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Partycjonowanie danych w rozwiązaniach Big Data

Tomasz Krawczyk

tkrawczyk@future-processing.com

Future Processing

About Me

Set your status

tkrawczyk
cloud4yourdata

Tomasz Krawczyk Azure Big Data Architect

Overview | Repositories 7 | Projects 0 | Stars 3 | Followers 2 | Following 0

Pinned — Customize your pins

- usql — C#
- CommunityEvents — CommunityEvents — C# ★1 1
- FP-DataSolutions/AzureDataLake — Azure Data Lake Training — C#
- AzureBigDataWorkshops

https://github.com/cloud4yourdata

{CommunityEvents}

Project

Projekt MDM - platforma zarządzania danymi z zaawansowanej infrastruktury pomiarowej

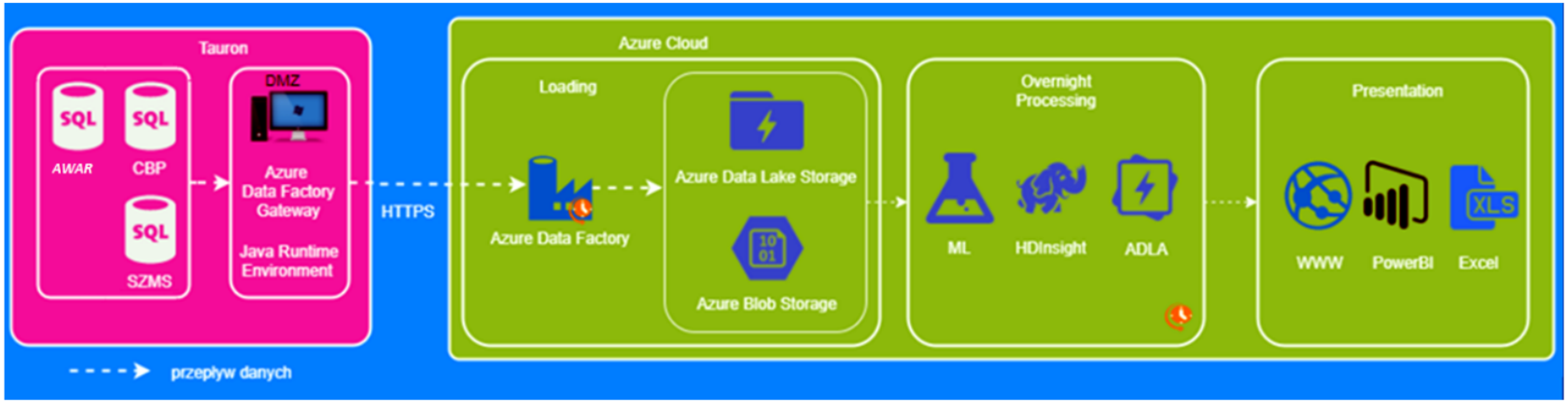
Ogólna koncepcja Platformy MDM

Celem p
infrastr
obejmu
licznikó

Poniżej przedstawiono schemat ogólnej koncepcji Platformy MDM.

Obszar

Projekt
Klientó
wyznac



https://www.tauron-dystrybucja.pl/o-spolce/innowacje-tauron/mdm

Agenda

- Big Data Game
- Big Data Solutions (Azure)
- Hive and Spark (and Azure Data Lake Analytics)
- External and Manage Tables
- Partitioning
- Bucketing
- Delta and Delta Lake
- Demos

Big Data Game

Is it Pokemon or Big Data ?

https://pixelastic.github.io/pokemonorbigdata/

Big Data (3V)

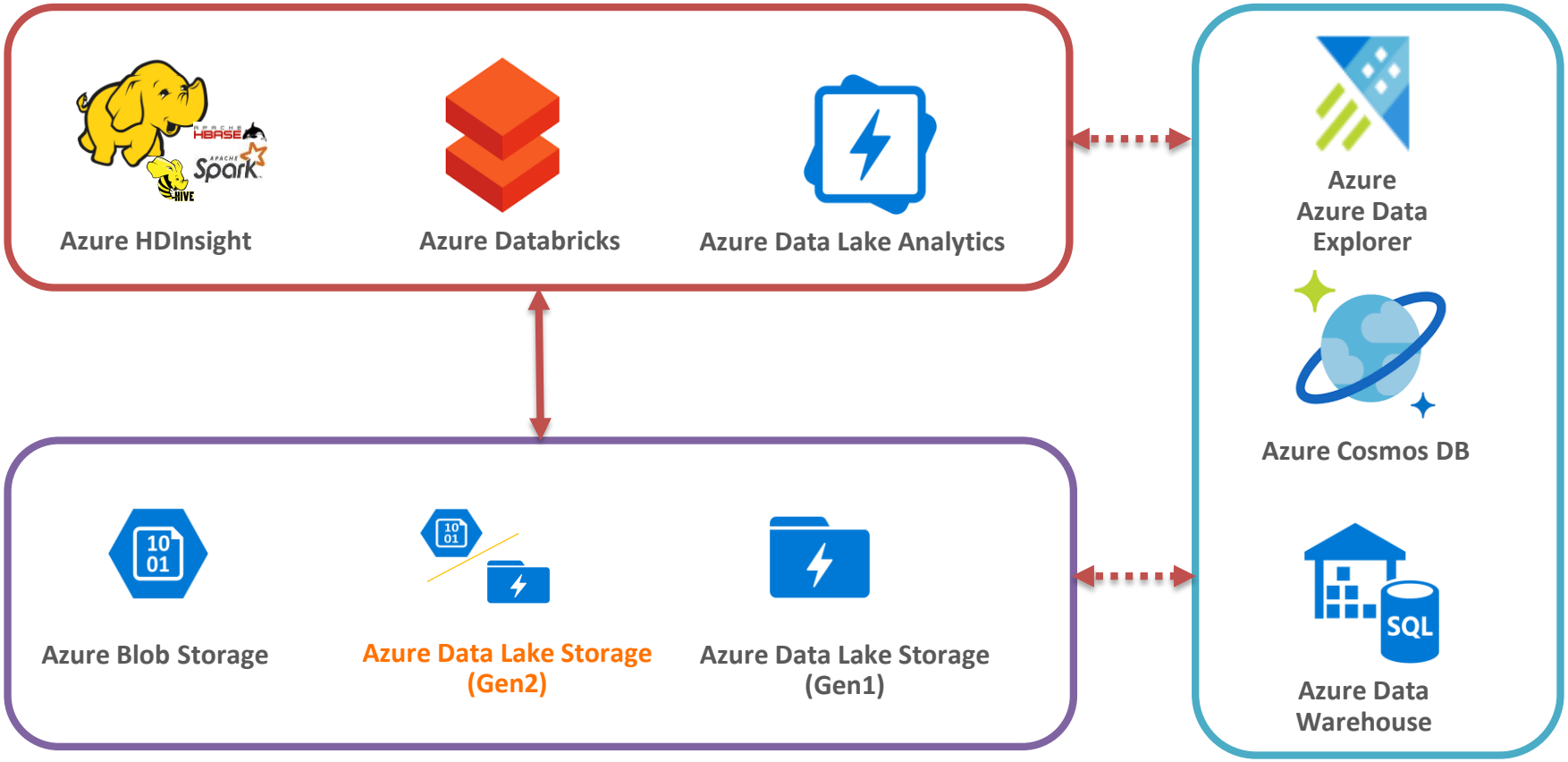
Byte	One grain of rice
Kilobyte	Cup of rice
Megabyte	8 bags of rice
Gigabyte	**3 semi trucks**
Terabyte	**2 container ships**
Petabyte	**Blankets Manhattan**
Exabyte	**Blankets west coast states**
Zettabyte	**Fills the Pacific Ocean**
Yottabyte	**As earth-sized rice ball**

Data Volume

Data Variety

Data Velocity

Big Data Solutions and Azure



Challenge

Data Set:

adlademosadls ▸ SQLDay2019 ▸ Data

NAME	SIZE
streetcrimes-000.csv	1.34 GB
streetcrimes-001.csv	1.53 GB
streetcrimes-002.csv	1.68 GB
streetcrimes-003.csv	135 MB

Azure Data Lake Storage (Gen1)

```
"CrimeID","DateReported","MonthReported","YearReported","ShortReportedByPoliceForceName","ReportedByPoliceForceName","FallsWithinPoliceForceName","Longitude","Latitude","Location","DistrictCode","DistrictName","CrimeType","Outcome"
"bd106bd30d971f4f0b0a7266c7e2ea28be38445116399d5f7d558745c7cd733d",2017-01-01T00:00:00.0000000,1,2017,"hertfordshire","Hertfordshire Constabulary","Hertfordshire Constabulary",-0.572545,51.819252,"On or near B4506","E01017701","Aylesbury Vale 009E","Criminal da
"5f8cd840ab19530450da6780b327f8f5bleda106545b46fb82356856bf9a2e20",2017-02-01T00:00:00.0000000,2,2017,"hertfordshire","Hertfordshire Constabulary","Hertfordshire Constabulary",-0.224338,51.6575165,"On or near Sports/Recreation Area","E01000253","Barnet 007B","I
"",2017-03-01T00:00:00.0000000,3,2017,"hertfordshire","Hertfordshire Constabulary","Hertfordshire Constabulary",-0.667245,51.81772,"On or near Parking Area","E01017651","Aylesbury Vale 009A","Anti-social behaviour",""
"e0e3025d30becb4f11bb00cd892eed23f38c247fa6b07335fac1fcaf1c126bd6",2017-04-01T00:00:00.0000000,4,2017,"hertfordshire","Hertfordshire Constabulary","Hertfordshire Constabulary",-0.710269,51.79715,"On or near Dennis Close","E01017629","Aylesbury Vale 021C","Drugs
"4367c5800d422f551457f4b0aab375dd00886c4aee95bee5cdeb5c0f08c08ad1",2017-05-01T00:00:00.0000000,5,2017,"hertfordshire","Hertfordshire Constabulary","Hertfordshire Constabulary",-0.001143,51.77788,"On or near Ryefeld Close","E01023316","Broxbourne 001A","Vehicle
```

FILTER (PROCESS):

```
YearReported = 2017 AND MonthReported = 10
```

Big Data Solutions

Azure Data Lake Analytics is an on-demand analytics job service that simplifies big data. (Legacy)

The Apache Hive ™ data warehouse software facilitates reading, writing, and managing large datasets residing in distributed storage using SQL.

Apache Spark™ is a unified analytics engine for large-scale data processing

- Scala, Python, R, **SQL and .Net**

Big Data and SQL

Using RDD (Spark)

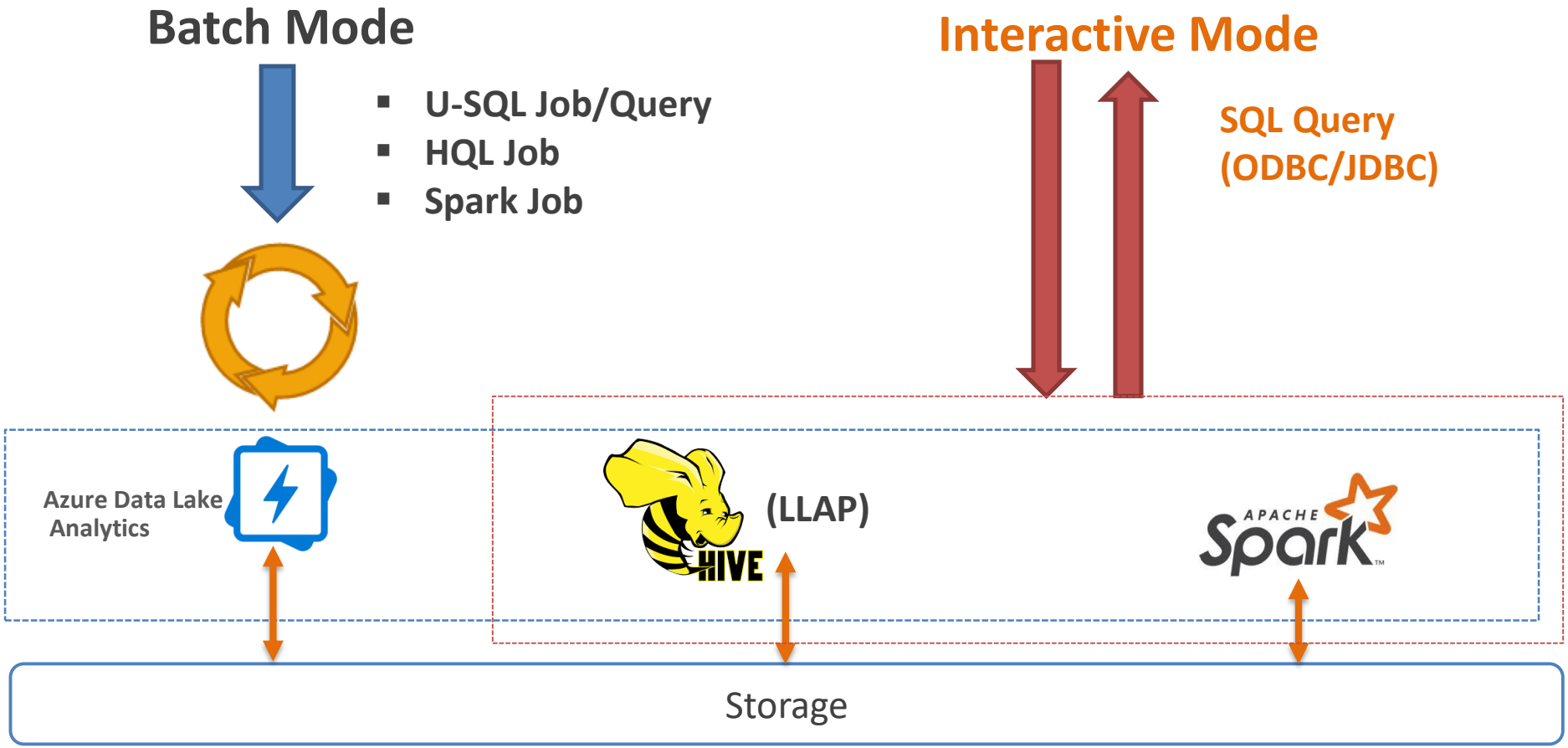
```
data = sc.textFile(...).split("\t")
data.map(lambda x: (x[0], [int(x[1]), 1])) \
    .reduceByKey(lambda x, y: [x[0] + y[0], x[1] + y[1]]) \
    .map(lambda x: [x[0], x[1][0] / x[1][1]]) \
    .collect()
```

Using SQL (Spark)

```
SELECT name, avg(age) FROM people GROUP BY name
```

„Phoenix Puts the SQL Back in NoSQL"

Data Processing
Batch mode vs Interactive mode



Hive and Spark SQL

- Hive Query Language

Metastore

- Spark SQL
- Hive Query Language

Hive Metastore allows mapping database structures (database, table, partition, column) to HDFS directories and files

Hive and Spark SQL -Tables

- External (unmanaged) tables
- Managed (internal) tables

```
%sql
DESCRIBE EXTENDED {TABLENAME}
```

Created By	Spark 2.4.0
Type	EXTERNAL
Provider	CSV

Created By	Spark 2.4.0
Type	MANAGED
Provider	CSV

```
CREATE TABLE IF NOT EXISTS
StreetCrimes
(
 CrimeID STRING,
 DateReported TIMESTAMP,
 Month INT,
 Year INT,
 ...
)
USING CSV
OPTIONS(header 'true')
LOCATION
'dbfs:/mnt/SQLDay2019/'
```

Providers: CSV, ORC, PARQUET, DELTA, JDBC

ADLA

- Demo-001.usql

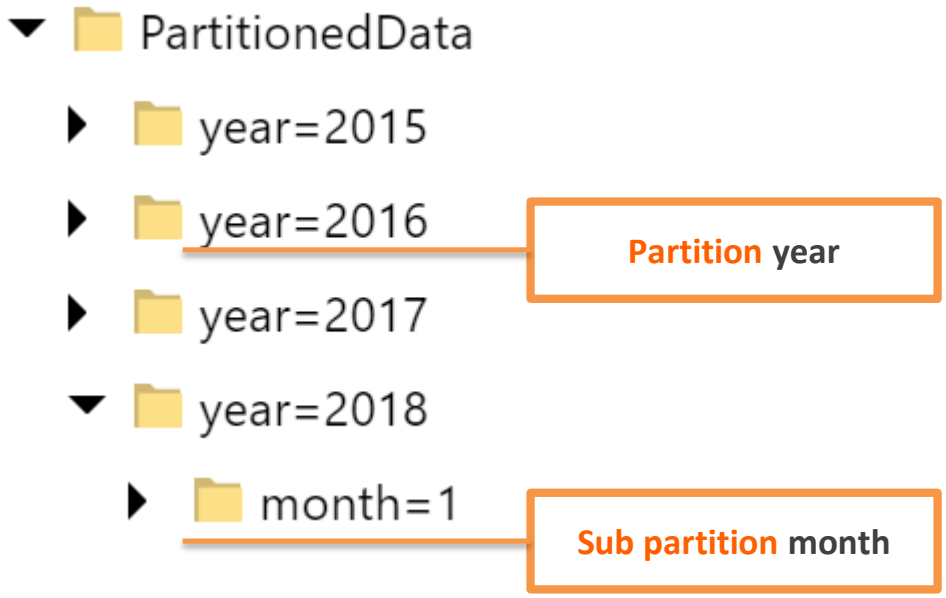
Spark

- 001-ExtAndManagedTables

DEMO

Partitioning and Partition Elimination

Partitioning is a way of dividing a table into related **parts** based on the values of partitioned columns.



- **Azure Event Hub**
  - (Event data capturing)
- **Azure Stream Analytics**
  - (Output)
- **Azure Data Factory**
  - Load into Azure Storage

```
{Partition Key}={Partition Value}
```

ADLA Partitioned Output

AzureDataLake / docs / Release_Notes / 2018 / 2018_Spring /

Data-driven Output Partitioning with `OUTPUT` fileset is in Private Preview

We have started a private preview of the data-driven output partitioning with filesets. It enables you to use column values to create parts of a file path and partition the remaining data into different files based on these values.

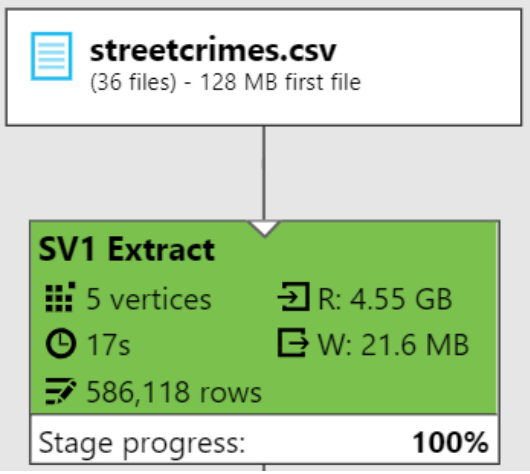
This feature addresses the following user-voice feedback: Support 'dynamic' output file names in ADLA

Please contact us if you want to try it out and provide us with your feedback.

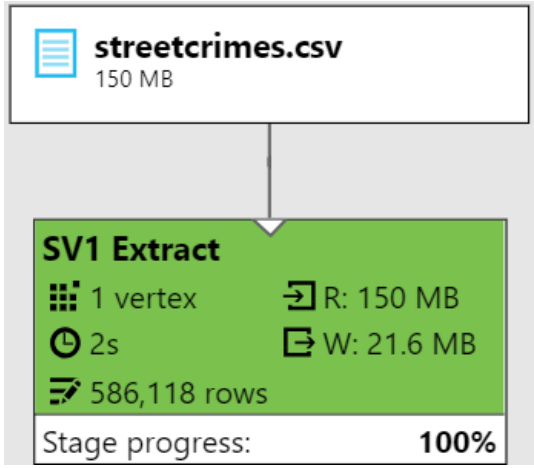
```
SET @@FeaturePreviews = "DataPartitionedOutput:on";
…;
DECLARE @outputPath string =
@"/SQLDay2019/Out/PartitionedData/year={YearReported}/month={MonthReported}/
streetcrimes.csv";
…
OUTPUT @inputData
    TO @outputPath
    USING Outputters.Csv();
```

ADLA- Read Partitioned Data (Partition Elimination)

```
DECLARE @inputPath string =@"../year={Year}/month={Month}/{*}.csv";

@inputData =
EXTRACT…
        Year string,
        Month string;

@outputData =
    SELECT * FROM @inputData WHERE
    Convert.ToInt32(Year) == 2017
AND Convert.ToInt32(Month) == 10;
```




```
@inputData =
EXTRACT…
        Year int,
        Month int;

@outputData =
    SELECT * FROM @inputData WHERE
            Year == 2017
             Month == 10;
```



Hive and Spark - Read Partitioned Data


```
CREATE EXTERNAL TABLE IF NOT
EXISTS StreetCrimesParitioned
(
 CrimeID STRING,
 DateReported TIMESTAMP,
 Month INT,
 Year INT,
 ...
)
USING CSV
OPTIONS(header 'true')
PARTITIONED BY (Year,Month)
...
```


```
CREATE EXTERNAL TABLE IF NOT EXISTS
StreetCrimesParitionedHive
(
 CrimeID STRING,
 DateReported TIMESTAMP,
 ...
)
PARTITIONED BY (year INT, month INT)
...
```

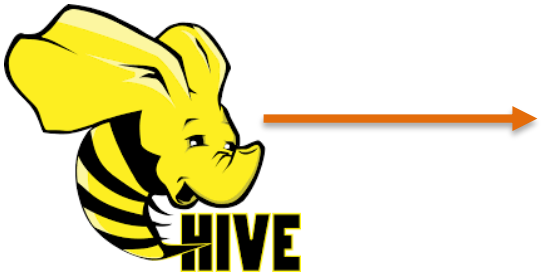
MSCK REPAIR TABLE { TableName }

Data Formats

CSV(TEXT)

```
2017-10-01T00:00:00.0000000,"E01012289","Shoplifting"
2017-10-01T00:00:00.0000000,"E01010781","Anti-social behaviour"
2017-10-01T00:00:00.0000000,"","Violence and sexual offences"
2017-10-01T00:00:00.0000000,"E01009421","Anti-social behaviour"
2017-10-01T00:00:00.0000000,"E01007502","Anti-social behaviour"
2017-10-01T00:00:00.0000000,"E01014809","Shoplifting"
2017-10-01T00:00:00.0000000,"W01000565","Violence and sexual offences"
2017-10-01T00:00:00.0000000,"E01025306","Anti-social behaviour"
2017-10-01T00:00:00.0000000,"E01009249","Violence and sexual offences"
2017-10-01T00:00:00.0000000,"E01013614","Vehicle crime"
2017-10-01T00:00:00.0000000,"E01012520","Criminal damage and arson"
```

Free and open-source column-oriented data storage format of the Apache Hadoop ecosystem.



The smallest, fastest columnar storage for Hadoop workloads

Hive and Spark SQL – Managed Tables , Static and Dynamic Partition

- **Static Partitions**

```
INSERT INTO
StreetCrimesParitionedParquet
PARTITION(Year=2018,Month=1)
SELECT CrimeID,
 DateReported,
 ...
 FROM StreetCrimesParitioned
 WHERE Year =2018 AND Month = 1
```

- **Dynamic Partitions**

```
INSERT INTO
StreetCrimesParitionedParquet
PARTITION(Year,Month)
 SELECT CrimeID,
 DateReported,
 ...
 Year, --Partitioned Column
 Month --Partitioned Column
 FROM StreetCrimesParitioned
 WHERE Year <2018
```

Key=__HIVE_DEFAULT_PARTITION__

ADLA

- Demo-002.usql
- Demo-003.usql
- Demo-004.usql

Spark

- 002-ExtPartitionedTable
- 003-Partitions

DEMO

Challenge

DATA SET 1 (Crime Location)

adlademosadls ▸ SQLDay2019 ▸ Out ▸ CrimesLocations

NAME	SIZE
CrimesLocation_1.csv	170 MB
CrimesLocation_10.csv	181 MB
CrimesLocation_11.csv	175 MB
CrimesLocation_12.csv	169 MB

DATA SET 2 (Crime Info)

adlademosadls ▸ SQLDay2019 ▸ Out ▸ Crimes

NAME	SIZE
Crimes_1.csv	207 MB
Crimes_10.csv	221 MB
Crimes_11.csv	215 MB
Crimes_12.csv	207 MB

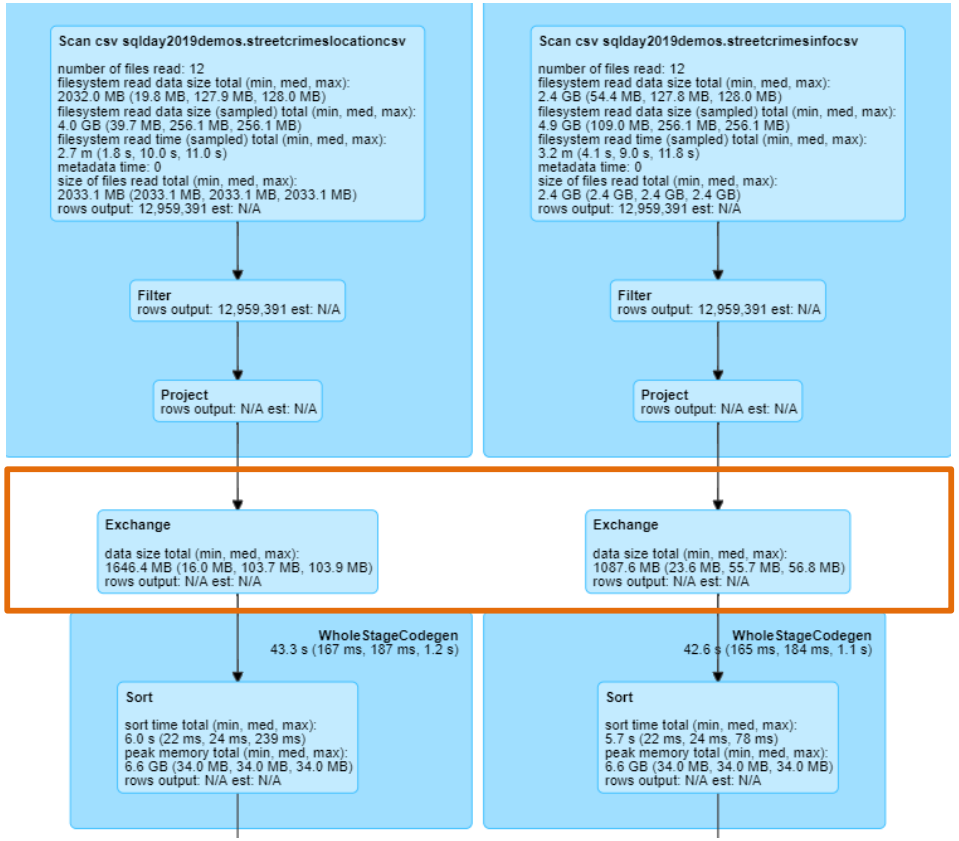
```
SELECT COUNT(*) AS Total
FROM StreetCrimesLocationCSV cl
JOIN StreetCrimesInfoCSV cd ON cd.CrimeID = cl.CrimeID
```

Challenge

```
SELECT COUNT(*) AS Total FROM
StreetCrimesLocationCSV cl
JOIN StreetCrimesInfoCSV cd ON
cd.CrimeID = cl.CrimeID
```

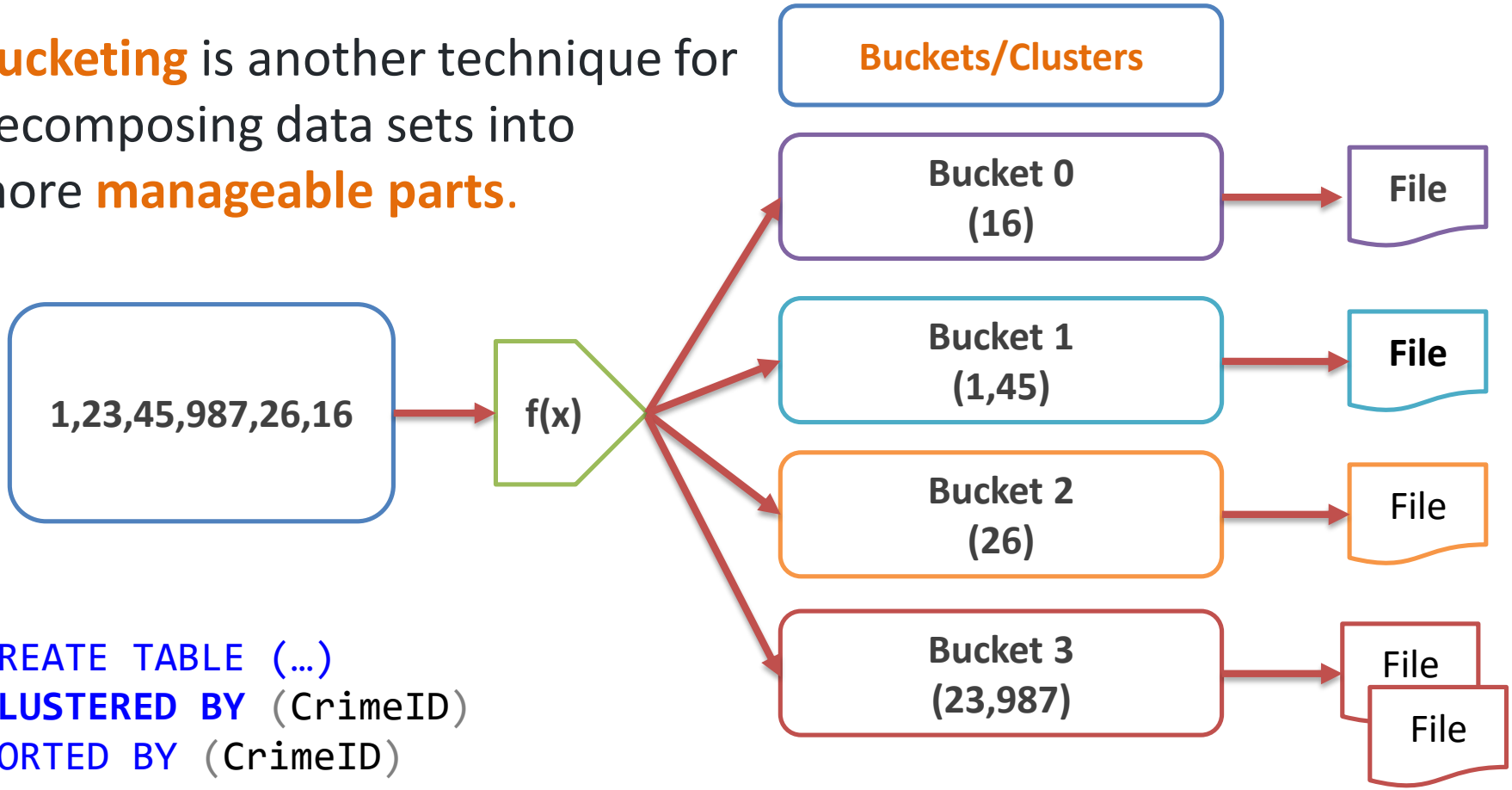
Shuffle (Exchange) operation is used in **Spark** to re-distribute data across multiple partitions.

It is a costly and complex operation.



Bucketing – optimization technique

Bucketing is another technique for decomposing data sets into more **manageable parts**.




```
CREATE TABLE (…)
CLUSTERED BY (CrimeID)
SORTED BY (CrimeID)
INTO 4 BUCKETS;
```

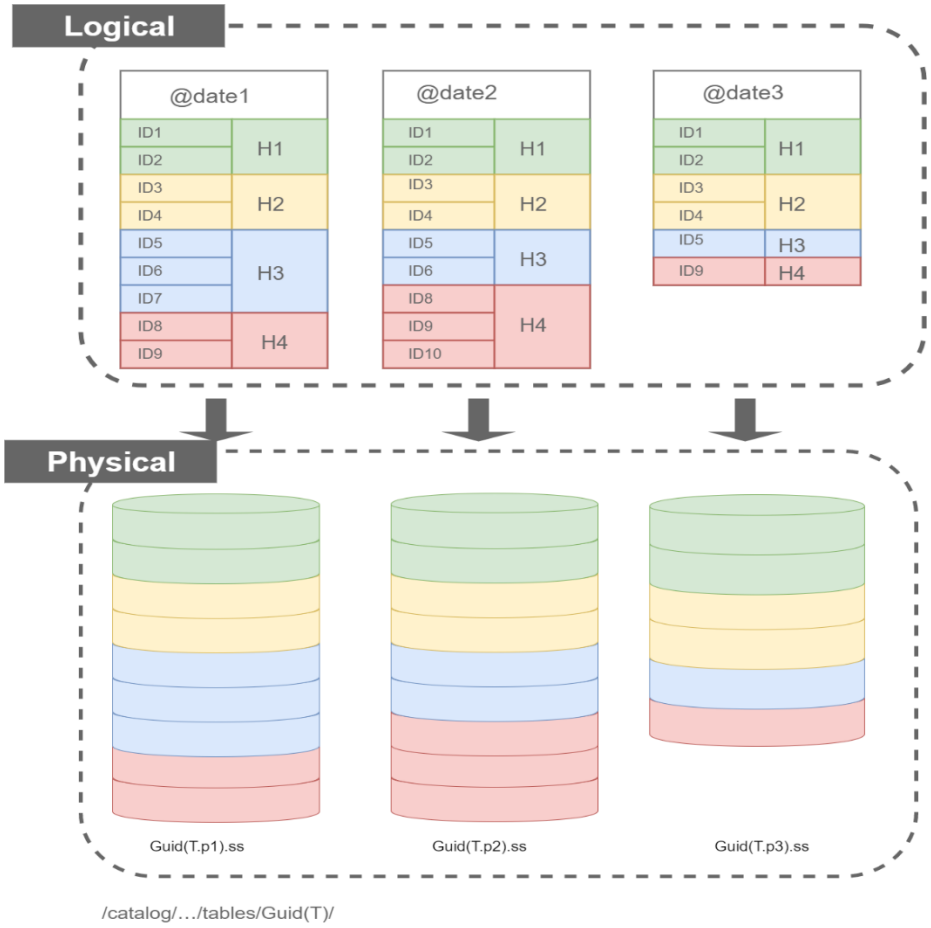
Spark

- 005-BucketingJoin
- 006-HivePartitionedAndBucketedTable
- ODBC/JDBC Connector

DEMO

ADLA Tables, Partitioning and bucketing

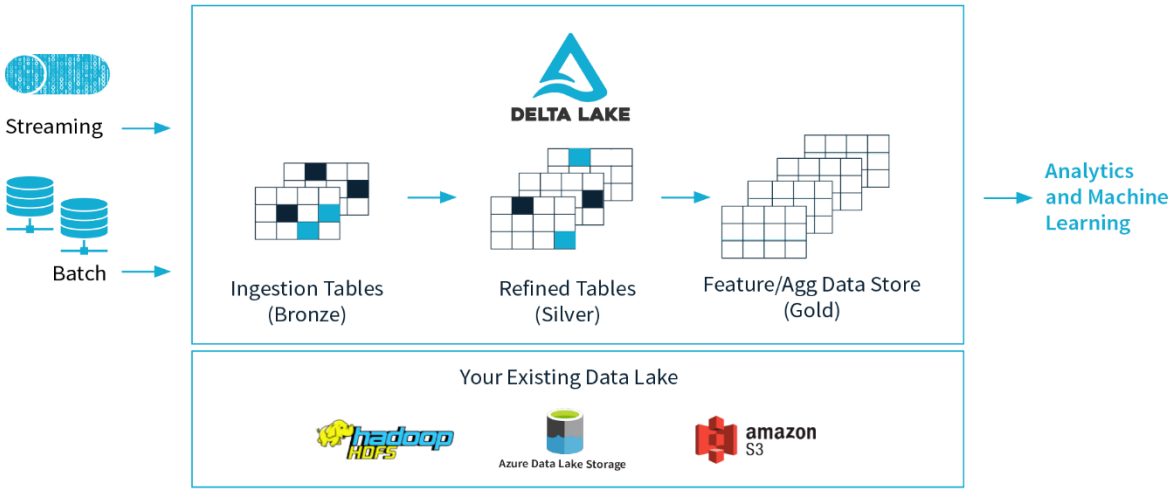
```
CREATE TABLE T
(
    id int,
    date DateTime,
    INDEX IDX
    CLUSTERED(id)
    PARTITIONED BY (date)
    DISTRIBUTED BY
    HASH(id)
    INTO 4
);
```



Delta Lake

Delta Lake is an open source storage layer that brings reliability to data lakes.

- Full ACID Transactions
- Unified Streaming and Batch
- Data versioning
- Native Support for
  - UPDATE
  - DELETE
  - MERGE



https://delta.io/

Azure Databricks Delta

```
CREATE TABLE IF NOT EXISTS
StreetCrimesParitionedParquet
(
 CrimeID STRING,
 DateReported TIMESTAMP,
 Month INT,
 Year INT,
 ...
)
USING Delta
PARTITIONED BY (Year,Month)
```

Delta

- OPTIMIZE
- Z-ORDER
  - (multi-dimensional clustering)
  - (**WHERE x=1 OR y=2**)
- VACUUM

ADLA

- CreateTableDist.usql
- LoadDataIntoStreetCrimesDistByCrimeType.usql
- PartitionInfo.usql
- Demo-005.usql

Spark

- 010-Delta

DEMO

Summary

- Open and Closed Big Data Solutions
- Storage structure
  - Partitioning vs /and Bucketing (Horizontal and Vertical Partitioning)
- Delta and Delta Lake

Resources

My examples (and demos)

- https://github.com/cloud4yourdata/usql/tree/develop
- https://github.com/cloud4yourdata/CommunityEvents/tree/master/DataCommunity201809_InteractiveQueries
- https://github.com/cloud4yourdata/demos/tree/develop/SQLDay2018

External resources

- https://docs.databricks.com/
- https://delta.io/
- https://spark.apache.org/
- https://jaceklaskowski.gitbooks.io/mastering-spark-sql/spark-sql-properties.html
- https://hive.apache.org/
- https://dotnet.microsoft.com/apps/data/spark
- http://usql.io
- https://databricks.com/blog/2018/07/31/processing-petabytes-of-data-in-seconds-with-databricks-delta.html

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