, however, we need to specify the '--volumes' option to remove volumes in Docker 17.06.

7.4 Useful Git Commands

Useful commands:

Installation process: If Git is not pre-installed, install Git with the command:

```
sudo apt-get install git
```

Navigate to the desired installation folder and clone the git repository:

```
git clone https://github.com/<repo_name>.git
```

To clone a specific branch from a remote repository

```
git clone -b <branchname> <remote-repo-url>
```

To list all branches, including both local branches and remote branches

```
git branch -a
```

To list all remote repositories along with their corresponding URLs

```
git remote -v
```

7.4.1 Maintenance process:

Step 1 : Pull code

To update your local repository with changes from the remote repository.

```
git pull
```

Step 2 : Add code to git

The '*git add .*' command stages all changes in the current directory (and its subdirectories) so that they are ready to be committed.

```
git add .
```

Step 3 : Commit code

It's essential to write clear and meaningful commit messages to help others understand the purpose of the changes.

```
git commit -m "commit_message"
```

Step 4 : Push code

This step sends your committed changes from your local repository to the remote repository.

```
git push origin master
```

The '*origin*' refers to the remote repository's name (commonly set to the URL of the repository), and '*master*' is the name of the branch you want to push to.

7.5 Laravel-related operations

Composer Install and Update: Run composer install to add or update all the composer packages and required dependencies by running:

```
# docker-compose run --rm composer install  
# docker-compose run --rm composer update  
# docker-compose run --rm composer dump-autoload
```

Generate App Key: Laravel requires an application key for encryption. Generate app key by running

```
# docker-compose run --rm artisan generate:key
```

Run NPM Install: Install the JavaScript dependencies specified in the package.json file by executing

```
# docker-compose run --rm npm install
```

Run NPM Watch: This command runs the npm run watch command inside the Docker container:

```
# docker-compose run --rm npm run watch
```

Cache configuration:

```
# docker-compose run --rm php artisan config:cache  
# docker-compose run --rm php artisan route:cache  
# docker-compose run --rm php artisan view:cache
```

Please note that the provided steps assume that you have set up Docker, have the necessary permissions, and have the repository properly configured.

7.6 Connect to db through pgadmin

Step 1 : Download and install pgAdmin.

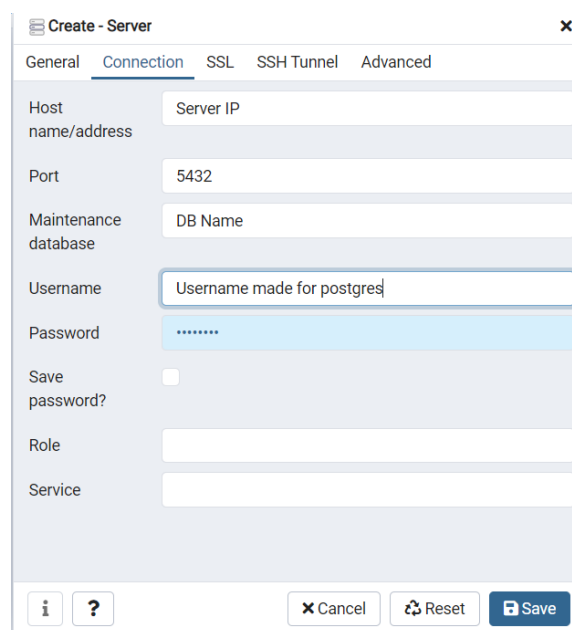
Step 2 : Start pgAdmin.

Step 3 : In the pgAdmin window, click the Servers tab.

Step 4 : Right-click on the Servers node and select Create > Server.

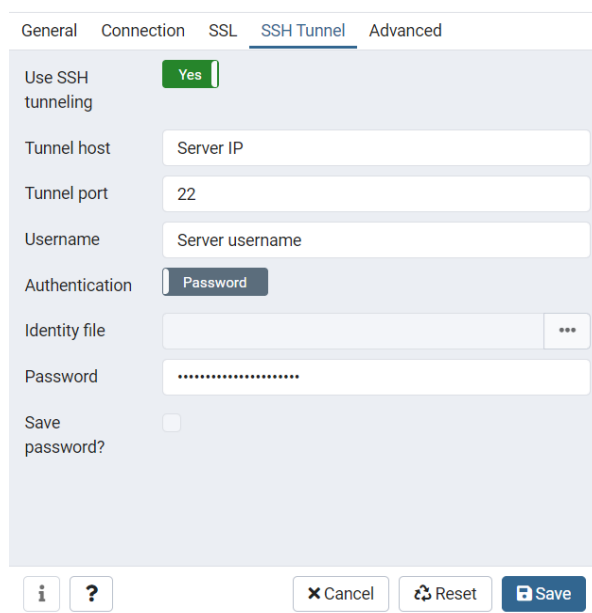
Step 5 : In the Create Server dialog, enter the following information:

- Name: The name of the server.
- Host name: The hostname or IP address of the PostgreSQL server.
- Port: The port number of the PostgreSQL server.
- Username: The username of the PostgreSQL user that you want to connect with.
- Password: The password of the PostgreSQL user.



Step 6 : You may need to configure the SSH Tunnel settings if your PostgreSQL server is not directly accessible and requires an SSH tunnel to establish a connection securely. Follow the steps below:

- Click the SSH Tunnel tab.
- **Tunnel host:** Enter the hostname or IP address of the SSH server (the server you will use to create the SSH tunnel).
- **Tunnel port:** Enter the port number on the SSH server where SSH is running. The default port for SSH is 22.



Step 7 : Click the Save button.

Step 8 : The server will be added to the pgAdmin window. Right-click on the server's name and select Connect.

Step 9 : You will be prompted to enter the password for the PostgreSQL user. Enter the password and click the OK button.

Step 10 : You should now be connected to the PostgreSQL server through pgAdmin.

7.7 Logo and Copyright Text

- i. To change logo in login page: public/img/logo.png
- ii. To change text in login page: resources/views/app.blade.php >> div classes login-main-title, login-sub-title
- iii. Copyright texts: resources/views/app.blade.php >> div class main footer
- iv. Copyright texts in dashboard: resources/views/footer.blade.php
- v. Copyright texts in maps: resources/views/index.blade.php

7.8 SSL Configuration in Docker

Generate SSL keys and keep them within the docker folder, preferably within the parent directory.

In docker-compose.yml:

Add ports 443 to nginx

```
container_name: nginx-imis
```

```
ports:
  - 80:80
  - 443:443
```

Add volume of SSL folder to desired file path in nginx (in docker-compose.yml file):

```
volumes:
  - ./src/ imis-base:/var/www/html/imis:delegated
  - ./ssl:/etc/ssl/private:ro
```

In default.conf of nginx file, uncomment the following lines of code.

```
# SSL Certificate and Key
ssl_certificate /etc/ssl/private/fullchain.pem;
ssl_certificate_key /etc/ssl/private/privkey.pem;
```

IN default.conf of nginx, update following code for force redirection of port 80 to SSL port:

```
server {
  listen 80;
  index index.php index.html;
  server_name <<server IP>>;
  return 301 https://$request_uri; // domain name you want to point to
}
```

In nginx.dockerfile, uncomment the following line.

```
EXPOSE 443
```

Final default.conf for nginx:

```
server {
  listen 80;
  index index.php index.html;
  server_name <<server IP>>;
```

```

    return 301 https:// <<server domain>>;
}
server {
    listen 443 ssl;
    index index.php index.html;
    server_name <<domain_name>>;

    root /var/www/html/imis/public;

    # SSL Certificate and Key
    ssl_certificate /etc/ssl/private/fullchain.pem;
    ssl_certificate_key /etc/ssl/private/privkey.pem;

    location / {
        try_files $uri $uri /index.php?$query_string;
    }
    location ~ \.php$ {
        try_files $uri =404;
        fastcgi_split_path_info ^(.+\.php)(/.+)$;
        fastcgi_pass php:9000;
        fastcgi_index index.php;
        include fastcgi_params;
        fastcgi_param SCRIPT_FILENAME $document_root$fastcgi_script_name;
        fastcgi_param PATH_INFO $fastcgi_path_info;
    }
}

```

Rebuild the Docker:

(Docker Compose version 2)

```
docker compose down  
docker compose up -d --build  
(Docker Compose version 1)  
docker-compose down  
docker-compose up -d --build
```

7.9 SSL Configuration in GeoServer

Configure GeoServer to use SSL; otherwise, it may create issues while displaying layers and styles. As geoserver is installed conventionally without docker, update the nginx configuration file of the database server as follows:

```
server {  
    listen 443 ssl;  
    server_name <<domain_name>>;  
  
    ssl_certificate <<path_to_file>>/fullchain.crt;  
    ssl_certificate_key <<path_to_file>>/private.key;  
  
    location / {  
        proxy_pass http://localhost:8080;  
        proxy_set_header Host $host;  
        proxy_set_header X-Real-IP $remote_addr;  
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;  
        proxy_set_header X-Forwarded-Proto $scheme;  
    }  
  
    access_log <<path_to_file>>/subdomain-ssl-access.log;  
    error_log <<path_to_file>>/subdomain-ssl-error.log;  
}
```

```
server {  
    listen <port number>;  
    server_name <<domain_name>>;  
  
    return 301 https://$host$request_uri;  
}
```

Restart Nginx and GeoServer

Restart the Tomcat service:

```
sudo systemctl restart nginx
```

Restart the Tomcat service:

```
sudo systemctl restart tomcat
```

8. REFERENCES

[HTTPS://WWW.DIGITALOCEAN.COM/COMMUNITY/TUTORIALS/INITIAL-SERVER-SETUP-WITH-UBUNTU-22-04](https://www.digitalocean.com/community/tutorials/initial-server-setup-with-ubuntu-22-04)

[HTTPS://WWW.DIGITALOCEAN.COM/COMMUNITY/TUTORIALS/UFW-ESSENTIALS-COMMON-FIREWALL-RULES-AND-COMMANDS](https://www.digitalocean.com/community/tutorials/ufw-essentials-common-firewall-rules-and-commands)

[HTTPS://WWW.DIGITALOCEAN.COM/COMMUNITY/TUTORIALS/HOW-TO-INSTALL-AND-USE-DOCKER-ON-UBUNTU-22-04](https://www.digitalocean.com/community/tutorials/how-to-install-and-use-docker-on-ubuntu-22-04)

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[HTTPS://WWW.DIGITALOCEAN.COM/COMMUNITY/QUESTIONS/HOW-TO-FIX-DOCKER-GOT-PERMISSION-DENIED-WHILE-TRYING-TO-CONNECT-TO-THE-DOCKER-DAEMON-SOCKET](https://www.digitalocean.com/community/questions/how-to-fix-docker-got-permission-denied-while-trying-to-connect-to-the-docker-daemon-socket)

[HTTPS://DOCS.GEOSERVER.ORG/STABLE/EN/USER/INSTALLATION/LINUX.HTML](https://docs.geoserver.org/stable/en/user/installation/linux.html)

[HTTPS://WWW.DIGITALOCEAN.COM/COMMUNITY/TUTORIALS/HOW-TO-INSTALL-POSTGRESQL-ON-UBUNTU-22-04-QUICKSTART](https://www.digitalocean.com/community/tutorials/how-to-install-postgresql-on-ubuntu-22-04-quickstart)

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[HTTPS://DOCS.GEOSERVER.GEO-SOLUTIONS.IT/EDU/EN/INSTALL_RUN/GS_EXTENSIONS.HTML](https://docs.geoserver.org/en/latest/user/extensions/html)

[HTTPS://DOCS.GEOSERVER.ORG/MAIN/EN/USER/EXTENSIONS/AUTHKEY/INDEX.HTML](https://docs.geoserver.org/en/latest/user/extensions/authkey/html)

[HTTPS://DOCS.GEOSERVER.ORG/MAIN/EN/USER/STYLING/CSS/INSTALL.HTML](https://docs.geoserver.org/en/latest/user/styling/css/html)

[HTTPS://DOCS.GEOSERVER.ORG/MAIN/EN/USER/EXTENSIONS/PRINTING/INDEX.HTML](https://docs.geoserver.org/en/latest/user/extensions/printing/html)

[HTTPS://DOCS.GEOSERVER.GEO-SOLUTIONS.IT/EDU/EN/PRETTY_MAPS/CROSS_LAYER_FILTER.HTML](https://docs.geoserver.org/en/latest/user/extensions/html)