ESTUDO DE CASO: UBER

Big Data

RELEMBRANDO...

CONTEXTUALIZAÇÃO

PIONEIRA NO SEGMENTO DE TRANSPORTE

Desenvolve serviços de mobilidade, entregas e transporte de mercadorias (freight)

PRESENTE EM 72 PAÍSES

Atua em todos os continentes urbanos e processa uma enorme volume de dados dado seu alcance global

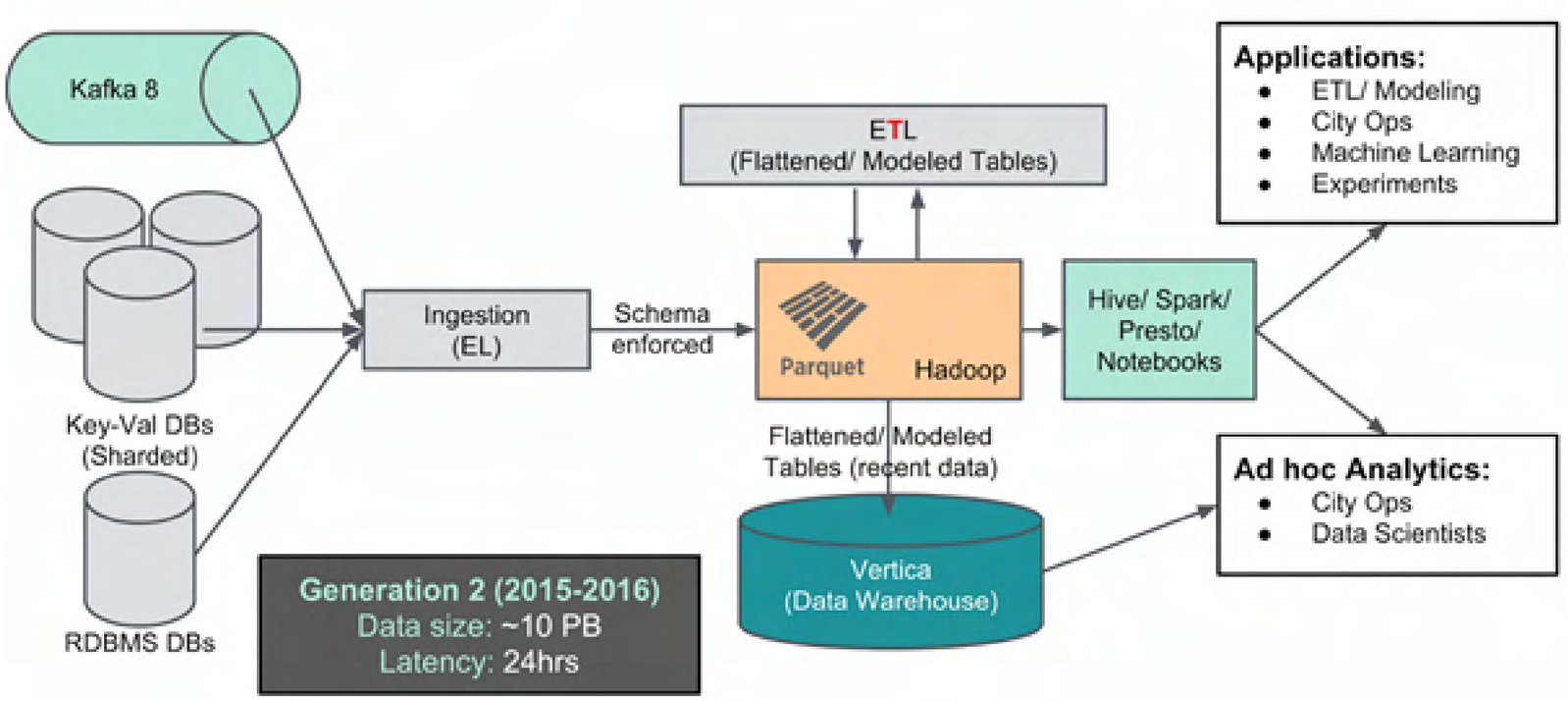
MASSIVA REDE DE COLABORADORES

A Uber possui milhões de colaboradores, entre eles: motoristas, consumidores, comerciantes, transportadoras e entregadores

Arquitetura dos Sistemas de Big Data

Ecossistema Hadoop

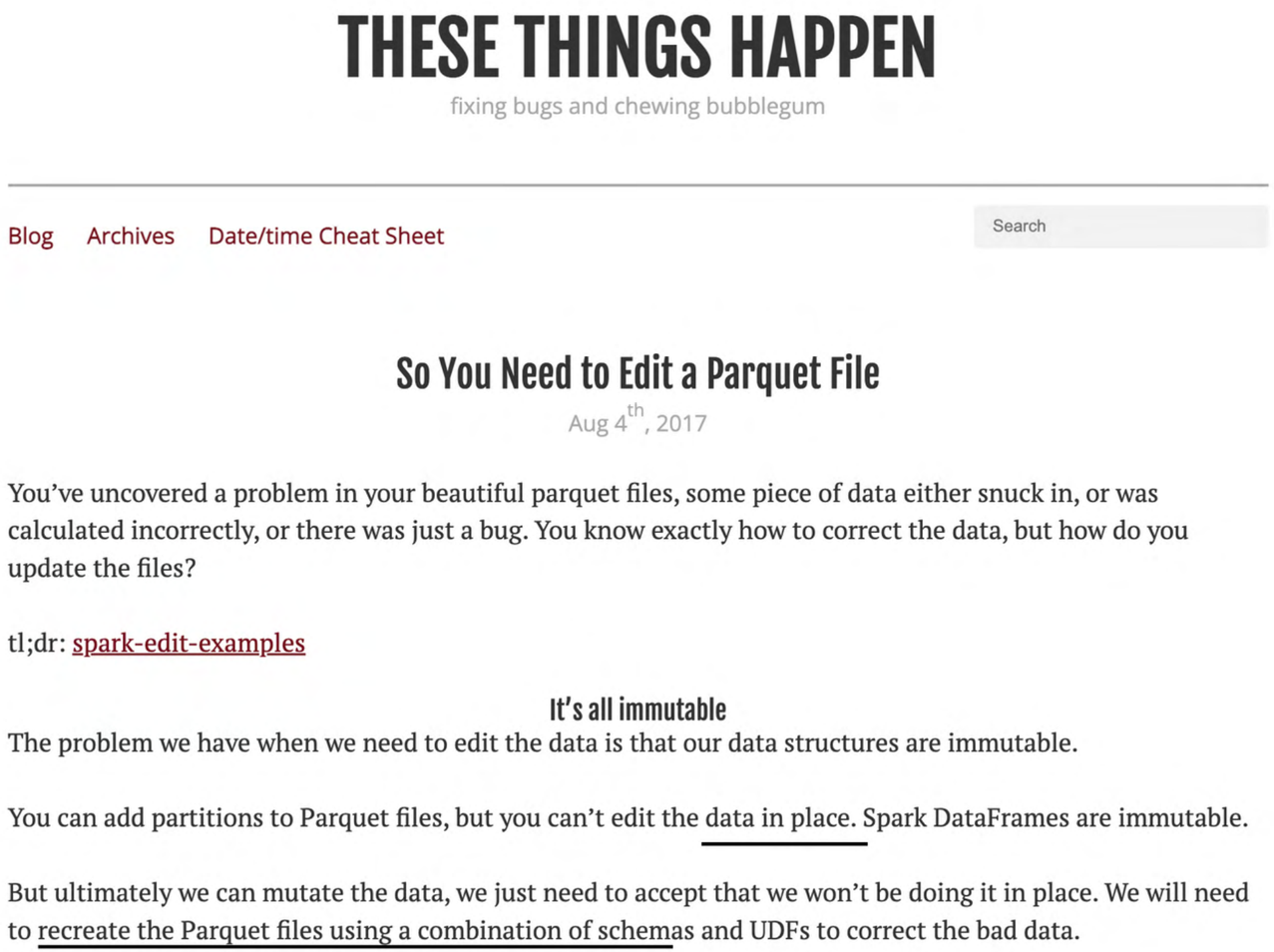
Nova abordagem permitiu ganhos de performance na ingestão e transformações desnecessárias de dados. Tal estrutura foi desenhada para ser utilizada em conjunto com o Presto, Apache Spark, Apache Hive e Apache Parquet



LIMITAÇÃO ESCOLHIDA:

Arquivos .Parquet não podem ser alterados

Imutabilidade dos arquivos Parquet



THESE THINGS HAPPEN

fixing bugs and chewing bubblegum

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So You Need to Edit a Parquet File

Aug 4th, 2017

You've uncovered a problem in your beautiful parquet files, some piece of data either snuck in, or was calculated incorrectly, or there was just a bug. You know exactly how to correct the data, but how do you update the files?

tl;dr: spark-edit-examples

It's all immutable

The problem we have when we need to edit the data is that our data structures are immutable.

You can add partitions to Parquet files, but you can't edit the data in place. Spark DataFrames are immutable.

But ultimately we can mutate the data, we just need to accept that we won't be doing it in place. We will need to recreate the Parquet files using a combination of schemas and UDFs to correct the bad data.

COMO A LIMITAÇÃO FORA MITIGADA?

DELTA LAKE

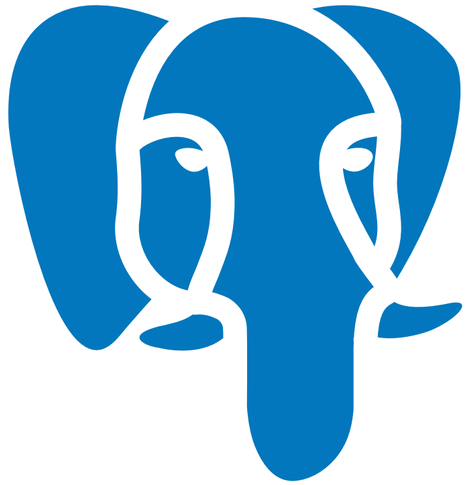
Experimentos

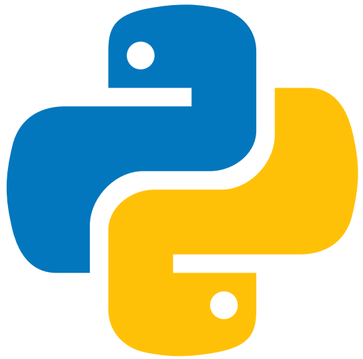
Alterações em um Conjunto de Dados

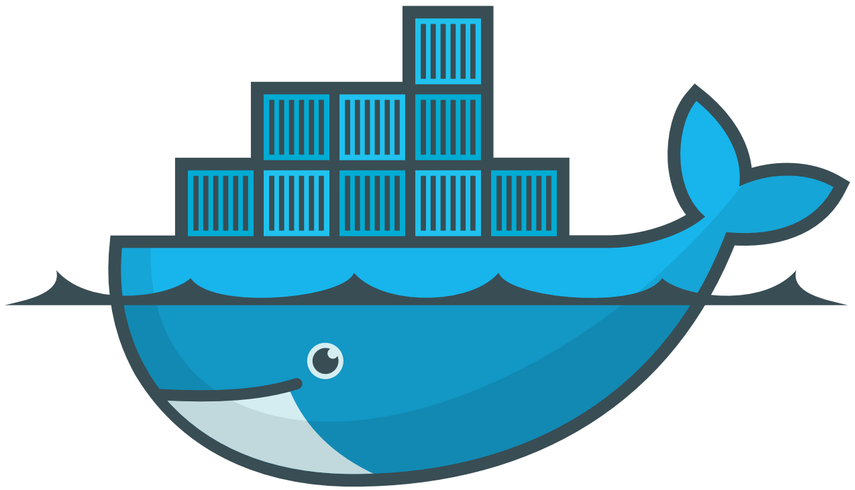
Salvar os Dados Alterados no Banco de Dados

Recuperar Dados Erroneamente Deletados ou alterados

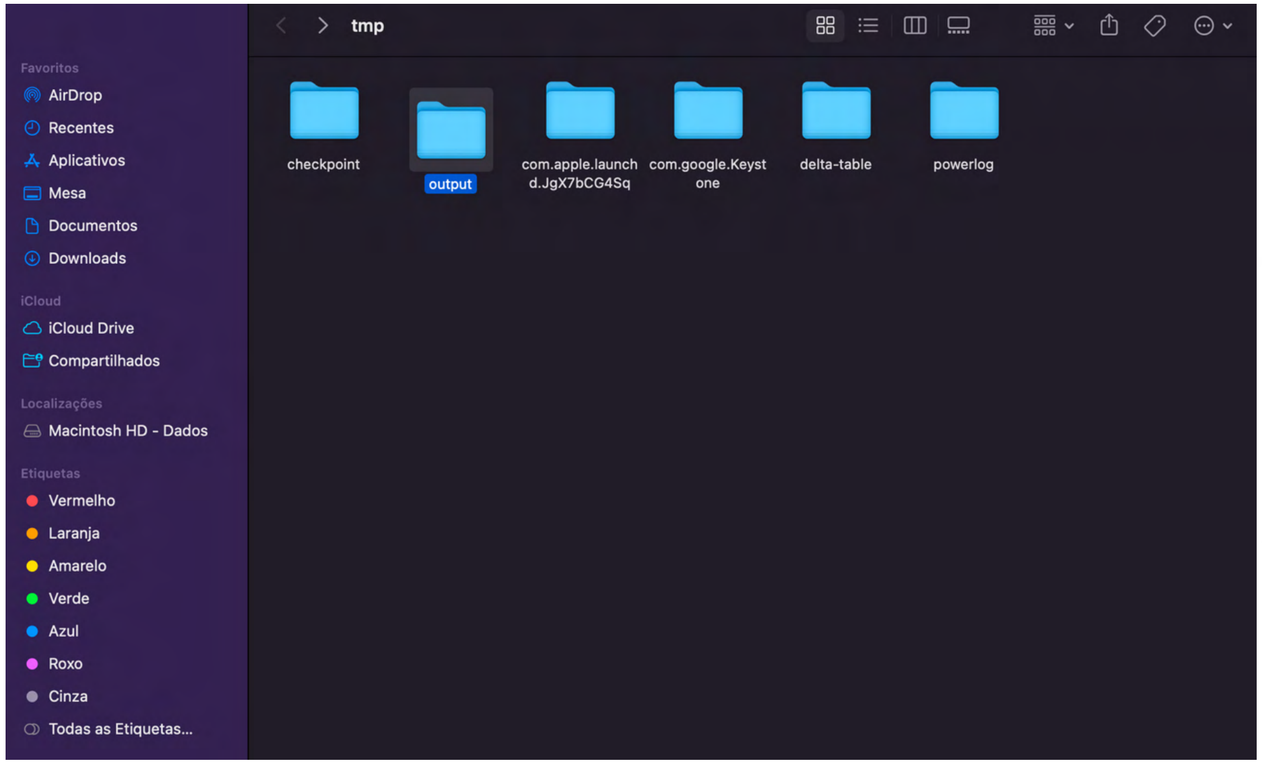
Preparação







Preparação



Importar as bibliotecas necessárias.

[1]:
```
import pyspark
from pyspark.sql import SparkSession
from pyspark.sql import Row
from delta.tables import *
from delta import *
import pyspark.sql.functions as PSF
import psycopg2
import pandas as pd
import os
import time
```

Coletar as variaveis de ambiente definidas em Variáveis de Ambiente.

[5]:
```
env_vars = !cat ../Environment/.env
for var in env_vars:
    key, value = var.split('=')
    os.environ[key] = value
```

Configuração do Ambiente

[6]:
```
builder = pyspark.sql.SparkSession.builder.appName("PySpark_Postgres_test").config("spark.jars", os.environ.get('SPARKJAR')) \
    .config("spark.sql.extensions", "io.delta.sql.DeltaSparkSessionExtension") \
    .config("spark.sql.catalog.spark_catalog", "org.apache.spark.sql.delta.catalog.DeltaCatalog") \
    .master("local").appName("PySpark_Postgres_test")

spark = configure_spark_with_delta_pip(builder).getOrCreate()
```

Preparação

Ler o arquivo a fim de enviá-lo para o banco de dados.

[8]:
```
dataf = spark.read.format("csv").option("delimiter", ",").option("header", "true").option("inferSchema", "true") \
        .load("../data/200ksales.csv")
dataf.show()
```

```
+--------------------+--------------------+-------------+-------------+--------------+----------+----------+----------+--------+
|              Region|             Country|    Item_Type|Sales_Channel|Order_Priority|Order_Date|  Order_ID| Ship_Date|Units_Sold|Unit_Price|Unit_Cost|Total_Revenue|Total_Cost|Total_Profit|
+--------------------+--------------------+-------------+-------------+--------------+----------+----------+----------+----------+----------+---------+-------------+----------+------------+
|Australia and Oce...|           Australia|         Meat|       Online|             C|  4/4/2011|451691138| 5/23/2011|        43|       421|      364|      1814127|   1568167|      245960|
|                Asia|          Tajikistan|Personal Care|       Online|             L| 7/12/2018|144177377|  8/1/2018|        41|        45|       81|       338770|    234897|      103873|
|  Sub-Saharan Africa|          Mozambique|    Cosmetics|       Online|             H|  7/6/2011|982716166| 7/17/2011|        64|       437|      263|      2801140|   1687155|     1113985|
|Central America a...|              Panama|Personal Care|      Offline|             L|  5/1/2011|784543836| 5/11/2011|        28|        10|       81|       229661|    159242|       70418|
|      North America|              Canada|       Fruits|       Online|             H|11/15/2013|137209212|12/29/2013|        21|        10|        9|        19686|     14601|        5085|
|              Europe|               Italy|       Fruits|      Offline|             C| 7/16/2016|148573625| 7/18/2016|        50|        92|        9|        47508|     35236|       12271|
|              Europe|             Romania|    Beverages|      Offline|             C|11/15/2012|196810901| 12/1/2012|        95|        74|       47|       454286|    304357|      149928|
|Australia and Oce...|           Australia|    Cosmetics|      Offline|             L| 4/30/2019|180407369| 5/25/2019|        54|        04|      437|      2362628|   1423035|      939593|
|              Europe|Bosnia and Herzeg...|    Cosmetics|      Offline|             C| 5/29/2016|968161857|  6/8/2016|        94|        63|      437|      4137223|   2491891|     1645331|
|                Asia|               Japan|      Clothes|       Online|             M| 3/25/2018|349185693|  4/8/2018|         6|        61|      109|        72234|     23690|       48543|
|Australia and Oce...|    Papua New Guinea|    Beverages|       Online|             H| 8/28/2013|682902705| 9/18/2013|        49|        41|       47|       234450|    157074|       77376|
```

[9]:
```
lista_de_colunas_inteiro = ["Units_Sold", "Unit_Price", "Unit_Cost", "Total_Revenue", "Total_Cost", "Total_Profit"]

def convert_data_types(df, columns_list):
    for column_name in columns_list:
        df.select(PSF.col(column_name).cast('bigint').alias(column_name))
    return df
```

[10]:
```
convert_data_types(dataf, lista_de_colunas_inteiro)
```

```
DataFrame[Region: string, Country: string, Item_Type: string, Sales_Channel: string, Order_Priority: string, Order_Date: string, Order_ID: int, Ship_Date: string, Units_Sold: int, Unit_Price: int, Unit_Cost: int, Total_Revenue: int, Total_Cost: int, Total_Profit: int]
```

Salvar o arquivo 200ksales.csv no banco de dados.

```
# O parâmetro OVERWRITE somente será True se já
# existir uma tabela cujo nome é o passado no
# parâmetro DBNAME.

def save_data_to_database(df, dbname: str, overwrite: bool):
    if overwrite:
        df.write.format("jdbc").option("driver", "org.postgresql.Driver").option("url", os.environ.get('DB_CONNECTION_STRING')
        .option("dbtable", dbname).option("user", os.environ.get('USER')).option("password", os.environ.get('PASSWORD')) \
        .mode("overwrite").save()

        return print("Overwrite done!")

    else:
        df.write.format("jdbc").option("driver", "org.postgresql.Driver").option("url", os.environ.get('DB_CONNECTION_STRING')
        .option("dbtable", dbname).option("user", os.environ.get('USER')).option("password", os.environ.get('PASSWORD')).save(

        return print("Saved without overwrite!")

save_data_to_database(dataf, "sales", True)
```

Experimentos

```
[4]: dataf = spark.read.format("jdbc").option("url", os.environ.get('DB_CONNECTION_STRING')) \
         .option("driver", "org.postgresql.Driver").option("dbtable", "sales") \
         .option("user", os.environ.get('USER')).option("password", os.environ.get('PASSWORD')).load()
```

```
[5]: dataf.where(dataf.Order_ID == 451691138).show()
```

```
+--------------------+---------+---------+-------------+--------------+----------+--------+---------+----
-------+-------------+----------+------------+
|              Region|  Country|Item_Type|Sales_Channel|Order_Priority|Order_Date| Order_ID|Ship_Date|Unit
it_Cost|Total_Revenue|Total_Cost|Total_Profit|
+--------------------+---------+---------+-------------+--------------+----------+--------+---------+----
-------+-------------+----------+------------+
|Australia and Oce...|Australia|     Meat|       Online|             C|  4/4/2011|451691138|5/23/2011|
364|      1814127|   1568167|      245960|
+--------------------+---------+---------+-------------+--------------+----------+--------+---------+----
-------+-------------+----------+------------+
```

```
[37]: dataf.write.format("delta").save("/tmp/output/experimentodelta")
```

```
[38]: parDF = spark.read.format("delta").load("/tmp/output/experimentodelta")
      parDF.where(parDF.Order_ID == 451691138).show()
```

```
+--------------------+---------+---------+-------------+--------------+----------+--------+---------+----
-------+-------------+----------+------------+
|              Region|  Country|Item_Type|Sales_Channel|Order_Priority|Order_Date| Order_ID|Ship_Date|Unit
it_Cost|Total_Revenue|Total_Cost|Total_Profit|
+--------------------+---------+---------+-------------+--------------+----------+--------+---------+----
-------+-------------+----------+------------+
|Australia and Oce...|Australia|     Meat|       Online|             C|  4/4/2011|451691138|5/23/2011|
364|      1814127|   1568167|      245960|
+--------------------+---------+---------+-------------+--------------+----------+--------+---------+----
-------+-------------+----------+------------+
```

Leitura dos dados presentes no banco de dados

```
[39]: teste = DeltaTable.forPath(spark, "/tmp/output/experimentodelta")
      start = time.time()
      for i in range(100):
          teste.update(
              condition = PSF.expr("Order_ID == 451691138"),
              set = { "Unit_Price": PSF.expr("Unit_Price + 1")
          }),
          teste.update(
              condition = PSF.expr("Order_ID == 451691138"),
              set = { "Units_Sold": PSF.expr("Units_Sold + 1")
          })
      end = time.time()
      print(end - start)
```

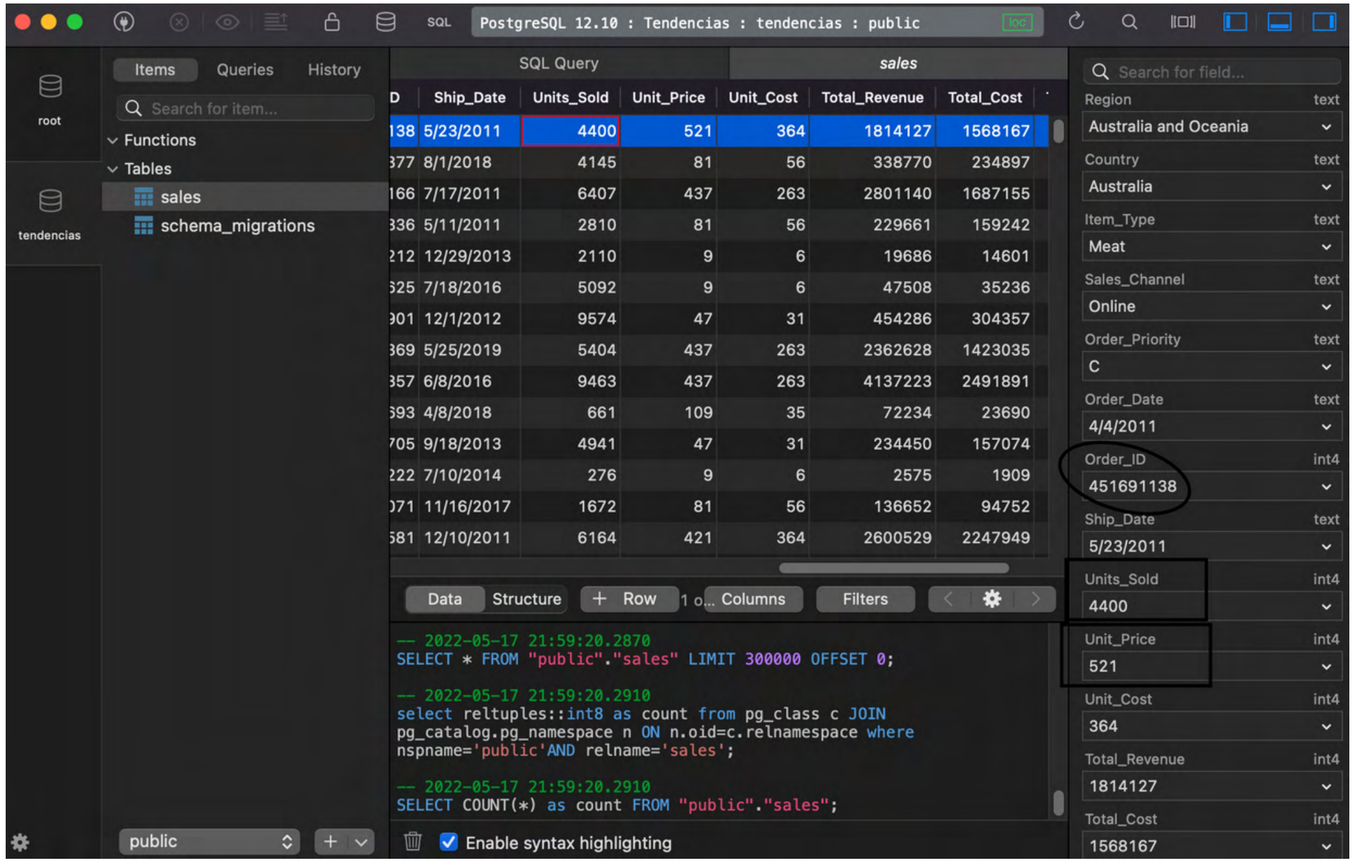
```
761.0740370750427
```

```
[41]: parDF = spark.read.format("delta").load("/tmp/output/experimentodelta")
      parDF.where(parDF.Order_ID == 451691138).show()
```

```
+--------------------+---------+---------+-------------+--------------+----------+--------+---------+----
-------+-------------+----------+------------+
|              Region|  Country|Item_Type|Sales_Channel|Order_Priority|Order_Date| Order_ID|Ship_Date|Unit
it_Cost|Total_Revenue|Total_Cost|Total_Profit|
+--------------------+---------+---------+-------------+--------------+----------+--------+---------+----
-------+-------------+----------+------------+
|Australia and Oce...|Australia|     Meat|       Online|             C|  4/4/2011|451691138|5/23/2011|
364|      1814127|   1568167|      245960|
+--------------------+---------+---------+-------------+--------------+----------+--------+---------+----
-------+-------------+----------+------------+
```

Alterações nas colunas Unit_Price e Units_Sold

Experimentos



Dados atualizados no banco

```
[42]: start = time.time()
parDF.write.format("jdbc").option("driver", "org.postgresql.Driver").option("url", os.environ.get('DB_CONNECTION_STRING')) \
    .option("dbtable", "sales").option("user", os.environ.get('USER')).option("password", os.environ.get('PASSWORD')) \
    .mode("overwrite").save()
end = time.time()
print(end - start)
```

```
[Stage 16378:>                                                  (0 + 1) / 1]
22.51351499557495
```

Salvando os dados no banco

Experimentos

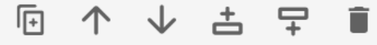
```
[49]: deleting = DeltaTable.forPath(spark, "/tmp/output/experimentodelta")

[52]: deleting.delete(PSF.col('Order_ID') == 451691138)
```

```
...

[60]: deletedDF = spark.read.format("delta").load("/tmp/output/experimentodelta")
      deletedDF.count()

[60]: 254159

[54]: deletedDF.where(deletedDF.Order_ID == 451691138).count()

[54]: 0

[64]: save_data_to_database(deletedDF, "sales", True)

      [Stage 16481:>                                                  (0 + 1) / 1]
      Overwrite done!
```

Subindo no banco de dados uma versão sem o pedido número 451691138

Experimentos

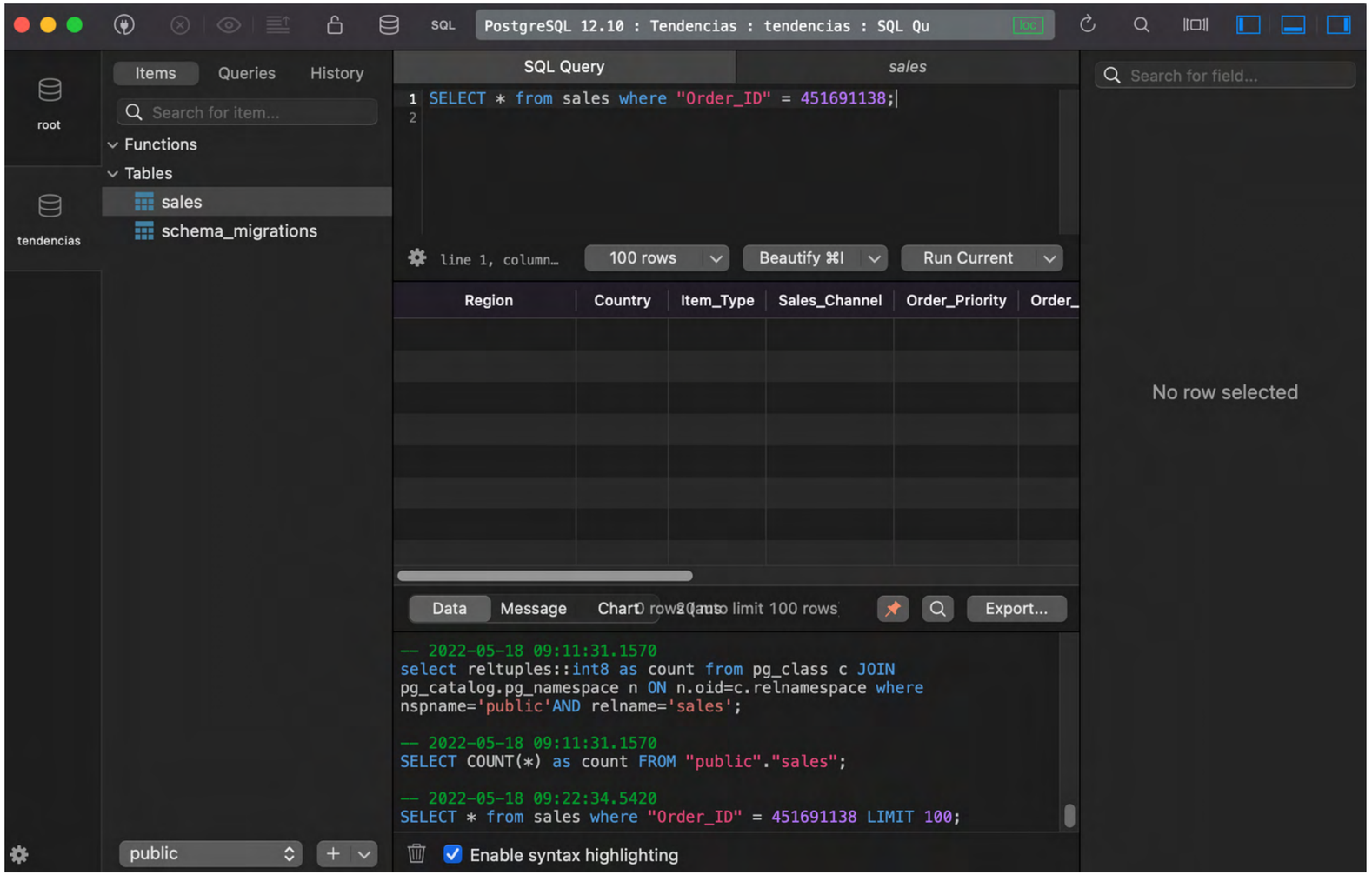
```
[49]: deleting = DeltaTable.forPath(spark, "/tmp/output/experimentodelta")

[52]: deleting.delete(PSF.col('Order_ID') == 451691138)
```



```
...

[60]: deletedDF = spark.read.format("delta").load("/tmp/output/experimentodelta")
      deletedDF.count()

[60]: 254159

[54]: deletedDF.where(deletedDF.Order_ID == 451691138).count()

[54]: 0

[64]: save_data_to_database(deletedDF, "sales", True)

      [Stage 16481:>                                                  (0 + 1) / 1]
      Overwrite done!
```

Subindo no banco de dados uma versão sem o pedido número 451691138

Experimentos



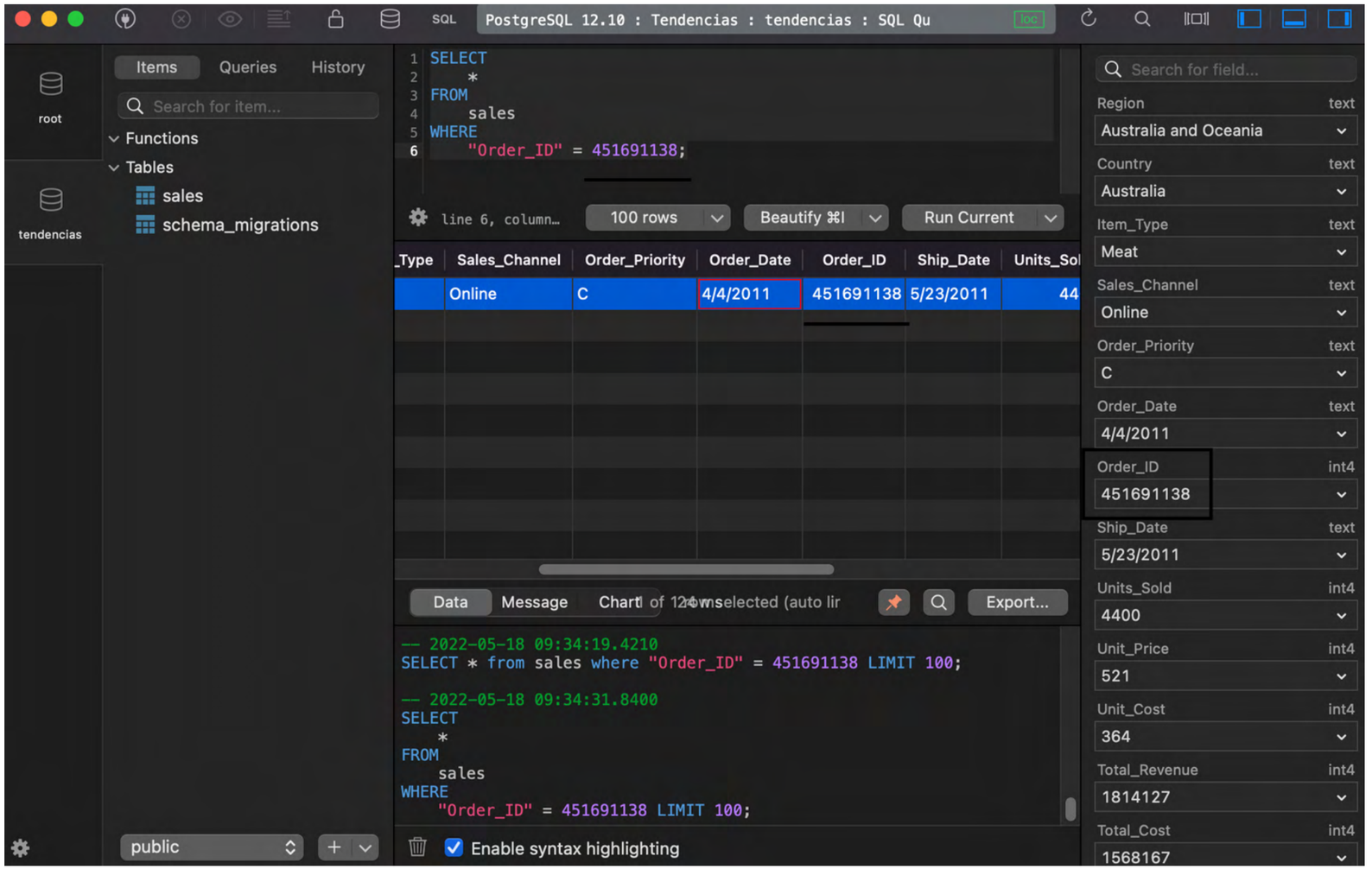
Pedido número 451691138 devidamente excluído do banco

Experimentos

```
[56]: history = spark.sql("DESCRIBE HISTORY delta.`/tmp/output/experimentodelta`")
      latest_version = history.selectExpr("max(version)").collect()
      print(latest_version[0][0])

      201

[65]: check_versions = spark.read.format("delta").option("versionAsOf", 200).load("/tmp/output/experimentodelta")
      check_versions.count()

[65]: 254160

[73]: df_final = check_versions.where(check_versions.Order_ID == 451691138)
      df_final.count()

[73]: 1

[74]: save_data_to_database(df_final, "sales", False, True)
```

Resgate de uma versão anterior do pedido número 451691138

Experimentos



Pedido número 451691138 reinserido no banco

Resultados Alcançados

01 3+ milhões de dados inseridos no banco em segundos

02 100 alterações em dados específicos em cerca de 10 minutos

03 1000 alterações em dados específicos em cerca de 1 Hora

04 Exclusão de dados específicos em segundos

05 Recuperação de dados outrora excluídos

Obrigado!

Grupo:

Renato Gabriel Ferreira