

# **MILESTONE 5**

## **PROJECT 2**

### **GROUP – 9**

#### **TOPIC:**

## **SPOTIFY MUSIC STREAMING TREND ANALYSIS**

#### **MEMBERS:**

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# SPOTIFY MUSIC TREND ANALYTICS

The end-to-end ETL pipeline built for the Spotify music trend analytics is explained in this report. The pipeline processes raw data from the S3 bucket, transforms it into dimension and fact tables using Amazon glue, and then Amazon Athena is used for analytics

## Dataset Information:

- Source: Kaggle
- Dataset link: [Spotify Popularity Prediction-ML Practice](#)
- Format:
  - Song\_data: contains detailed information regarding the audio features of the song
    - Contains 18836 rows and 10 columns of different data types
  - Song\_info: the information regarding the song characteristics such as the artist, album, playlist etc.
    - Contains 11836 rows and 4 columns of different data types
- Generated the song\_history.json file for details regarding the number of streams and chart positions.

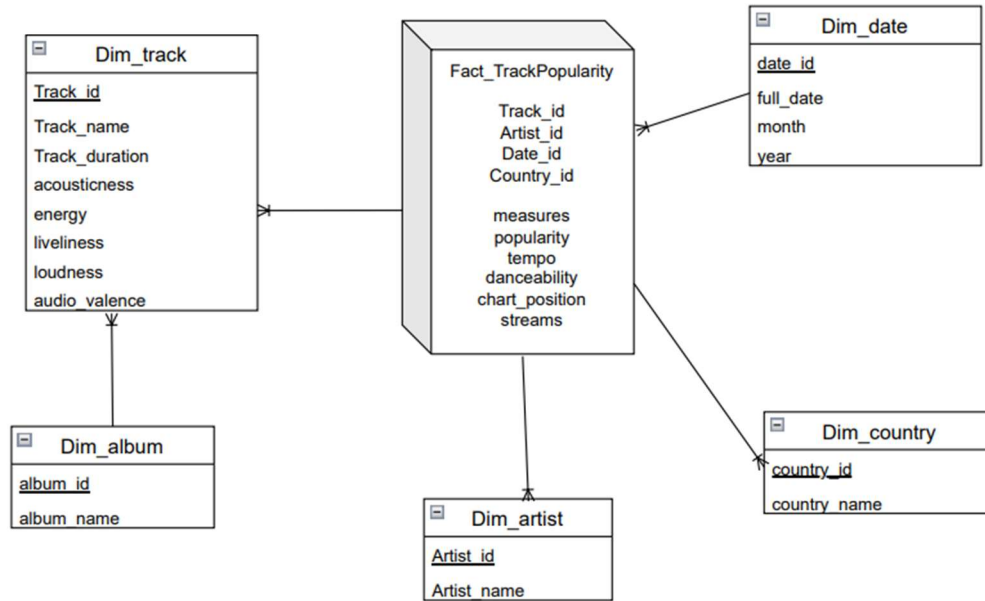
## Dimension Tables:

- Dim\_track: Contains information regarding the track such as track\_id, track name, duration, energy, danceability, liveliness..
- Dim\_artist: Contains the artist information such as the artist\_id and artist name
- Dim\_album: Contains the information regarding the album id and album name
- Dim\_date: Contains the fulldate, month and year for further analysis
- Dim\_country: contains the country\_id and country name

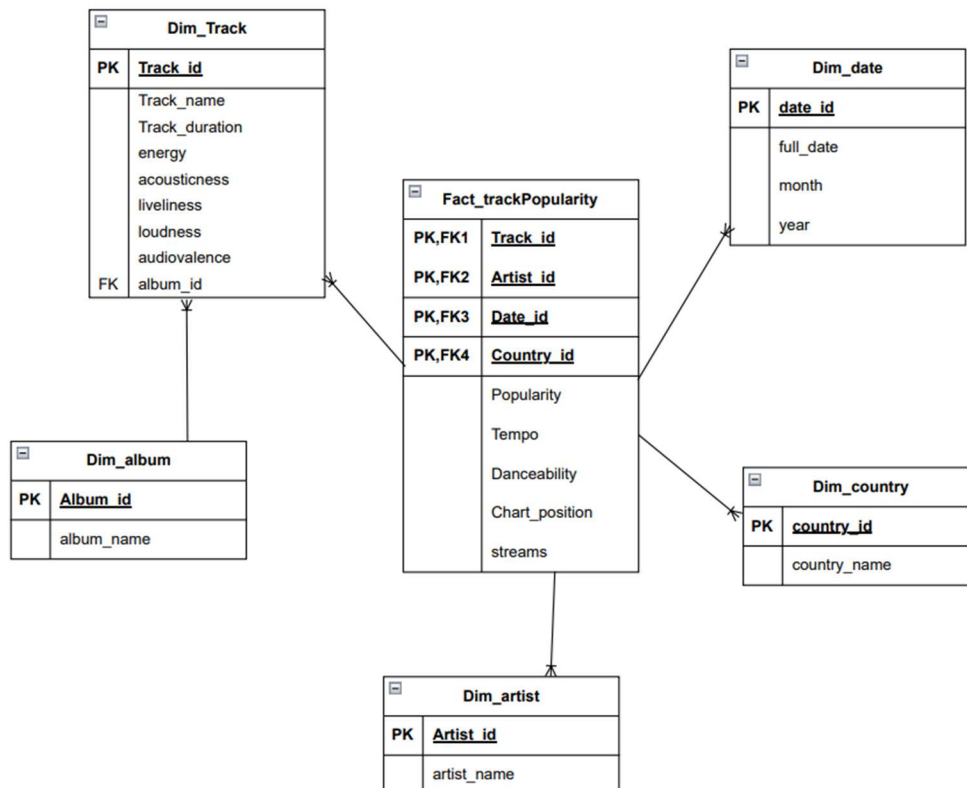
## Fact Table:

- Fact\_TrackPopularity: Contains the keys of the dimension table along with measures such as chart position, popularity and number of streams

## Conceptual model



## Logical Model



## ETL PIPELINE

- **Storage layer**
  - Amazon S3 bucket:
  - Raw data path:
  - Processed data path:
- **Processing layer**
  - AWS Lambda Trigger: Activates Glue ETL jobs when all required files are present. Sequential job execution (dimension tables first, fact tables second)
  - AWS Glue ETL Jobs: Creates dimension tables from raw data and creates fact tables referencing dimension tables
- **Data Crawling**
  - Processed-data crawler: Scans the processed data files to create catalog
  - Raw-data crawler: Scans the raw data files to create catalog tables
- **Serving layer**
  - AWS Athena is used as a SQL query interface for the analytics. It enables direct querying of the processed data

### Data Extraction:

- An S3 bucket is created for storing data.
- Manually uploaded the csv and the json files to the raw data folder created in the bucket
- A lambda function will be enabled on the bucket, once the files are uploaded it will trigger the ETL jobs

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Amazon S3 > Buckets

General purpose buckets | All AWS Regions | Directory buckets

General purpose buckets (1) Info

Buckets are containers for data stored in S3.

Find buckets by name

Name

AWS Region

Creation date

spotify-popularity-analytics

US East (N. Virginia) us-east-1

November 21, 2025, 15:38:11 (UTC-05:00)

Copy ARN

Empty

Delete

Create bucket

Account snapshot Info

Updated daily

Storage Lens provides visibility into storage usage and activity trends.

View dashboard

External access summary - new Info

Updated daily

External access findings help you identify bucket permissions that allow public access or access from other AWS accounts.

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Amazon S3 > Buckets > spotify-popularity-analytics

spotify-popularity-analytics Info

Objects | Metadata | Properties | Permissions | Metrics | Management | Access Points

Objects (2)

Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 inventory](#) to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. [Learn more](#)

Find objects by prefix

Name

Type

Last modified

Size

Storage class

processed-data/

Folder

-

-

-

raw-data/

Folder

-

-

-

Copy S3 URI

Copy URL

Download

Open

Delete

Actions

Create folder

Upload

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Amazon S3 > Buckets > spotify-popularity-analytics > raw-data/

raw-data/ Copy S3 URI

Objects Properties

Objects (3) Copy S3 URI Copy URL Download Open Delete Actions Create folder Upload

Find objects by prefix

	Name	Type	Last modified	Size	Storage class
<input type="checkbox"/>	<a href="#">song_data.csv</a>	csv	November 21, 2025, 15:39:45 (UTC-05:00)	2.1 MB	Standard
<input type="checkbox"/>	<a href="#">song_info.csv</a>	csv	November 21, 2025, 15:39:46 (UTC-05:00)	1.2 MB	Standard
<input type="checkbox"/>	<a href="#">track_history.json</a>	json	November 21, 2025, 15:39:44 (UTC-05:00)	2.8 MB	Standard

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## Data Crawling

- The datasets in the raw data are made available in the data catalogue using the AWS Glue Crawler. Which crawls all the sub folders present in the raw data for data.

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AWS Glue > Crawlers > rawdata

**AWS Glue**

- Getting started
- ETL jobs
  - Visual ETL
  - Notebooks
  - Job run monitoring
- Data Catalog tables
- Data connections
- Workflows (orchestration)
- Zero-ETL integrations [New](#)
- Data Catalog**
  - Databases
  - Tables
  - Stream schema registries
  - Schemas
  - Connections
  - Crawlers**
  - Classifiers
  - Catalog settings
- Data Integration and ETL**
- Legacy pages**
- What's New [↗](#)
- Documentation [↗](#)
- AWS Marketplace
- ☐ Enable compact mode
- ☐ Enable new navigation

**rawdata** Last updated (UTC) November 21, 2025 at 20:48:58 Run crawler Edit Delete

**Crawler successfully starting**  
The following crawler is now starting: "rawdata"

**Crawler properties**

Name rawdata	IAM role <a href="#">LabRole</a>	Database spotify	State READY
Description -	Security configuration -	Lake Formation configuration -	Table prefix -
Maximum table threshold -			

**Advanced settings**

**Crawler runs** Schedule Data sources Classifiers Tags

**Crawler runs (1)** Stop run View CloudWatch logs View run details

The list of crawler runs for this crawler.

	Start time (UTC)	End time (UTC)	Current/last duration	Status	DPU hours	Table changes
<input type="radio"/>	November 21, 2025 at 20:49:04	November 21, 2025 at 20:49:46	42 s	Completed	0.121	3 table changes, 0 partition changes

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The screenshot displays the AWS Glue console interface. On the left, a navigation pane lists various AWS Glue services including ETL jobs, Visual ETL, Notebooks, Job run monitoring, Data Catalog tables, Data connections, Workflows (orchestration), Zero-ETL integrations, Data Catalog, Databases, Tables, Stream schema registries, Schemas, Connections, Crawlers, Classifiers, and Catalog settings. The main content area shows the 'spotify' database properties and a list of tables.

**Database properties**

Name	Description	Location	Created on (UTC)
spotify	-	-	November 21, 2025 at 20:48:00

**Tables (3)**

View and manage all available tables.

Filter tables

Name	Database	Location	Classification	Deprecated	View data	Data quality	Column statistics
song_data_csv	spotify	s3://spotify-popularity-ana	CSV	-	<a href="#">Table data</a>	<a href="#">View data quality</a>	<a href="#">View statistics</a>
song_info_csv	spotify	s3://spotify-popularity-ana	CSV	-	<a href="#">Table data</a>	<a href="#">View data quality</a>	<a href="#">View statistics</a>
track_history_json	spotify	s3://spotify-popularity-ana	JSON	-	<a href="#">Table data</a>	<a href="#">View data quality</a>	<a href="#">View statistics</a>

## Data Transformation

- The AWS Glue python script is used to transform the raw data into processed data, that is the dimension tables and fact table
  - Dimsong
  - Dimartist
  - Dimalbum
  - Dimdate
  - Dimcountry
  - FactSongPopularity
- Created two scripts for the data transformation. Create\_dim\_tables and create\_fact\_table for the transformation of raw data to processed data.





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create\_fact\_table

Last modified on 11/21/2025, 6:00:20 PM

Actions Save Run

ScriptJob detailsRunsData qualitySchedulesVersion Control

Job runs (1/8) info

Last updated (UTC) November 21, 2025 at 23:02:27

View detailsStop job runTroubleshoot with AI

Table ViewCard View

Filter job runs by property

Run status	Retries	Start time (Local)	End time (Local)	Duration	Capacity (DPU)	Worker type	Glue version
<input checked="" type="radio"/> Succeeded	0	11/21/2025 18:00:23	11/21/2025 18:02:16	1 m 41 s	10 DPUs	G.1X	5.0
<input type="radio"/> Failed	0	11/21/2025 17:57:45	11/21/2025 17:59:27	1 m 35 s	10 DPUs	G.1X	5.0
<input type="radio"/> Failed	0	11/21/2025 17:54:47	11/21/2025 17:56:21	1 m 27 s	10 DPUs	G.1X	5.0
<input type="radio"/> Failed	0	11/21/2025 17:50:28	11/21/2025 17:52:01	1 m 27 s	10 DPUs	G.1X	5.0

Run detailsInput arguments (9)LogsRun insightsMetricsTroubleshooting analysis - previewSpark UI

Job namecreate\_fact\_table

Start time (Local)11/21/2025 18:00:23

Glue version5.0

Last modified on (Local)11/21/2025 18:02:16

Idjr\_e20d34e90987f86e0a0e35ef7c4faa45d4bd59e176fe11b8c7b901640d814d42

End time (Local)11/21/2025 18:02:16

Worker typeG.1X

Log group name/aws-glue/jobs

Run statusSucceeded

Start-up time12 seconds

Max capacity10 DPUs

Number of workers10

Retry attempt numberExecution time1 minute 41 seconds

Execution classStandard

Timeout480 minutes

Initial runCloudwatch logs

Usage profile-

Trigger name-

Security configuration-

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create\_fact\_table

Last modified on 11/21/2025, 6:00:20 PM

Actions Save Run

ScriptJob detailsRunsData qualitySchedulesVersion Control

Script info

```
1 import sys
2 from aws glue.context import GlueContext
3 from pyspark.context import SparkContext
4 from pyspark.sql import functions as F
5 from pyspark.sql.window import Window
6 from pyspark.sql.functions import col
7
8
9 # Glue context
10 sc = SparkContext()
11 glueContext = GlueContext(sc)
12 spark = glueContext.spark_session
13
14 # Input paths for fact job
15 song_history_path = "s3://spotify-popularity-analytics/raw-data/track_history.json"
16 song_info_path = "s3://spotify-popularity-analytics/raw-data/song_info.csv"
17 song_data_path = "s3://spotify-popularity-analytics/raw-data/song_data.csv"
18 dim_song_path = "s3://spotify-popularity-analytics/processed-data/DimSong/"
19 dim_artist_path = "s3://spotify-popularity-analytics/processed-data/DimArtist/"
20 dim_album_path = "s3://spotify-popularity-analytics/processed-data/DimAlbum/"
21 dim_date_path = "s3://spotify-popularity-analytics/processed-data/DimDate/"
22 dim_country_path = "s3://spotify-popularity-analytics/processed-data/DimCountry/"
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25 # Load dimension tables
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**AWS Glue**

Getting started  
ETL jobs  
Visual ETL  
**Notebooks**  
Job run monitoring  
Data Catalog tables  
Data connections  
Workflows (orchestration)  
Zero-ETL integrations [New](#)

▼ **Data Catalog**  
Databases  
Tables  
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Schemas  
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Crawlers  
Classifiers  
Catalog settings

► **Data Integration and ETL**  
► **Legacy pages**

What's New [i](#)  
Documentation [i](#)  
AWS Marketplace

Enable compact mode  
Enable new navigation

### create\_dim\_tables

Last modified on 11/21/2025, 5:04:37 PM [Actions](#) [Save](#) [Run](#)

[Script](#) [Job details](#) [Runs](#) [Data quality](#) [Schedules](#) [Version Control](#)

**Script** [info](#)

```
1 import sys
2 from aws glue.context import GlueContext
3 from pyspark.context import SparkContext
4 from pyspark.sql import functions as F
5 from pyspark.sql.window import Window
6 from pyspark.sql.types import StructType, StructField, StringType, IntegerType, LongType
7
8 # Glue context
9 sc = SparkContext()
10 glueContext = GlueContext(sc)
11 spark = glueContext.spark_session
12
13 # Input paths
14 song_info_path = "s3://spotify-popularity-analytics/raw-data/song_info.csv"
15 song_data_path = "s3://spotify-popularity-analytics/raw-data/song_data.csv"
16 song_history_path = "s3://spotify-popularity-analytics/raw-data/track_history.json"
17
18 # Read raw data
19 song_info_df = spark.read.option("header", True).csv(song_info_path)
20 song_data_df = spark.read.option("header", True).csv(song_data_path)
21 song_history_df = spark.read.json(song_history_path)
22
23 # DimAlbum
24 # -----
25 album_dim = song_info_df.select("album_names").dropDuplicates() \
```

Python Ln 21, Col 53 Errors: 0 Warnings: 0

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**Amazon S3**

[Amazon S3](#) > [Buckets](#) > [spotify-popularity-analytics](#) > [processed-data/](#)

**Amazon S3**

General purpose buckets  
Directory buckets  
Table buckets  
Vector buckets  
Access Grants  
Access Points (General Purpose Buckets, FSx file systems)  
Access Points (Directory Buckets)  
Object Lambda Access Points  
Multi-Region Access Points  
Batch Operations  
IAM Access Analyzer for S3

Block Public Access settings for this account

▼ **Storage Lens**  
Dashboards  
Storage Lens groups  
AWS Organizations settings

Feature spotlight **11**

► **AWS Marketplace for S3**

### processed-data/

[Copy S3 URI](#)

[Objects](#) [Properties](#)

**Objects (6)** [Copy S3 URI](#) [Copy URL](#) [Download](#) [Open](#) [Delete](#) [Actions](#) [Create folder](#) [Upload](#)

Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 inventory](#) to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. [Learn more](#)

Find objects by prefix

<input type="checkbox"/>	Name	Type	Last modified	Size	Storage class
<input type="checkbox"/>	<a href="#">DimAlbum/</a>	Folder	-	-	-
<input type="checkbox"/>	<a href="#">DimArtist/</a>	Folder	-	-	-
<input type="checkbox"/>	<a href="#">DimCountry/</a>	Folder	-	-	-
<input type="checkbox"/>	<a href="#">DimDate/</a>	Folder	-	-	-
<input type="checkbox"/>	<a href="#">DimSong/</a>	Folder	-	-	-
<input type="checkbox"/>	<a href="#">FactSongPopularity/</a>	Folder	-	-	-

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## Data Catalog

- A glue crawler is used to make the data in the processed S3 bucket available in the Data Catalog by scanning all the subfolders within the specified bucket.



aws [Search] [Alt+S] United States (N. Virginia) Account ID: 5699-4215-8796 voclabs/user4576769-Kavya\_Pati\_Bandia

AWS Glue > Databases > spotify-popularity

**AWS Glue**

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  - Notebooks
  - Job run monitoring
- Data Catalog tables
- Data connections
- Workflows (orchestration)
- Zero-ETL integrations [New](#)

▼ **Data Catalog**

**Databases**

- Tables
- Stream schema registries
- Schemas
- Connections
- Crawlers
- Classifiers
- Catalog settings

► **Data Integration and ETL**

► **Legacy pages**

- What's New
- Documentation
- AWS Marketplace

Enable compact mode

Enable new navigation

**Announcing new optimization features for Apache Iceberg tables**  
Optimize storage for Apache Iceberg tables with automatic snapshot retention and orphan file deletion. [Learn more](#)

**spotify-popularity** Last updated (UTC) November 21, 2025 at 23:11:38 [Edit](#) [Delete](#)

**Database properties**

Name	Description	Location	Created on (UTC)
spotify-popularity	-	-	November 21, 2025 at 23:07:25

**Tables (6)** Last updated (UTC) November 21, 2025 at 23:11:39 [Delete](#) [Add tables using crawler](#) [Add table](#)

View and manage all available tables.

<input type="checkbox"/>	Name	Database	Location	Classification	Deprecated	View data	Data quality	Column statistics
<input type="checkbox"/>	dimalbum	spotify-popularity	s3://spotify-popularity-anz	Parquet	-	<a href="#">Table data</a>	<a href="#">View data quality</a>	<a href="#">View statistics</a>
<input type="checkbox"/>	dimartist	spotify-popularity	s3://spotify-popularity-anz	Parquet	-	<a href="#">Table data</a>	<a href="#">View data quality</a>	<a href="#">View statistics</a>
<input type="checkbox"/>	dimcountry	spotify-popularity	s3://spotify-popularity-anz	Parquet	-	<a href="#">Table data</a>	<a href="#">View data quality</a>	<a href="#">View statistics</a>
<input type="checkbox"/>	dimdate	spotify-popularity	s3://spotify-popularity-anz	Parquet	-	<a href="#">Table data</a>	<a href="#">View data quality</a>	<a href="#">View statistics</a>
<input type="checkbox"/>	dimsong	spotify-popularity	s3://spotify-popularity-anz	Parquet	-	<a href="#">Table data</a>	<a href="#">View data quality</a>	<a href="#">View statistics</a>
<input type="checkbox"/>	factsongpopularity	spotify-popularity	s3://spotify-popularity-anz	Parquet	-	<a href="#">Table data</a>	<a href="#">View data quality</a>	<a href="#">View statistics</a>

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43°F Mostly cloudy 6:11 PM 11/21/2025

## Data Loading:

- The target tables are then loaded into Athena for querying and for popularity analytics of the Spotify music

aws [Search] [Alt+S] United States (N. Virginia) Account ID: 5699-4215-8796 voclabs/user4576769-Kavya\_Pati\_Bandia

Amazon Athena > Query editor

**Data**

Data source: [AwsDataCatalog](#)

Catalog: [None](#)

Database: [spotify-popularity](#)

Tables and views [Create](#) [Filter tables and views](#)

▼ **Tables (6)** < 1 >

- [dimalbum](#)
- [dimartist](#)
- [dimcountry](#)
- [dimdate](#)
- [dimsong](#)
- [factsongpopularity](#)

► **Views (0)** < 1 >

**Query editor**

1 select \* from factsongpopularity

2

SQL Ln 1, Col 1

[Run again](#) [Explain](#) [Cancel](#) [Clear](#) [Create](#)

[Reuse query results up to 60 minutes ago](#)

**Query results** [Query stats](#)

Completed Time in queue: 106 ms Run time: 1:109 sec Data scanned: 521.14 KB

[Copy](#) [Download results CSV](#)

**Results (18,835)**

#	song_id	artist_id	date_id	country_id	chart_position	streams	song_popularity	tempo
1	1600	2510	20160611	2	200	8642887002	73	167.06
2	5564	3829	20990115	4	179	7725307844	66	105.256
3	9649	6728	20961022	2	34	3398903753	76	123.881
4	1799	5359	20960924	3	47	7815606665	74	122.444

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44°F Light rain 11:49 AM 11/22/2025