Paris-Lodron Universität Salzburg
Department of Geoinformatics
Copernicus Master in Digital Earth

Spatial Databases Final Project

Database for Music Festival *Rock No River* (RnR)

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Introduction

This report is a documentation of all steps and approaches taken during the development of the final project of Spatial Databases lecture.
The main objective of the project is to develop a database for a music festival. The databases contains information about the stages, its location, concert schedule, food trucks, user position and other festival related things.
To create all fictional information, the 2011 Rock In Rio site was taken as basis for spatial distribution of stages, booths, tents and facilities. Regarding tools used, QGIS was important for uploading spatial information to the database, besides performing edits on the layers. PgAdmin was the main tool utilized; with it all queries and database configuration was performed.

Database Structure

The database has 4 main tables:

Table 1: “Facilities”

FacilityID (Primary Key)
FacilityName
FacilityType
OpeningTime
ClosingTime
X
Y
Geom (Spatial data type)

Table 2: “Events”

LinupID (Primary Key)
Artist
StartTime
EndTime
StageID (FK)
DayFestival

Table 3: “Users”

UserID (Primary Key)
UserName
X
Y
DayFestival
CurrentLocation (Spatial data type)

Table 4: “Stages”

StageID (Primary Key)
Geom (Spatial Data Type)
StageName

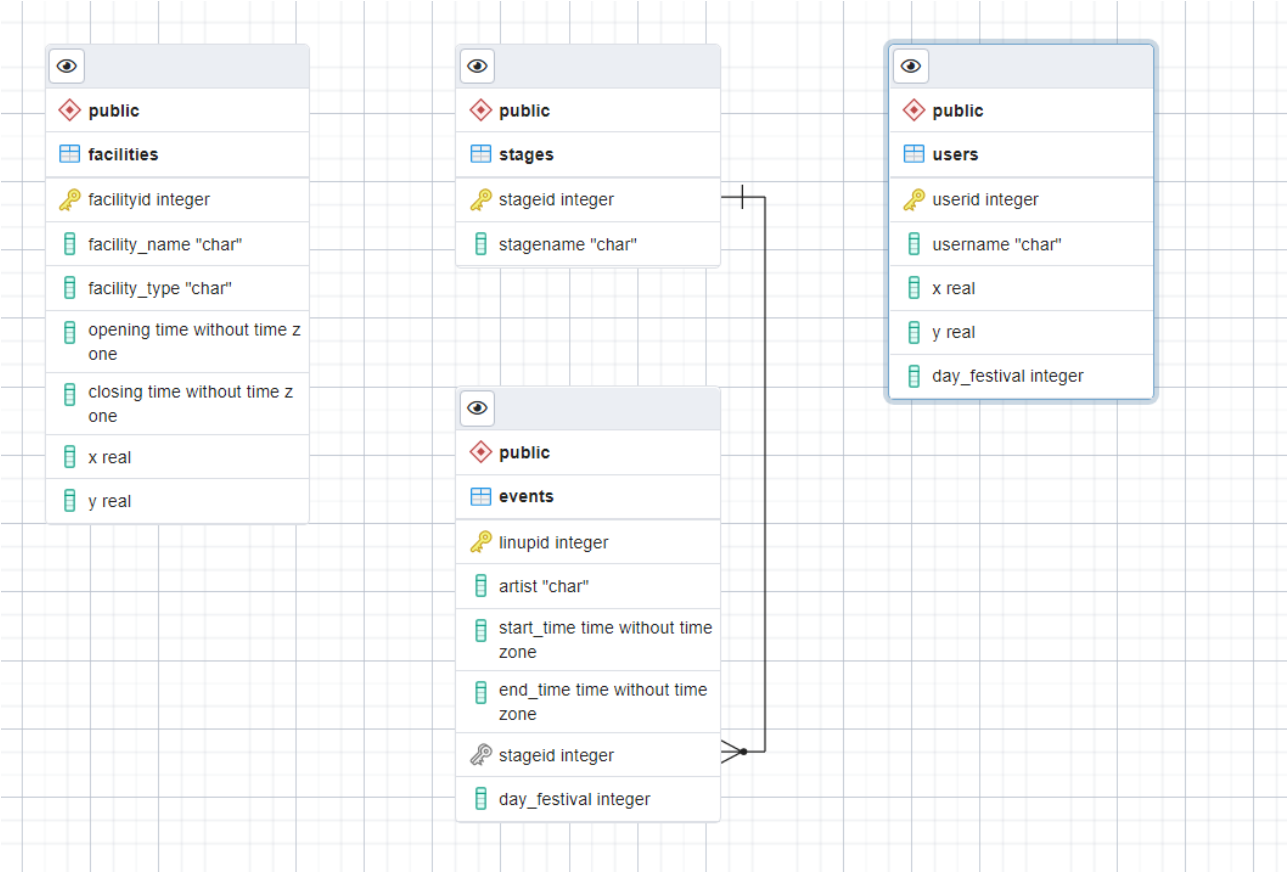
This model uses four tables: “Facilities”, “Events”, “Stages” and “Users”.

The “**Facilities” table** stores information about the various facilities available at the festival, such as booths, roller coasters, food tents, garbage bins and toilets and emergency points.

The “**Events” table** stores information about the various events taking place at the festival, including the name, location, start time, end time, and the stage ID where the event is taking place.

The “**Users” table** stores information about individual festival-goers, including their ID, name, and current location.

Database Graphical Representation



Querying Database

In this chapter, a few queries are shown to demonstrate the usability of the database and how it could be implemented in the backend of the mobile app.

A set of views are also created in order to return easily and quicker the most demanded results for each day of festival.

Creating Views for Each Day of Festival

- Day One

```
1  CREATE VIEW festival_day_one AS
2                       SELECT e.artist, e.start_time, e.stageid, e.day_festival, s.stage_name
3                       FROM events AS e, stages AS s
4                       WHERE e.stageid = s.stageid AND e.day_festival = 1
5                       ORDER BY e.start_time ASC
6  ;
```

- Day Two

```
1  CREATE VIEW festival_day_two AS
2                       SELECT e.artist, e.start_time, e.stageid, e.day_festival, s.stage_name
3                       FROM events AS e, stages AS s
4                       WHERE e.stageid = s.stageid AND e.day_festival = 2
5                       ORDER BY e.start_time ASC
6  ;
```

- Day Three

```
1  CREATE VIEW festival_day_three AS
2               SELECT e.artist, e.start_time, e.stageid, e.day_festival, s.stage_name
3               FROM events AS e, stages AS s
4               WHERE e.stageid = s.stageid AND e.day_festival = 3
5               ORDER BY e.start_time ASC
6  ;
```

- Creating a View Measuring the Distance from Bathrooms and Healthcare facilities from each Stage.

```
1  CREATE VIEW health_facility AS
2               SELECT
3                       s.stage_name,
4                       s.stageid,
5                       f.facility_name,
6                       f.opening,
```

```
7                   f.closing,
8                   ST_DISTANCE(s.geom, f.geom) AS stage_distance_to
9           FROM stages AS s, facilities as f
10          WHERE f.facility_type = 'Healthcare' OR  f.facility_name = 'Bathroom'
11          ;
```

World Stage	1	Bathroom	00:00:00.000	00:00:00.000	304.26876978136033
Sunset Stage	2	Bathroom	00:00:00.000	00:00:00.000	114.07931069489287
Eletro Stage	4	Bathroom	00:00:00.000	00:00:00.000	320.8992541940516
World Stage	1	Health Facility	06:00:00.000	03:00:00.000	30.316795910150038
Sunset Stage	2	Health Facility	06:00:00.000	03:00:00.000	214.192160750867
Eletro Stage	4	Health Facility	06:00:00.000	03:00:00.000	615.3403799039174
World Stage	1	Health Facility	00:00:00.000	00:00:00.000	333.138092091648
Sunset Stage	2	Health Facility	00:00:00.000	00:00:00.000	113.68400883624894
Eletro Stage	4	Health Facility	00:00:00.000	00:00:00.000	322.33828441982814

a) Query to check distance for each user from each stage

```
1  SELECT s.stageid,
2                  u.userid,
3                  ST_DISTANCE(
4                                  ST_CENTROID(s.geom),
5                                  u.geom
6                                        ) AS distance
7  FROM stages as s, users as u
8  ORDER BY distance ASC;
```

	stageid integer	userid integer	distance double precision
1	2	2	69.63408746686392
2	2	3	108.92875411239869
3	1	3	123.07359933206456
4	1	1	192.34952969676172
5	2	4	222.22984231256862
6	1	2	259.610203197761
7	4	4	263.52237261893265
8	1	5	266.01274327830674
9	2	1	301.07732203313356
10	2	5	399.0414487475396
11	4	2	425.7144805889723
12	1	4	426.68832920232876
13	4	3	575.4585973406023
14	4	1	785.412360465222
15	4	5	883.3052495894549

b) After many beers, Slash would like to go to the bathroom. But before, he needs to throw the Stigel beer cans in the garbage bin. So he needs to find the shortest path to the trash and then to the bathroom. Here is the query to find the closest distance to a bathroom.

```
SELECT
        u.username,
        f.facility_name,
        ST_CLOSESTPOINT(f.geom, u.geom) AS closest_bathroom,
        ST_DISTANCE(f.geom, u.geom) AS distance_in_meters,
        f.geom
FROM
        users as u,
        facilities as f
WHERE
        u.username = 'Slash' AND
        f.facility_name = 'Garbage Bins' AND
        ST_DISTANCE(f.geom, u.geom) < 50
ORDER BY
        distance_in_meters ASC
;
```

	username	facility_name	closest_bathroom	distance_in_meters	geom
1	Slash	Garbage Bins	0101000020EF7...	23.5296186387...	0101000020EF7...
2	Slash	Garbage Bins	0101000020EF7...	41.0134948249...	0101000020EF7...

```sql
SELECT
        u.username,
        f.facility_name,
        ST_CLOSESTPOINT(f.geom, u.geom) AS closest_bathroom,
        ST_DISTANCE(f.geom, u.geom) AS distance_in_meters
FROM
        users as u,
        facilities as f
WHERE
        u.username = 'Slash' AND
        f.facility_name = 'Bathroom' AND
        ST_DISTANCE(f.geom, u.geom) < 500
ORDER BY
        distance_in_meters ASC
;
```

	username character varying	facility_name character varying (254)	closest_bathroom geometry	distance_in_meters double precision
1	Slash	Bathroom	0101000020EF7C0000B7...	164.3185614785116
2	Slash	Bathroom	0101000020EF7C0000E6...	334.97516011161025

c) Mary Jane is feeling hungry. She wants to eat a hot dog and then have some fun in the River Eye before going to the shows. Can you check the distances? Is she in a 500 m buffer of a food place?

```
1  SELECT
2     u.username,
3     f.facility_name,
4     f.facility_type,
5     ST_WITHIN(f.geom,ST_BUFFER(u.geom,500)) AS buffer,
6     f.geom
7  FROM
8     users as u,
9     facilities as f
10  WHERE
11     u.username = 'Mary Jane' AND
12     f.facility_name = 'Hot Dog Store'
13  ;
```

	username	facility_name	facility_type	buffer	geom
1	Mary Jane	Hot Dog Store	Food and Beer	True	0101000020EF7...

```sql
SELECT
    u.username,
    f.facility_name,
    f.facility_type,
    ST_WITHIN(f.geom,ST_BUFFER(u.geom,500)) AS buffer,
            f.geom
FROM
    users as u,
    facilities as f
WHERE
     u.username = 'Mary Jane' AND
     f.facility_name = 'River Eye'
;
```

	username	facility_name	facility_type	buffer	geom
1	Mary Jane	River Eye	Entertainment	True	0101000020EF7...

d) Nicolas Cage is in a terrible hangover due to the last day of festival and he thinks that buying a medicine will help him to get better ASAP. How long will he take to arrive in the Apoteke considering that his velocity is 5km/h.

```
SELECT
        u.username,
        f.facility_name,
        ST_DISTANCE(f.geom, u.geom) AS distance,
        (ST_DISTANCE(f.geom, u.geom) / 1.39) / 60 AS time_taken
-- 5km/h = 1.39m/s

FROM
        users as u,
        facilities as f
 WHERE
        u.username = 'Nicolas Cage' AND
        f.facility_name = 'Apoteke'

;
```

	username character varying	facility_name character varying (254)	distance double precision	time_taken_seconds double precision
1	Nicolas Cage	Apoteke	292.9509647539754	3.5126014958510243

e) Dua Lipa is a famous singer but she’s not going to perform in Rock no River. She was invited by Samsung to make a marketing partnership with Samsung. Under a desguise, what is the distance she needs to walk until the stand?

```
SELECT
        u.username,
        f.facility_name,
        f.facility_type,
        ST_DISTANCE(f.geom, u.geom) AS distance,
        f.geom
FROM
        users as u,
        facilities as f
WHERE
        u.username = 'Dua Lipa' AND
        f.facility_name = 'Samsung'

;
```

	username	facility_name	facility_type	distance	geom
1	Dua Lipa	Samsung	Booth	500.697747797...	0101000020EF7...

g) What is the area of the Eletro Stage? And what about the perimeter of the World Stage?

```
1  SELECT ST_PERIMETER(s.geom) AS stage_perimeter
2  FROM stages AS s
3  WHERE s.stageid = 1
4  ;
```

	stage_perimeter double precision
1	228.698525001020

```
1  SELECT ST_AREA(s.geom) AS stage_area
2  FROM stages AS s
3  WHERE s.stageid = 4
4  ;
```

	stage_area double precision
1	1065.12484740531

h) What is the distance from the centroid of Eletro Stage to the Sunset Stage?

```
1  SELECT ST_Distance(
2                     ST_CENTROID(e.geom),
3                     ST_CENTROID(s.geom)
4                     ) AS stage_distance
5  FROM stages AS e, stages as s
6  WHERE e.stageid = 4 AND s.stageid = 2
7  ;
```

	stage_distance double precision
1	484.706734311516

Conclusions

The development of this Festival Database was quite captivating. It was essential to use many concepts from what was learned during the semester. A few topics, like creating secure views were not utilized, however others were more used, such as utilizing more spatial functions to calculate distances, buffers, check if geometries fall within an area.

It is feasible to say that the main idea for the creation of the database was achieved. Nonetheless, there are a couple of challenges to be improved. Depending on the type of query performed, the database is taking too long to return an output. It was not possible to determine whether this is due to the fact that spatial functions are more memory consuming, or it was because of not setting properly the foreign keys to make it more performative and provide scalability.

References

https://postgis.net/docs/manual-2.0/PostGIS_Special_Functions_Index.html

https://www.w3schools.com/sql