DATA VISUALIZATION PROJECT

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https://github.com/nada912/Tracks-Record

Start and run the project

Prerequisites:

Have a data bricks account (If not, create an account with your professional email on databricks).

Step 1: Create a cluster on Databricks

On the menu bar, click on “Compute” then “Create cluster” button.

Choose a name then create.

Step 2: Import the data to Databricks

On the menu bar, click on “Catalog”, then “Create table” button.
Name the target directory “data” then upload all the text files at once.

Step 3: Open the notebook

On the menu bar, click “New” -> “Notebook”.

Once the notebook is created, click on “File” -> “Import” to import the notebook available on Github.

Now execute the cells to get and process the data then load it to the database.

Step 4: At this point everything is done, you can visualize the dashboard on PowerBi.

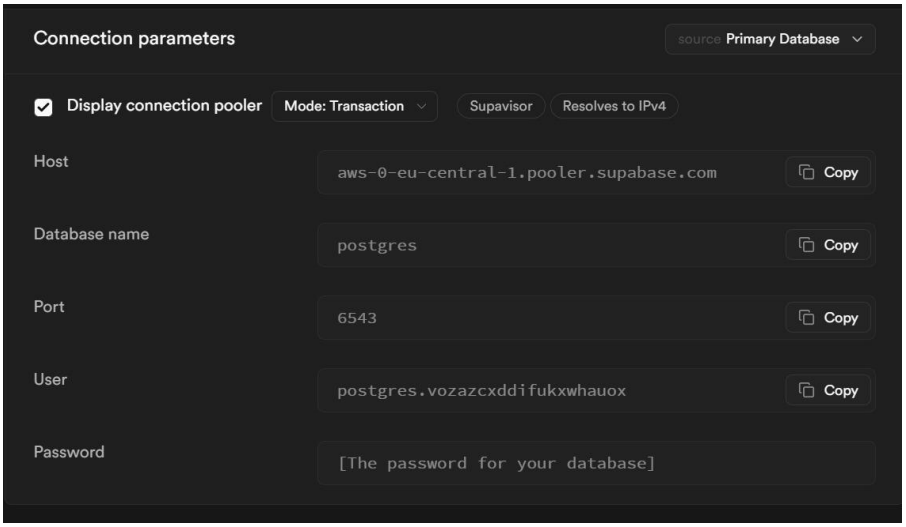
Connect To PowerBi and select “Get Data from other source”

Select on the left sidebar “Database” -> “PostgreSQL Database”

Connect with the following and open the Report Tracks.pbix file:

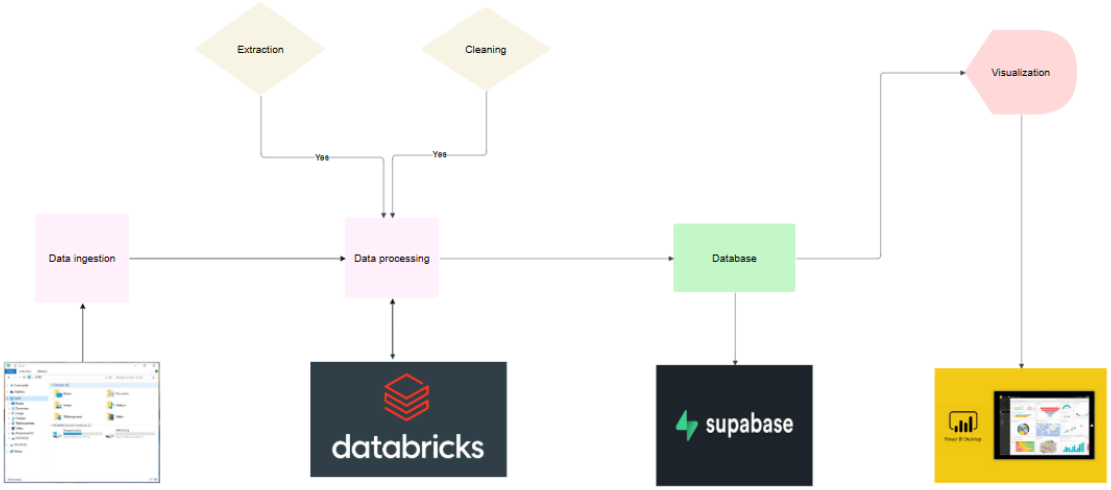
Host : http://aws-0-eu-central-1.pooler.supabase.com
Database name: postgre
user : postgres.vozazcxddifukxwhauox
password: PasswordTracks2024.

Reconnect to the database in case you have trouble visualizing the dashboard



Conception and implementation

Process and tools:



To achieve this project, we have gone through several steps and used some tools in order to first retrieve the data, clean it, load it to the database and finally visualize it.

Data ingestion :

Given the context of the project, the data was available on Teams, so we downloaded the files locally on our computers.

Data processing :

For this part we used *Databricks*, which is a powerful platform for big data processing, allowing us to clean, transform, and process our datasets efficiently.

It supports distributed computing, enabling scalability for complex operations on large amounts of data and it greatly integrates various data sources including databases.

Loading Data:
The data was initially loaded from text files into our Resilient Distributed Dataset (RDD) using the *WholeTextFiles* method. This method reads all files from a specified directory containing the .txt files and returns a pair consisting of the file path and the content of the file.

```
In [0]: rdd =sc.wholeTextFiles("/FileStore/tables/tracks-data")
        rdd.collect()

Out[1]: [('dbfs:/FileStore/tables/tracks-data/AkaGambit.csv',
  "聳巢詩郎,,Blaze of the Soul Reaper,09 Jan 2008 06:23\n聳巢詩郎,,Battle Ignition,09 Jan 2008 06:21\nEvanescence,Fallen,Taking
Over Me,22 Dec 2007 07:23\nEvanescence,Fallen,Imaginary,22 Dec 2007 07:19\nEvanescence,Fallen,Tourniquet,22 Dec 2007 07:14\nE
vanescence,Fallen,Haunted,22 Dec 2007 07:11\nEvanescence,Fallen,My Immortal,22 Dec 2007 07:07\nEvanescence,Fallen,Everybody's
Fool,22 Dec 2007 07:04\nEvanescence,Fallen,Bring Me to Life,22 Dec 2007 07:00\nLinkin Park,Minutes to Midnight,Given Up,21 De
c 2007 03:33\nLinkin Park,Minutes to Midnight,Wake,21 Dec 2007 03:31\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 2
0:09\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 20:08\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 20:06\n
D. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 20:05\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 20:03\nD. Gray
Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 20:02\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 20:00\nD. Gray Man (Ak
a Gambit Rip),,Opening 3,17 Dec 2007 20:00\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 19:59\nD. Gray Man (Aka Gambi
t Rip),,Opening 3,17 Dec 2007 19:58\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 18:28\nD. Gray Man (Aka Gambit Ri
p),,Opening 3,17 Dec 2007 18:27\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 18:25\nD. Gray Man (Aka Gambit Rip),,Ope
ning 3,17 Dec 2007 18:24\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 18:19\nD. Gray Man (Aka Gambit Rip),,Opening 3,
17 Dec 2007 18:17\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 18:16\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec
2007 18:14\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 18:13\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 1
8:11\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 18:10\nD. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 18:01\n
D. Gray Man (Aka Gambit Rip),,Opening 3,17 Dec 2007 18:00\nPaul Linford and Chris Vrenna,,Most Wanted Mash Up,16 Dec 2007 0
0:17\nJamiroquai,,Feels Just Like it Should (Timo Maas Remix),16 Dec 2007 00:14\nAvenged Sevenfold,,Blinded in Chains,16 Dec
```

Data Extraction:

The raw data within the RDD was processed to extract the listener names from the file paths. Additionally, the content was split into individual records, each representing a unique music listening event. Each record was parsed into five distinct fields: listener name, artist/band, album, track, and date.

```
In [0]: from pyspark.sql import SparkSession
        from pyspark.sql import Row

        rdd_transformed = rdd.map(lambda e: (e[0].split("/")[-1].split(".")[0], e[1])) \
                             .flatMapValues(lambda v: v.split("\n")) \
                             .map(lambda e: (e[0], e[1].split(","))) \
                             .map(lambda e: (
                                 e[0],                              # Listener name
                                 e[1][0],                           # Artist name
                                 e[1][1] if len(e[1]) > 1 else None,  # Album name (if it exists)
                                 e[1][2] if len(e[1]) > 2 else None,  # Track name (if it exists)
                                 e[1][3] if len(e[1]) > 3 else None   # Date (if it exists)
                             ))

        columns = ["listener", "artist / band", "album", "track", "date"]
        # create a structured PySpark DataFrame with our specified schema for processing
        df = spark.createDataFrame(rdd_transformed, schema=columns)
        display(df)
```

Here is a preview of the result we get after the first transformation:

listener	artist / band	album	track	date
AkaGambit	鶯巣詩郎		Blaze of the Soul Reaper	09 Jan 2008 06:23
AkaGambit	鶯巣詩郎		Battle Ignition	09 Jan 2008 06:21
AkaGambit	Evanescence	Fallen	Taking Over Me	22 Dec 2007 07:23
AkaGambit	Evanescence	Fallen	Imaginary	22 Dec 2007 07:19

Date Column Processing:

The original "date" column was split into two separate columns: listened_date and hour. This transformation allowed for more granular analysis of the listening behavior, separating the date from the time of the event.

```
In [0]: from pyspark.sql import functions as F

df_formatted = df.withColumn(
    "listened_date",
    F.date_format(F.to_date(F.col("date"), "dd MMM yyyy HH:mm"), "dd/MM/yy")
).withColumn(
    "hour",
    F.date_format(F.to_timestamp(F.col("date"), "dd MMM yyyy HH:mm"), "HH:mm")
)
display(df_formatted)
```

This is what we get:

track	date
Opening 3	17 Dec 2007 20:09
Opening 3	17 Dec 2007 20:08
Opening 3	17 Dec 2007 20:06
Opening 3	17 Dec 2007 20:05
Opening 3	17 Dec 2007 20:03
Opening 3	17 Dec 2007 20:02
Opening 3	17 Dec 2007 20:00
Opening 3	17 Dec 2007 20:00
Opening 3	17 Dec 2007 19:59
Opening 3	17 Dec 2007 19:58
Opening 3	17 Dec 2007 18:28
Opening 3	17 Dec 2007 18:27
Opening 3	17 Dec 2007 18:25
Opening 3	17 Dec 2007 18:24

track	listened_date	hour
Opening 3	17/12/07	20:09
Opening 3	17/12/07	20:08
Opening 3	17/12/07	20:06
Opening 3	17/12/07	20:05
Opening 3	17/12/07	20:03
Opening 3	17/12/07	20:02
Opening 3	17/12/07	20:00
Opening 3	17/12/07	20:00
Opening 3	17/12/07	19:59
Opening 3	17/12/07	19:58
Opening 3	17/12/07	18:28
Opening 3	17/12/07	18:27
Opening 3	17/12/07	18:25
Opening 3	17/12/07	18:24

Handling Null Values:

Empty cells in the dataset were set to null, ensuring that missing values were appropriately handled. The original date column was then dropped as its information had been separated into the new listened_date and hour columns.

```
In [0]: df_formatted = df_formatted.select(
            [F.when(F.col(c) == '', None).otherwise(F.col(c)).alias(c) for c in df_formatted.columns]
        )
        display(df_formatted)
```

listener	artist / band	album
AkaGambit	鷺巣詩郎	null
AkaGambit	鷺巣詩郎	null

Removing Duplicates and Empty Rows:

As can be seen below, there were quite a bit of duplicates in the dataset. We then had to make sure that any rows that were redundant or completely empty were removed from the dataset to ensure data integrity and reduce potential noise in the analysis.

listener	artist / band	album	track	listened_date	hour
AscendingNode	-MASA Works DESIGEN-	ADULT	SOAP LAGOON	11/04/23	20:04
AscendingNode	-MASA Works DESIGEN-	ADULT	SOAP LAGOON	11/04/23	20:04
AscendingNode	A Crow is White	バックトゥザフューチャー	Let it die~You shall die~	11/04/23	19:36
AscendingNode	A Crow is White	バックトゥザフューチャー	Let it die~You shall die~	11/04/23	19:36
AscendingNode	ALT236	Leviathan	Behelit	20/03/23	16:56
AscendingNode	ALT236	Leviathan	Behelit	20/03/23	16:56

Drop duplicates

```
In [0]: df_formatted = df_formatted.dropDuplicates()
```

Drop empty rows

```
In [0]: df_formatted = df_formatted.dropna(subset=[col for col in df_formatted.columns if col != 'listener'], how='all')
```

Final processed database

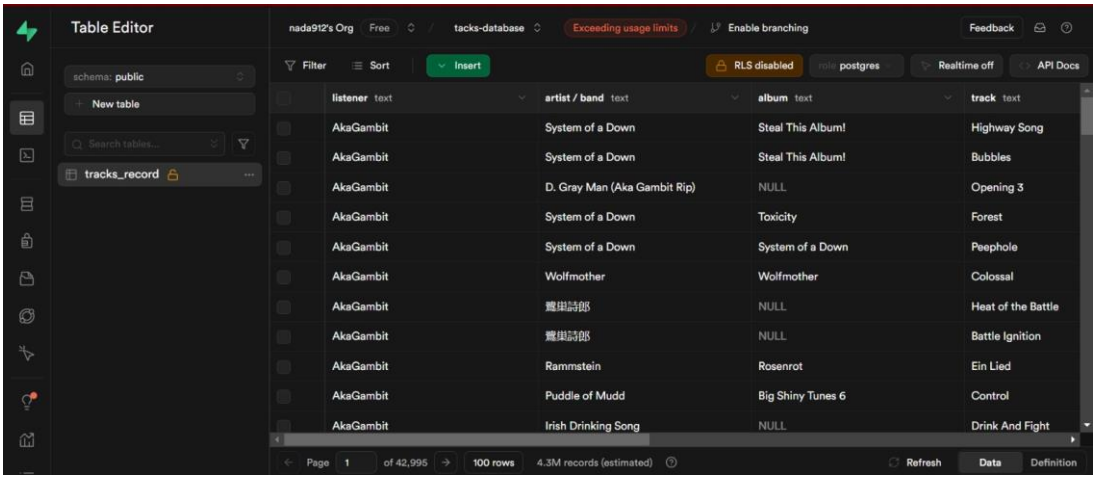
Table

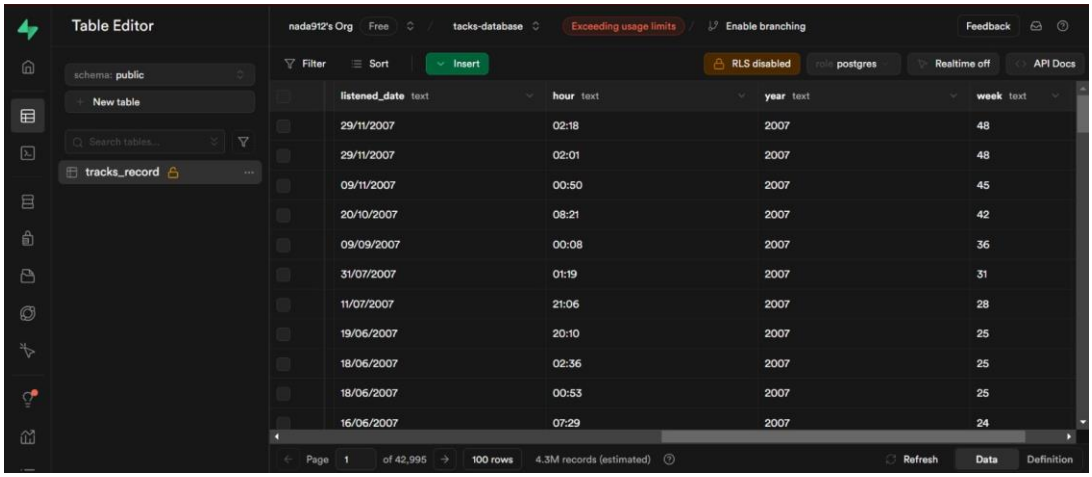
	listener	artist	album	track	listened_date	hour
82	AkaGambit	System of a Down	System of a Down	War?	29/11/07	02:55
83	AkaGambit	System of a Down	System of a Down	Soil	29/11/07	02:52
84	AkaGambit	System of a Down	System of a Down	DDevil	29/11/07	02:50
85	AkaGambit	System of a Down	System of a Down	Spiders	29/11/07	02:47
86	AkaGambit	System of a Down	System of a Down	Suggestions	29/11/07	02:44
87	AkaGambit	System of a Down	System of a Down	Sugar	29/11/07	02:42
88	AkaGambit	System of a Down	System of a Down	Know	29/11/07	02:39
89	AkaGambit	System of a Down	System of a Down	Suite-Pee	29/11/07	02:36
90	AkaGambit	System of a Down	Steal This Album!	Streamline	29/11/07	02:33
91	AkaGambit	System of a Down	Steal This Album!	Roulette	29/11/07	02:29
92	AkaGambit	System of a Down	Steal This Album!	Thetawaves	29/11/07	02:27
93	AkaGambit	System of a Down	Steal This Album!	Ego Brain	29/11/07	02:24
94	AkaGambit	System of a Down	Steal This Album!	F**k the System	29/11/07	02:21
95	AkaGambit	System of a Down	Steal This Album!	Highway Song	29/11/07	02:18
96	AkaGambit	System of a Down	Steal This Album!	I-E-A-I-A-I-O	29/11/07	02:15

Database Integration:
The cleaned and processed data was then connected to a PostgreSQL database hosted on Supabase. Here's the Identifiers to connect to our postgre database in supabase and populate it.

```
jdbc_url = "jdbc:postgresql://aws-0-eu-central-1.pooler.supabase.com:6543/postgres"
properties = {
    "user": "postgres.dbwrzjfnxqhllunphygs",
    "password": "PasswordTracks2024.",
    "driver": "org.postgresql.Driver"
}

df_formatted.write.jdbc(url=jdbc_url, table="public.tracks_record", mode="overwrite", properties=properties)
```





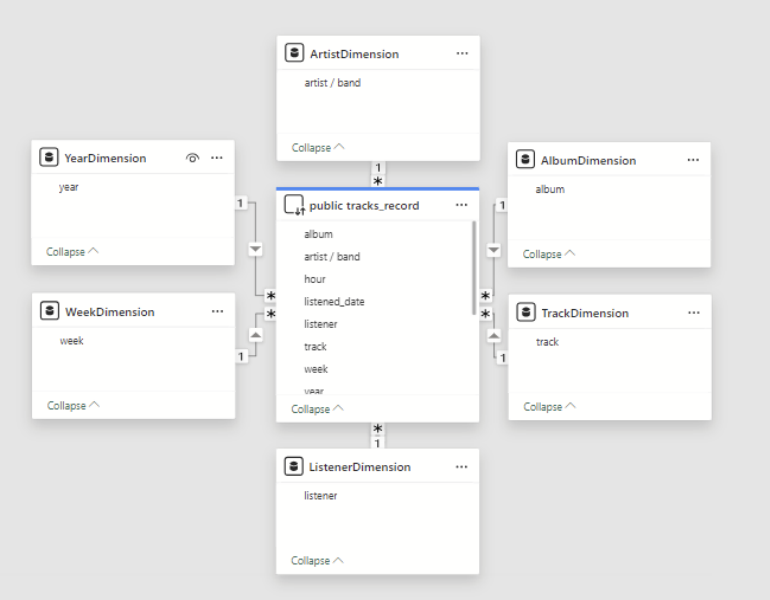
PowerBi Dashboard conception

The star model

In this project, we used a star schema to structure our data model, enhancing query performance and enabling efficient reporting. The star schema consists of a central fact table here called "**public tracks_record**" surrounded by multiple dimension tables, which simplifies data relationships and improves readability. Each table is smaller and easier to join which makes it easier to filter and query our data.

Therefore, the dimensions table here are:

Year Dimension: A table that contains a list of all unique years.
Week Dimension: A table that contains a list of all unique weeks.
Listener Dimension: A table that contains information about listeners.
Track Dimension: A table that contains information about the tracks being listened to.
Album Dimension: A table that contains information about the albums.
Artist Dimension: A table that contains information about the artists.



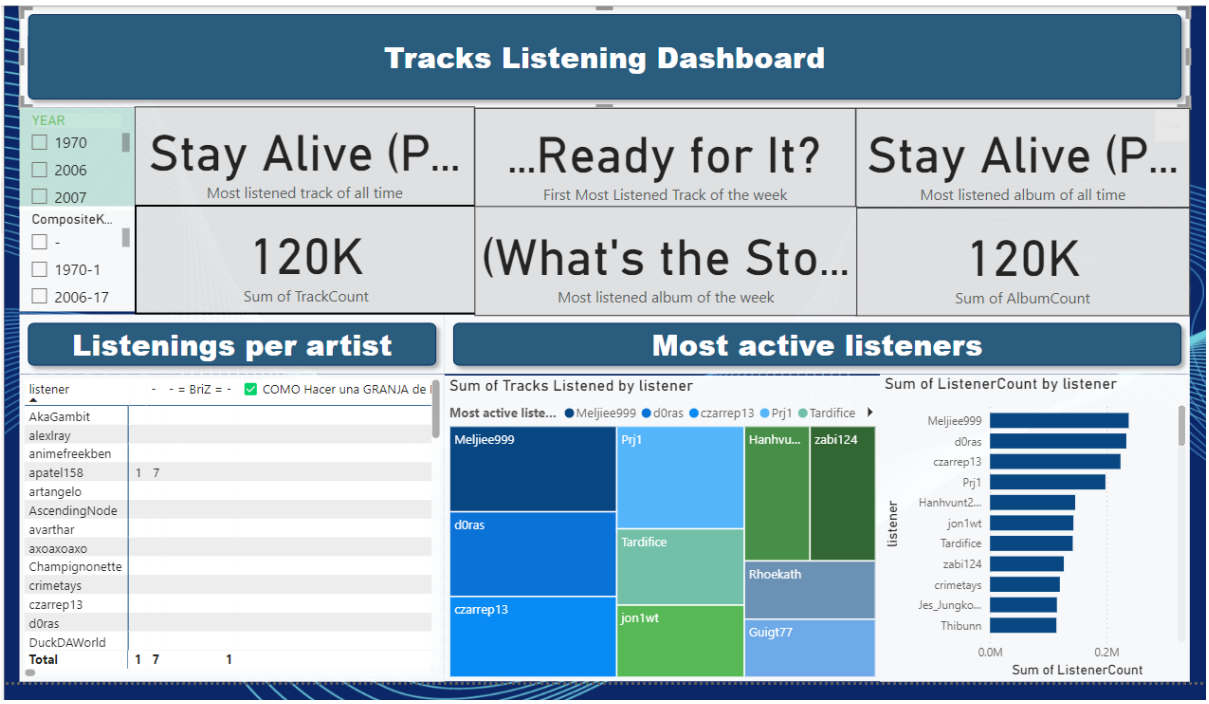
The requested KPIs

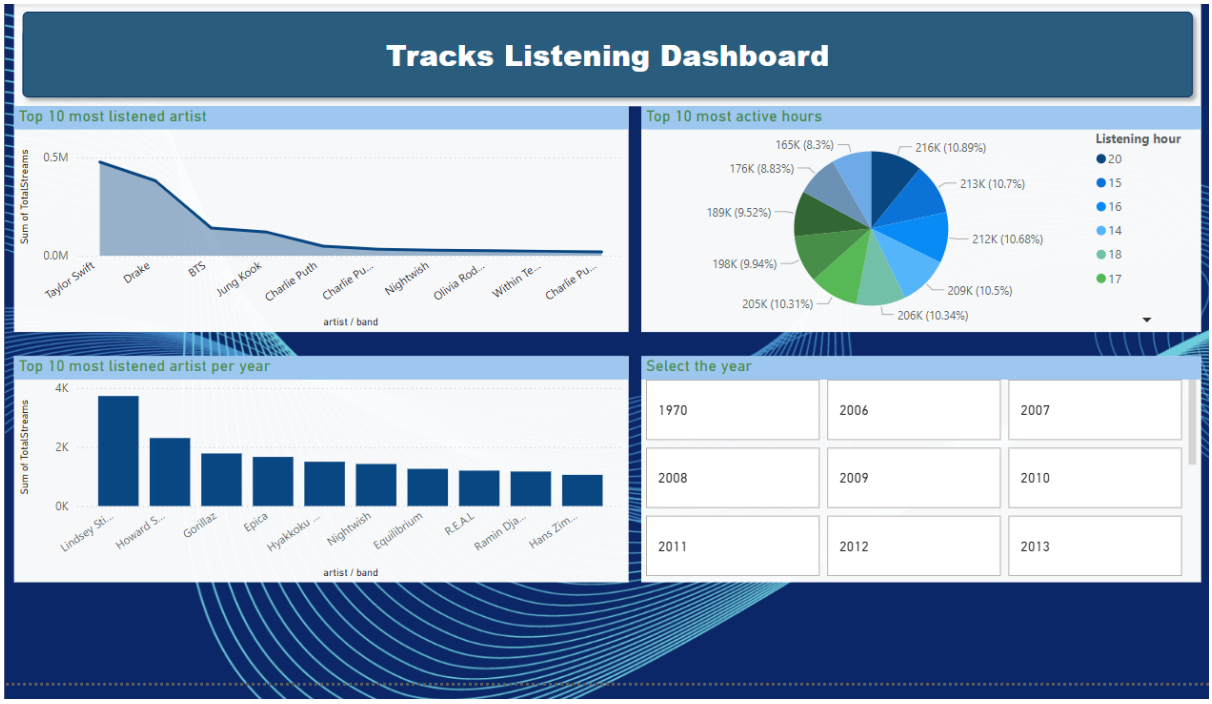
Most listened track of all time
Most listened track for each week

Most listened album of all time
Most listened album for each week
Cross tabulation of the number of listened tracks by listener and by artist
Ranking the 10 biggest listeners of all time
Ranking the 10 biggest listeners for each week

Additional KPIs
For additional KPIs, we added:
-The 10 most active hours
-The 10 most listened artists
-The most listened artist all time
-The 10 most listened artists by year

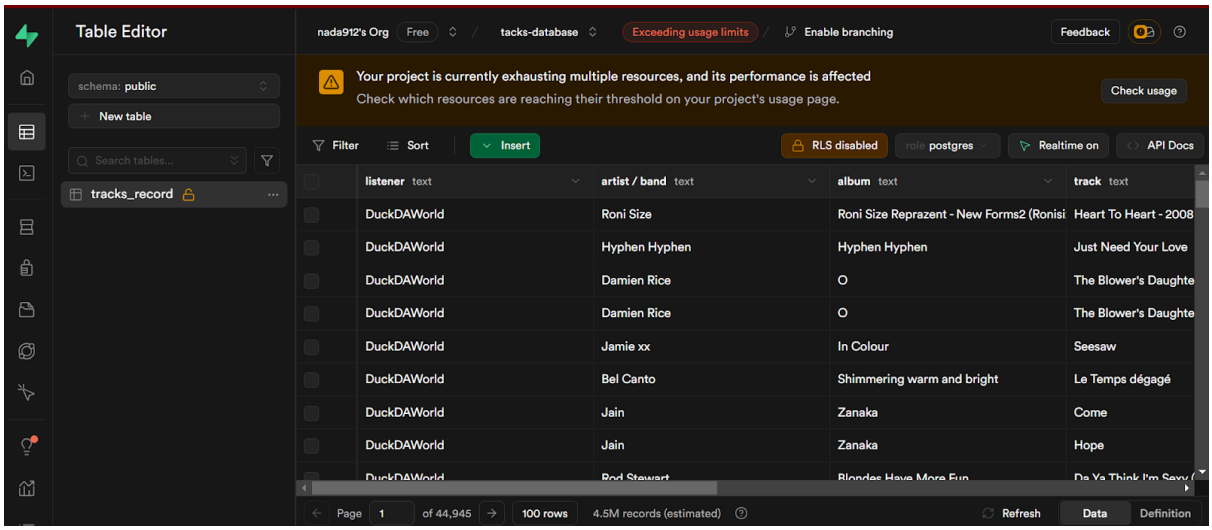
Dashboard:
https://app.powerbi.com/groups/me/reports/0d08a7dd-5c0b-49bf-8084-3ef0a6cdf71a?experience=power-bi



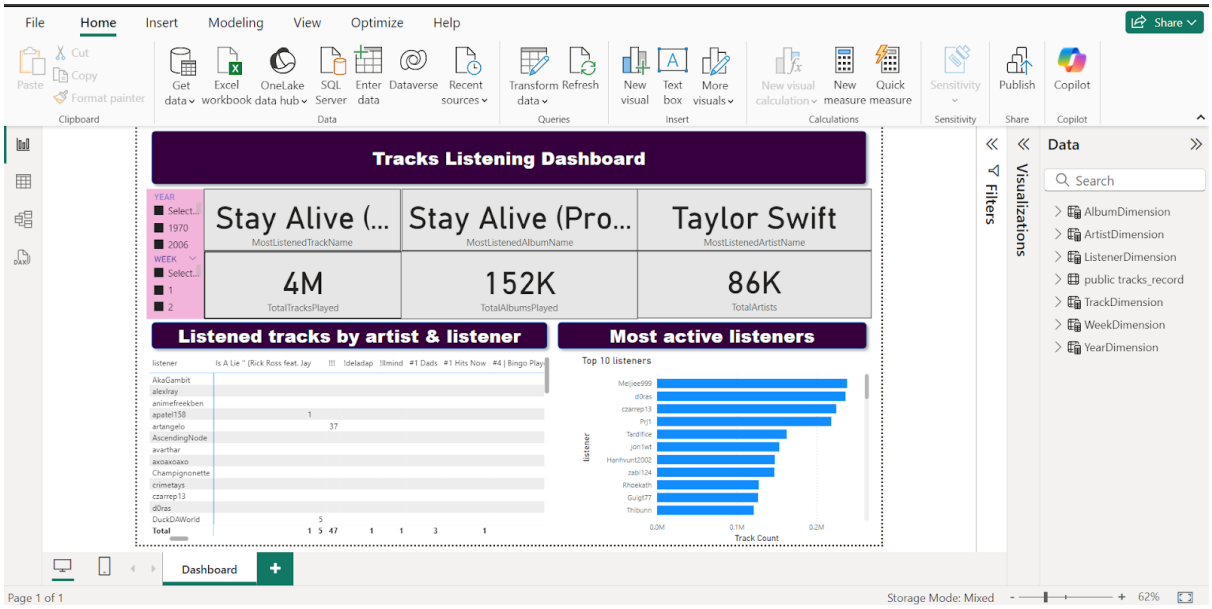


Troubles:

We opted for a direct connection to the database stored in supabase but in the free version we had some problems with the available resources so that we could keep our data updated.



So this dashboard looks like this while using the direct connection : https://app.powerbi.com/groups/me/reports/44b305e4-de77-4c69-bb24-7238383c05a3/7cdfb37a54de9da0e9c9?experience=power-bi


File
Home
Insert
Modeling
View
Optimize
Help
Share
Paste
Cut
Copy
Format painter
Clipboard
Get data
Excel workbook
OneLake data hub
SQL Server
Enter data
Dataverse
Recent sources
Data
Transform data
Refresh
Queries
New visual
Text box
More visuals
Insert
New visual calculation
New measure
Quick measure
Calculations
Sensitivity
Sensitivity
Publish
Share
Copilot
Copilot
Tracks Listening Dashboard
YEAR
Select...
1970
2006
WEEK
Select...
1
2
Stay Alive (...
MostListenedTrackName
Stay Alive (Pro...
MostListenedAlbumName
Taylor Swift
MostListenedArtistName
4M
TotalTracksPlayed
152K
TotalAlbumsPlayed
86K
TotalArtists
Listened tracks by artist & listener
Most active listeners
Top 10 listeners
Track Count
Filters
Visualizations
Data
Search
AlbumDimension
ArtistDimension
ListenerDimension
public tracks_record
TrackDimension
WeekDimension
YearDimension
Dashboard
Page 1 of 1
Storage Mode: Mixed
62%