Microsoft

GPS Data/AI Strategy FY23

Delivered by CSA Team

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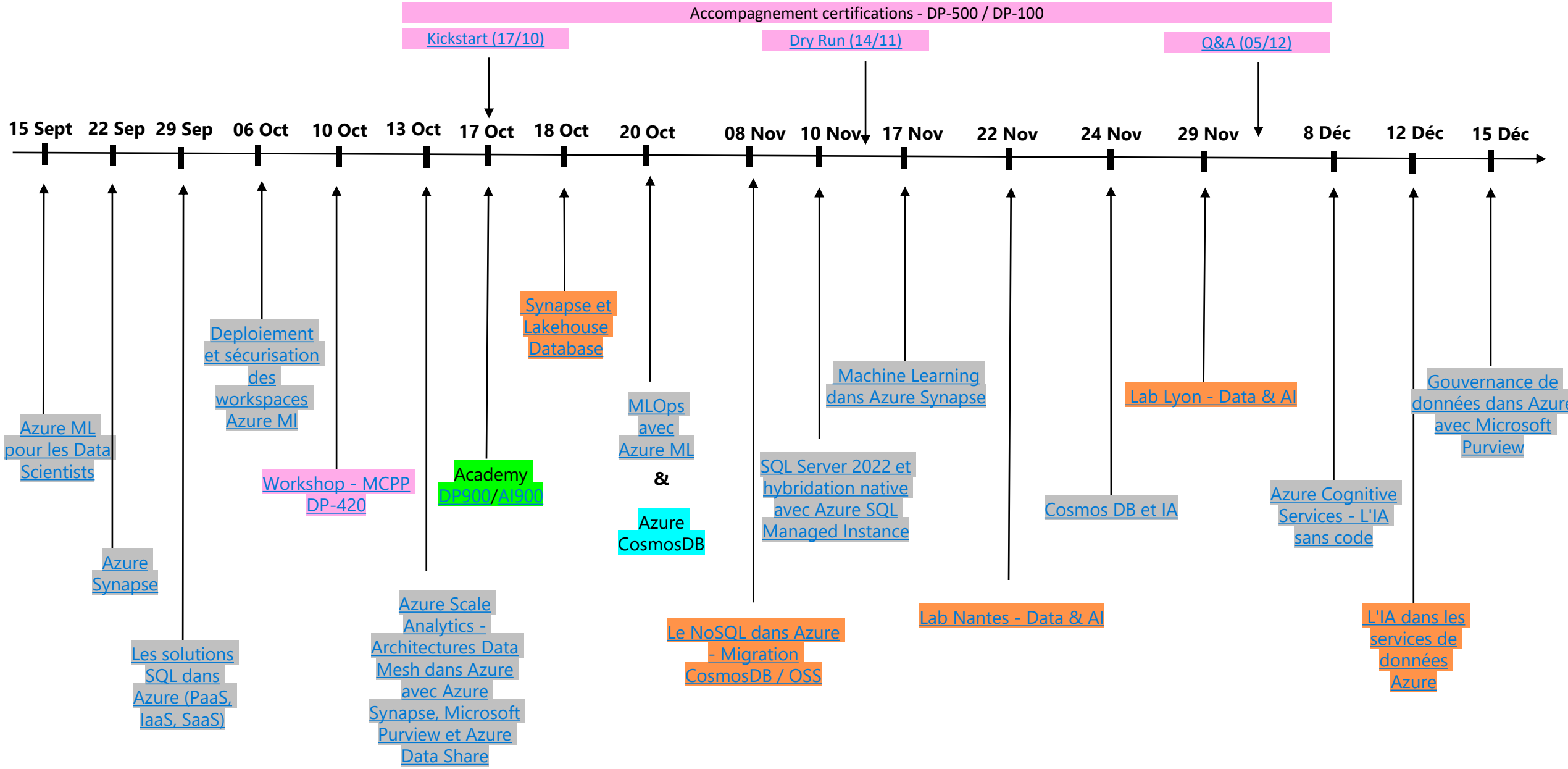
Azure Data & AI technical intensity plan

- From June 2022 to June 2023
- Focus on "**Azure Data & AI**" tech intensity

- Many content, from **L100** Beginner to **L400** Expert level:
  - **Academy** L100
  - **Webinar** L200/L300
  - **Workshop** L300/L400
  - **Certification kickstart** L300/L400
  - **Openhack / Microhack** L400

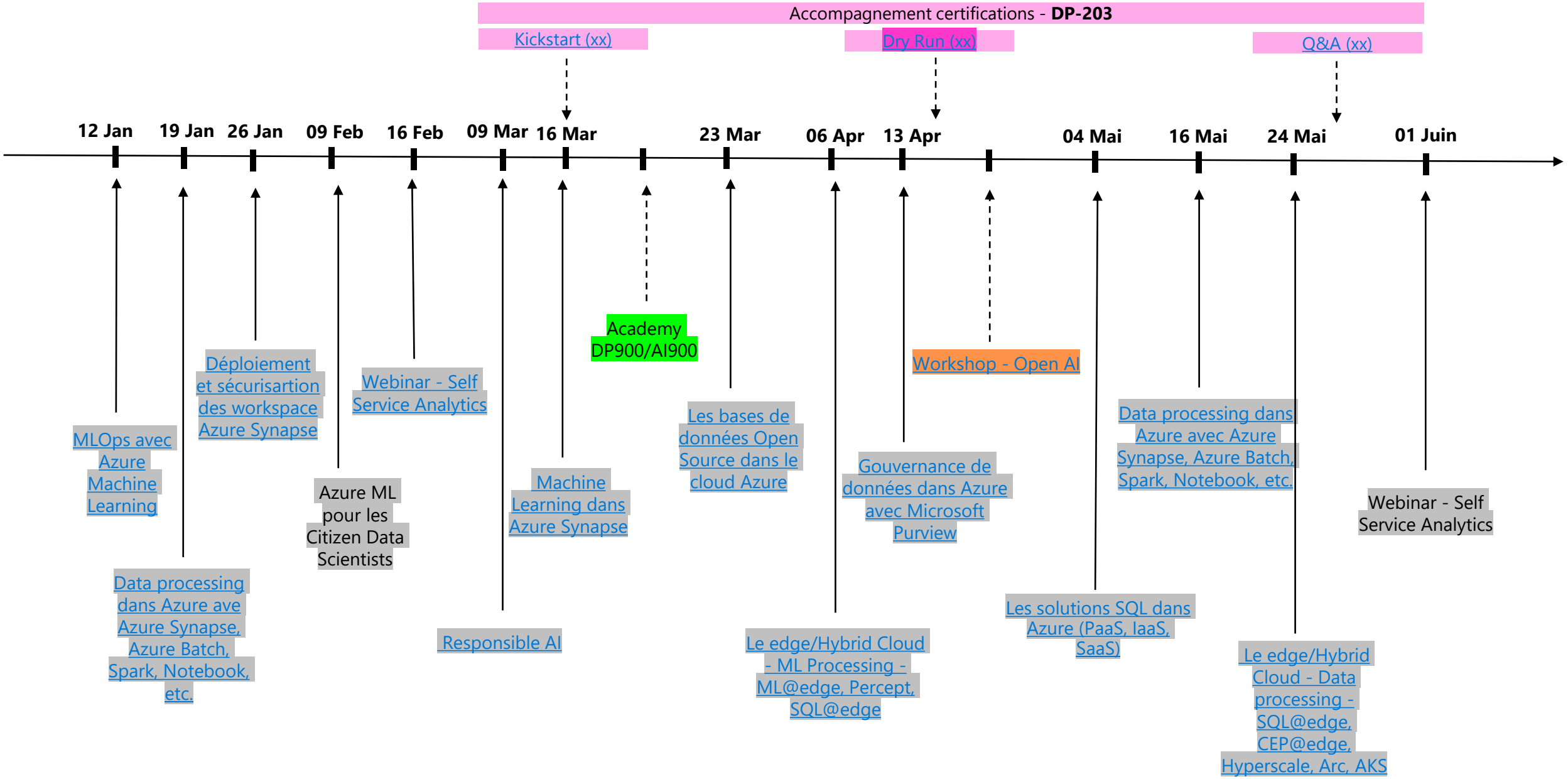
Data & AI events timeline – H1

Webinar/Academy- L 200/300
Workshop/ Openhack/ Certifications – L 300/400



Data & AI events timeline – H2

Webinar/Academy- L 200/300
Workshop/ Openhack/ Certifications – L 300/400



Liste des évènements de type Webinar 2H

Event Webinar (Les jeudis de la Data & AI) - L200/300	Date	Duration (min)	Link
Azure Machine Learning pour les Data Scientists	15/09/2022	120	https://msevents.microsoft.com/event?id=2454281594
Azure Synapse	22/09/2022	120	https://msevents.microsoft.com/event?id=857781749
Les solutions SQL dans Azure (PaaS, IaaS, SaaS)	29/09/2022	120	https://msevents.microsoft.com/event?id=502366997
Déploiement et sécurisation des workspaces Azure Machine learning	06/10/2022	120	https://msevents.microsoft.com/event?id=1505714138
Azure Scale Analytics - Architectures Data Mesh dans Azure avec Azure Synapse, Microsoft Purview et Azure Data Share	13/10/2022	120	https://msevents.microsoft.com/event?id=139685175
MLOps avec Azure Machine Learning	20/10/2022	120	https://msevents.microsoft.com/event?id=1245885767
SQL Server 2022 et hybridation native avec Azure SQL Managed Instance	10/11/2022	120	https://msevents.microsoft.com/event?id=145826476
Machine Learning dans Azure Synapse Analytics	17/11/2022	120	https://msevents.microsoft.com/event?id=3637723312
Azure Cosmos DB et IA	24/11/2022	120	https://msevents.microsoft.com/event?id=2646013445
Azure et les Services Cognitifs	08/12/2022	120	https://msevents.microsoft.com/event?id=3772037220
La gouvernance de données dans Azure avec Microsoft Purview	15/12/2022	120	https://msevents.microsoft.com/event?id=1499560981
MLOps avec Azure Machine Learning	12/01/2023	120	https://msevents.microsoft.com/event?id=4115194515
Data processing dans Azure ave Azure Synapse, Azure Batch, Spark, Notebook, etc.	19/01/2023	120	https://msevents.microsoft.com/event?id=1537241181
Déploiement et sécurisation des workspace Azure Synapse	26/01/2023	120	https://msevents.microsoft.com/event?id=1806467748
Azure Machine Learning pour les Citizen Data Scientists	09/02/2023	120	En cours
PowerBI - Self Service Analytics	16/02/2023	120	https://msevents.microsoft.com/event?id=1401519679
L'IA responsable avec Azure machine learning	09/03/2023	120	https://msevents.microsoft.com/event?id=2072953112
Machine Learning dans Azure Synapse Analytics	16/03/2023	120	https://msevents.microsoft.com/event?id=3413014857
Les bases de données Open Source dans le cloud Azure	23/03/2023	120	https://msevents.microsoft.com/event?id=2727487131
Hybridation des services de Machine Learning Azure	06/04/2023	120	https://msevents.microsoft.com/event?id=1624914222
La gouvernance de données dans Azure avec Microsoft Purview	13/04/2023	120	https://msevents.microsoft.com/event?id=3909342839
Les solutions SQL dans Azure (PaaS, IaaS, SaaS)	04/05/2023	120	https://msevents.microsoft.com/event?id=1162207895
Data processing dans Azure ave Azure Synapse, Azure Batch, Spark, Notebook, etc.	16/05/2023	120	https://msevents.microsoft.com/event?id=3517068442
Hybridation des services de données Azure	24/05/2023	120	https://msevents.microsoft.com/event?id=2996507398
Self Service Analytics	01/06/2023	120	En cours

Liste des évènements de type Workshop/Prepa Cert/Academy

Event Workshop L300/400	Date	Duration (min)	Link
Synapse et Lakehouse Database	18/10/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdURE1RMVgwTDNISTE1TDFYSDVLR0cyS1kwWS4u
Le NoSQL dans Azure - Migration CosmosDB / OSS	08/11/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdURE1RMVgwTDNISTE1TDFYSDVLR0cyS1kwWS4u
Lab Lyon - Data & AI	22/11/2022	240	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUMlZZOURET0RSWjcyTERYRkJGTlFFUjJaUi4u
Lab Nantes - Data & AI	29/11/2022	240	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUMlZZOURET0RSWjcyTERYRkJGTlFFUjJaUi4u
L'IA dans les services de données Azure	12/12/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdURE1RMVgwTDNISTE1TDFYSDVLR0cyS1kwWS4u
Open AI	H2	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdURE1RMVgwTDNISTE1TDFYSDVLR0cyS1kwWS4u

Event Academy, kickstart certifications, workshop certifications	Date	Duration (min)	Link
MCPP - DP-420	10/10/2022	420	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUMkJISlRKSU1RRFA0OVgzSFdTSTY0RE9WQy4u
Micro Hack CosmosDB	20/10/2022	420	H1 - Inscriptions PTA
Academy DP900	17-21/10/2022	300	https://msevents.microsoft.com/event?id=3250818161
Academy AI900	17-21/10/2022	300	https://msevents.microsoft.com/event?id=2717528090
Kickstart DP-500	17/10/2022	60	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNEk3WFQ1TEdNNTQ2Uk85V0cxQzM3TE9ZRS4u
Dry Run DP-500	14/11/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNEk3WFQ1TEdNNTQ2Uk85V0cxQzM3TE9ZRS4u
Q&A DP-500	05/12/2022	90	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNEk3WFQ1TEdNNTQ2Uk85V0cxQzM3TE9ZRS4u
Kickstart DP-100	17/10/2022	60	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNDAxV0hSN0FHM1YzUzI3OUNMUFYxSkRIMi4u
Dry Run DP-100	14/11/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNDAxV0hSN0FHM1YzUzI3OUNMUFYxSkRIMi4u
Q&A DP-100	05/12/2022	90	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNDAxV0hSN0FHM1YzUzI3OUNMUFYxSkRIMi4u
Kickstart DP-203	17/10/2022	60	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUOVFWOUVCNFcyQk5SVjFBUFczNktCUFpLMi4u
Dry Run DP-203	14/11/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUOVFWOUVCNFcyQk5SVjFBUFczNktCUFpLMi4u
Q&A DP-203	05/12/2022	90	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUOVFWOUVCNFcyQk5SVjFBUFczNktCUFpLMi4u

Microsoft

Azure Synapse Analytics & Lake Database

18/10/2022

Speaker info

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Cloud Solutions Architect

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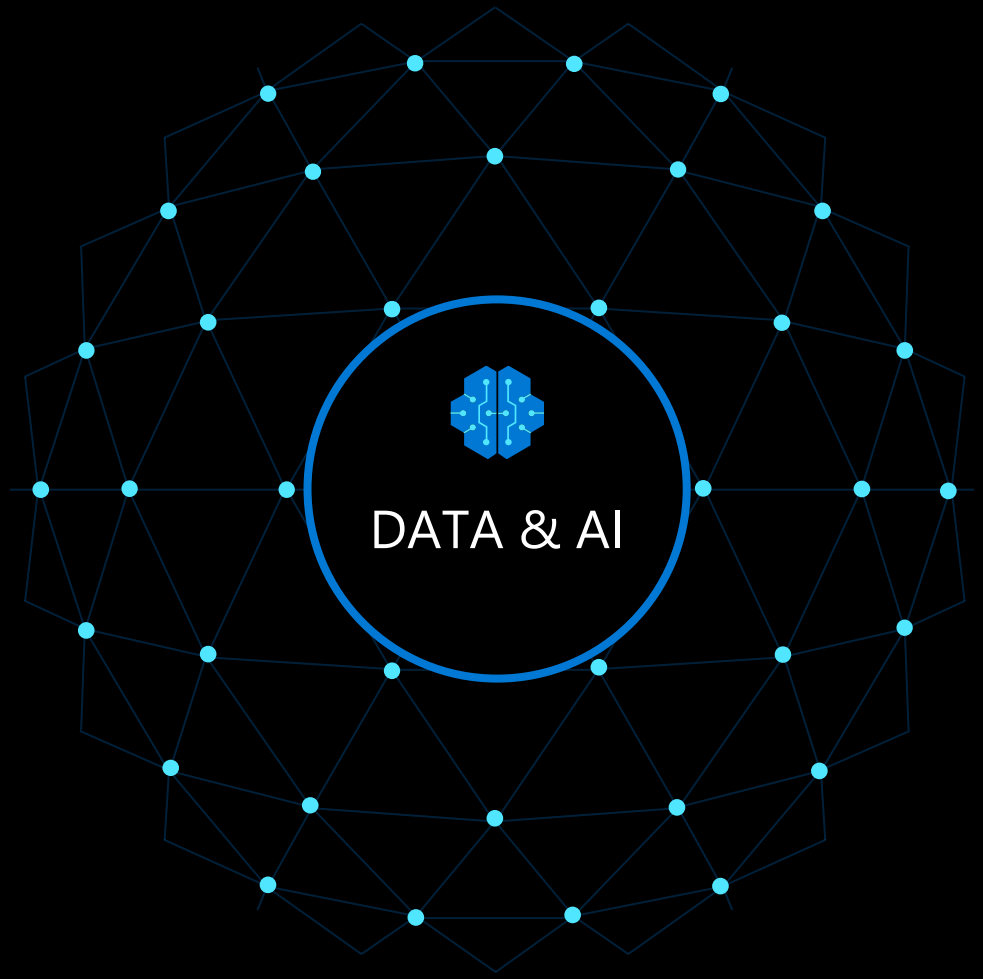
The Data Driven Enterprise

Engage customers

Transform products



Optimize operations

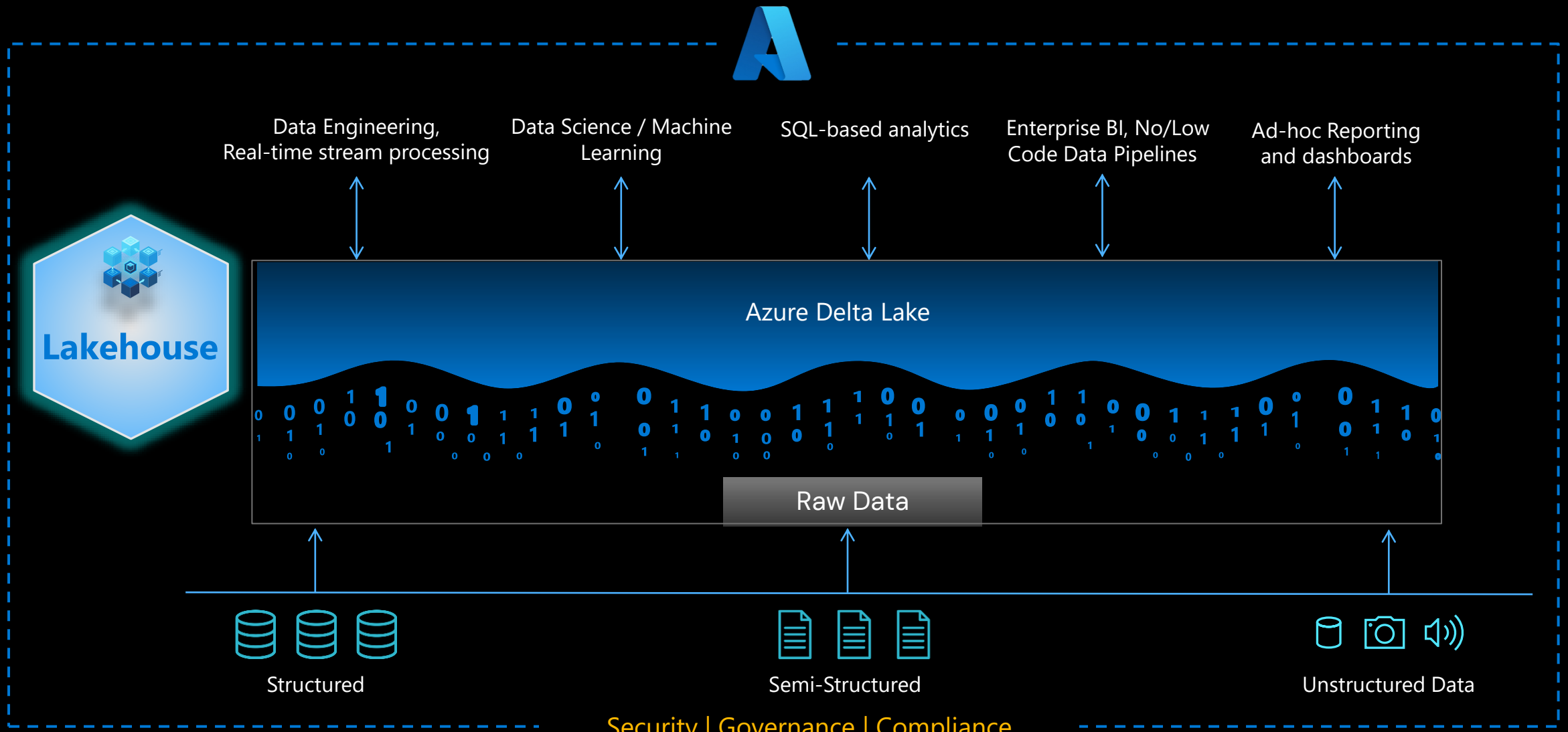
Empower people

Approche serverless de données

Besoin d'expliquer finement l'approche analytique moderne
Besoin d'expliquer les nouvelles avancées des services de données dans le cloud

- Détachement de la scalabilité des services, plus de "capacity planning"
- Détachement de la notion de performance
- Consommation "à la demande" de "l'analytique"
- Les limites d'une telle approche
- **Réflexion sur "où" est calculé l'indicateur, modèles hybrides/composites**
- Couts variables pour les métiers (dépendant de l'utilisation), besoin de changer l’approche budgétaire.

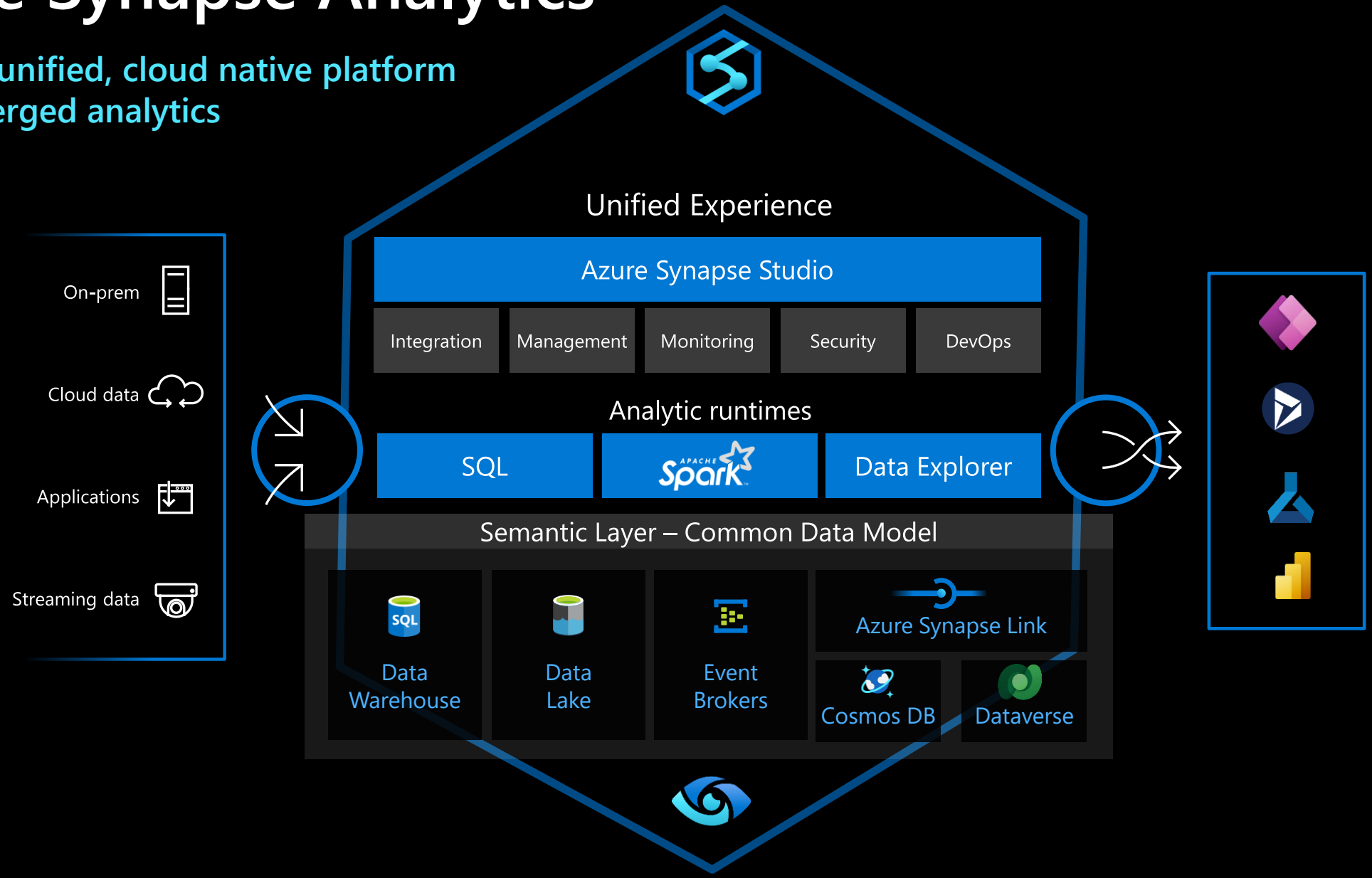
L'approche Lakehouse, multi moteur analytique



Microsoft Azure

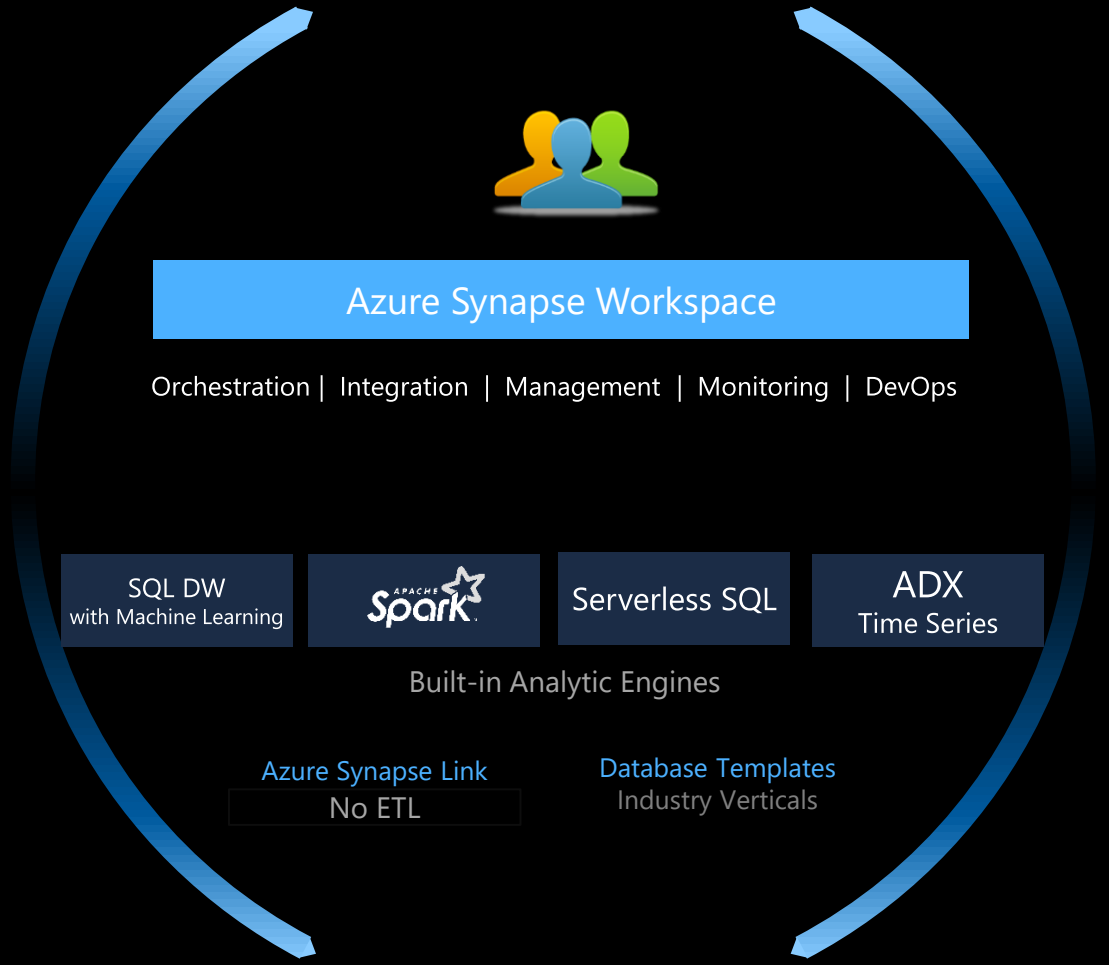
Azure Synapse Analytics

The first unified, cloud native platform for converged analytics



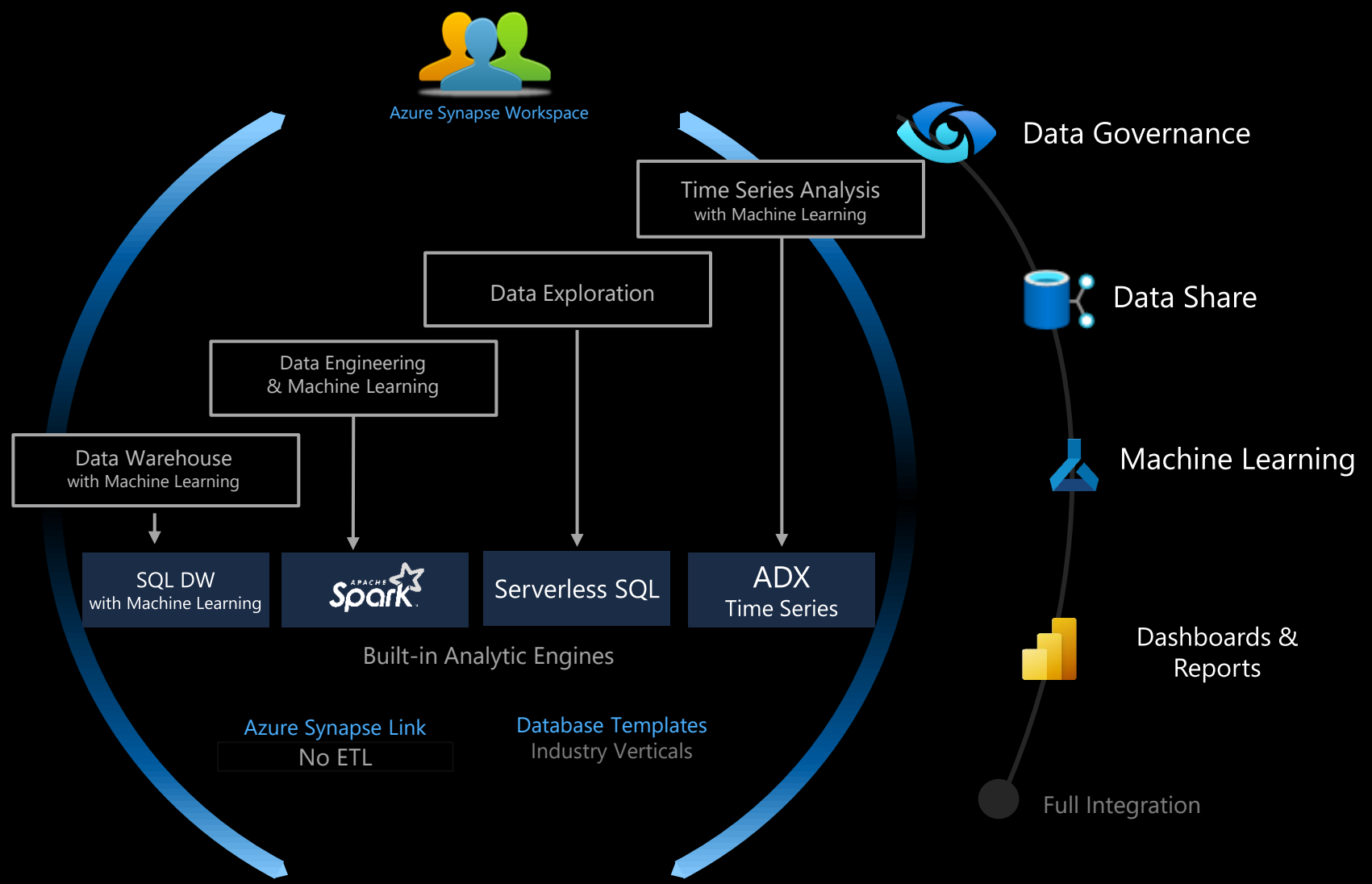
Azure Synapse Analytics

Unified, Secured, and Integrated Ecosystem



Azure Synapse Analytics

Unified, Secured, and Integrated Ecosystem

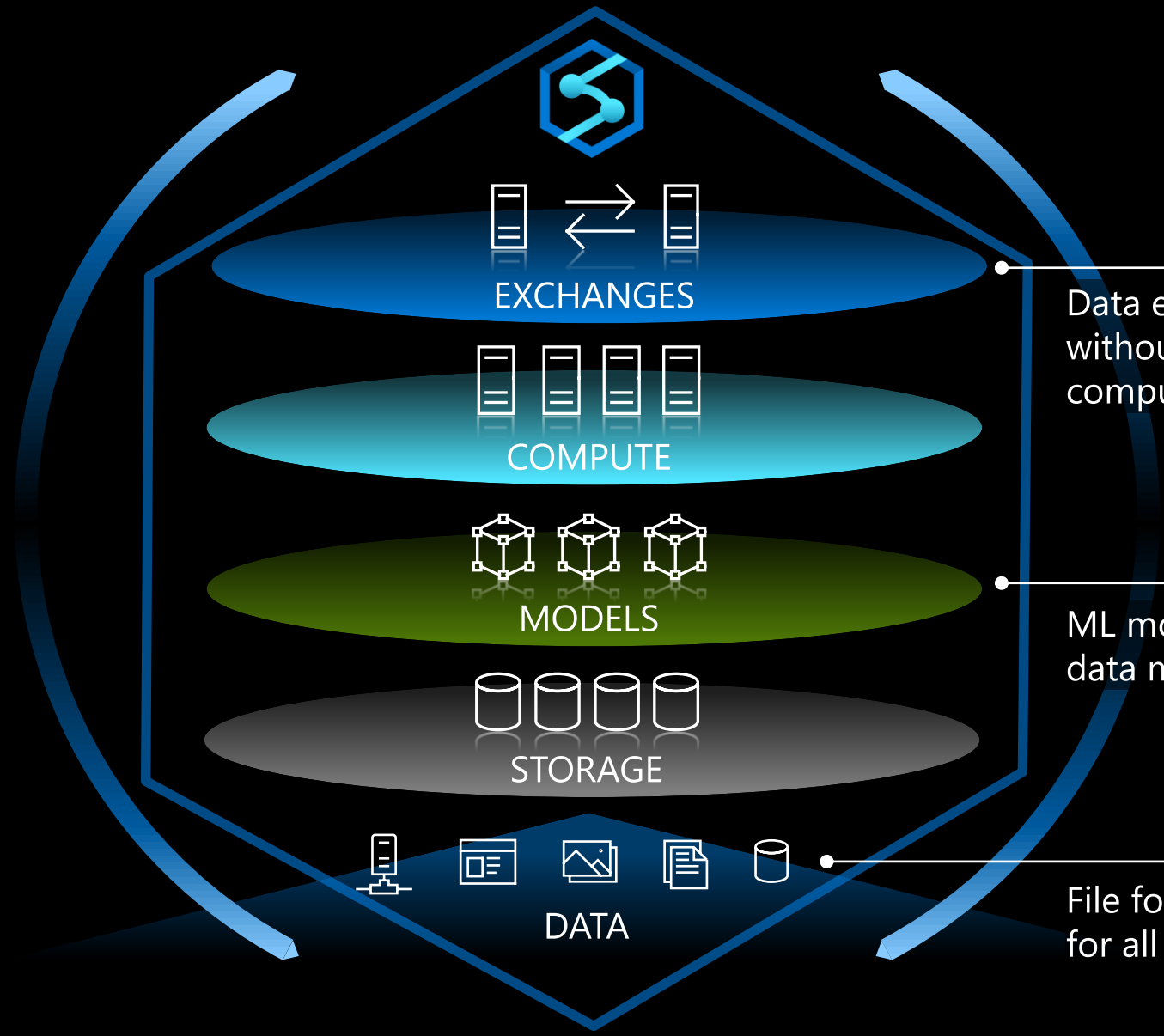


Polyglot Data Store: On-premise Cloud data Operational Data Streaming data

Why Synapse
Open Hub

Hub & Spoke Model

- Integrated with hundreds of ISVs
- Compute choices using both proprietary and open-source tech
- Open lake format
- Open file formats



Data easily shared without proprietary compute or dataset

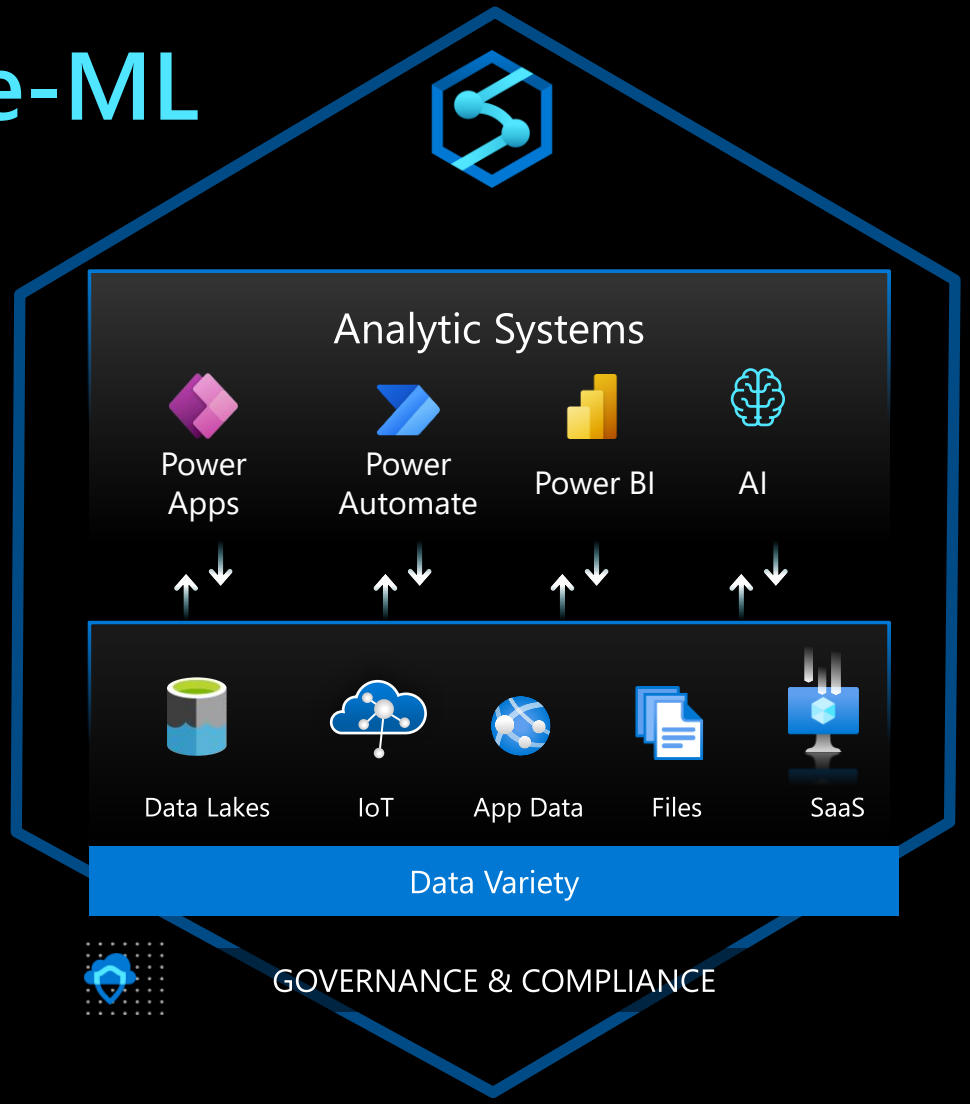
ML models (Onnx) & data models

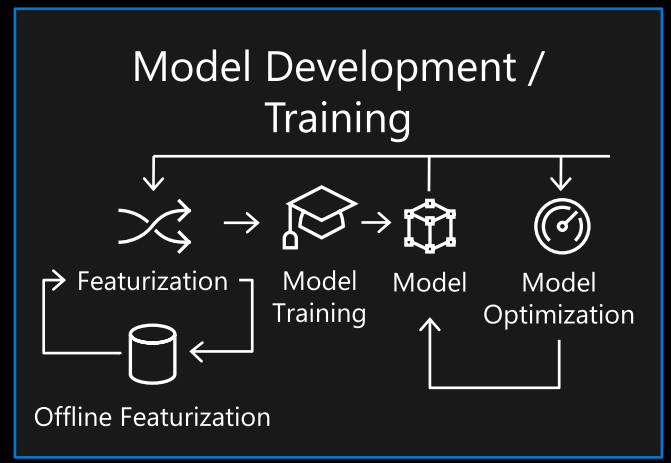
File formats accessible for all

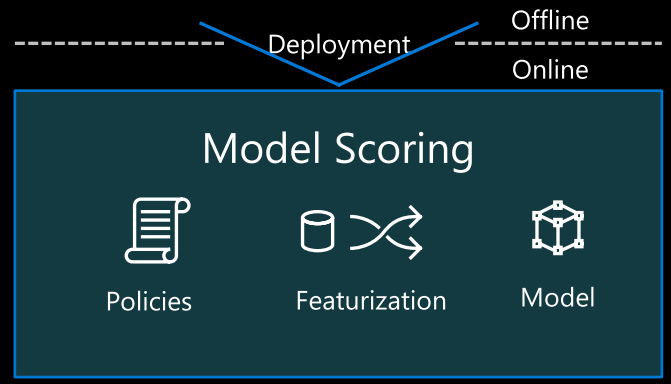
Why Synapse
Enterprise Grade-ML

Productizing AI

- Train in the cloud within the Hub
- Scoring with operational systems
- Governance everywhere (models, lineage)
- Ethical AI
- Control over deployment
- Deployment across Apps, BI, Processes
- Exchange of models (ONNX)
- Enabling Reinforcement learning







Microsoft

Azure Synapse Analytics

Apache Spark

Azure Synapse Apache Spark - Summary

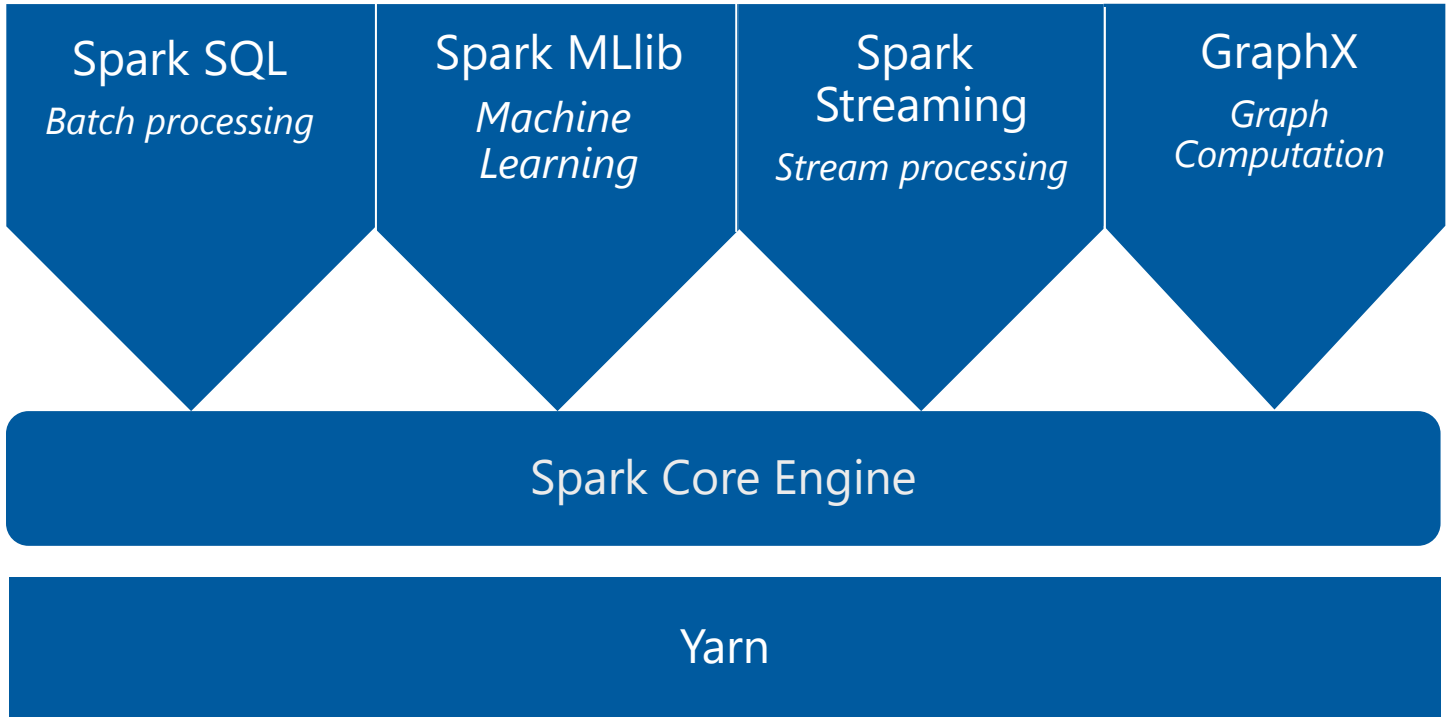
- **Apache Spark 2.4/3.1 derivation**
  - Linux Foundation Delta Lake 0.6/1.2 support
  - .Net Core 3.0/3.1 support
  - Python 3.6/3.8 + Anacondas support
- **Tightly coupled to other Azure Synapse services**
  - Integrated security and sign on
  - Integrated Metadata
  - Integrated and simplified provisioning
  - Integrated UX including nteract based notebooks
  - Fast load of Synapse SQL (provisioned) pools
- **Core scenarios**
  - Data Prep/Data Engineering/ETL
  - Machine Learning via Spark ML and Azure ML integration
  - Extensible through library management
- **Efficient resource utilization**
  - Fast Start
  - Auto scale (up and down)
  - Auto pause
  - Min cluster size of 3 nodes
- **Multi Language Support**
  - .Net (C#), PySpark, Scala, Spark SQL, Java

Apache Spark

An unified, open source, parallel, data processing framework for Big Data Analytics

Spark Unifies:

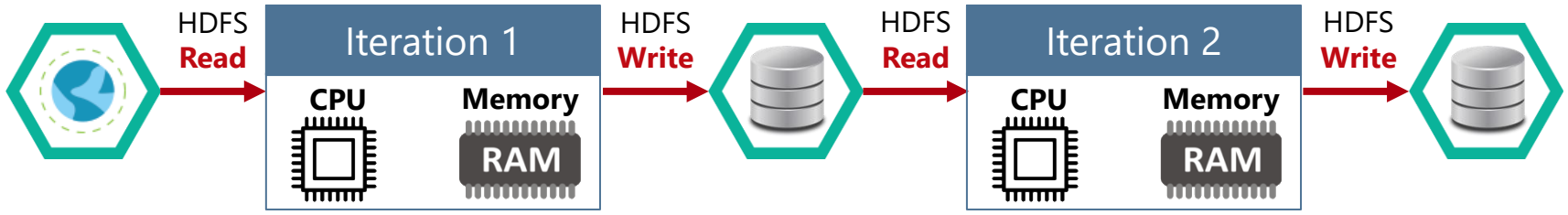
- Batch Processing
- Interactive SQL
- Real-time processing
- Machine Learning
- Deep Learning
- Graph Processing



http://spark.apache.org

Motivation for Apache Spark

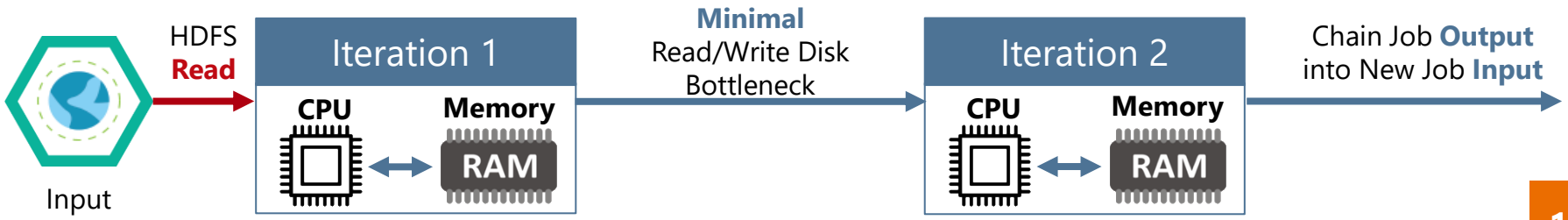
Traditional Approach: MapReduce jobs for complex jobs, interactive query, and online event-hub processing involves lots of (slow) disk I/O



Motivation for Apache Spark

Traditional Approach: MapReduce jobs for complex jobs, interactive query, and online event-hub processing involves lots of **(slow) disk I/O**

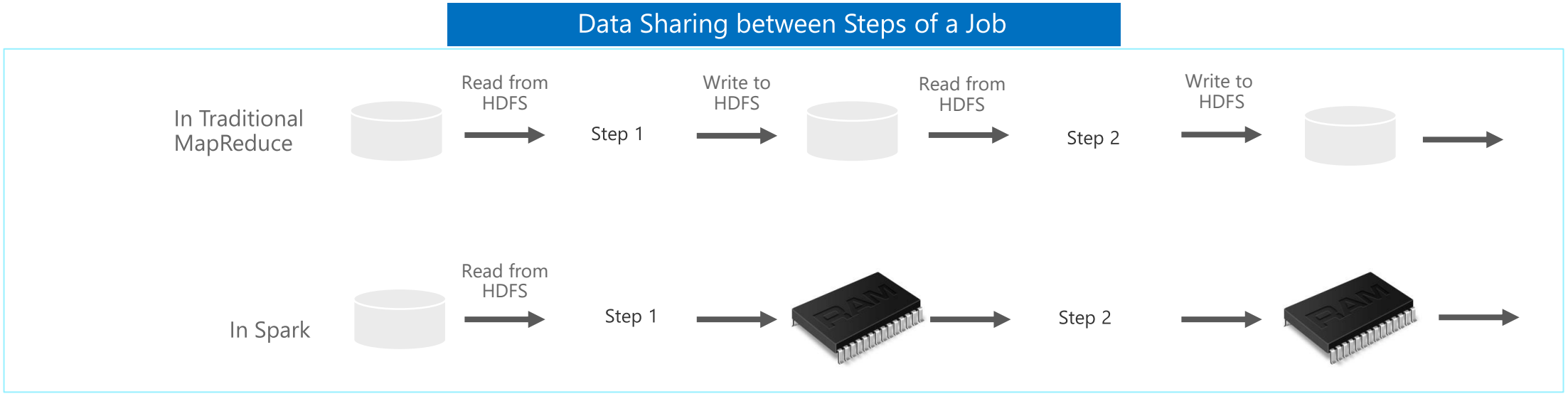
Solution: Keep data **in-memory** with a new distributed execution engine



10–100x faster than network & disk

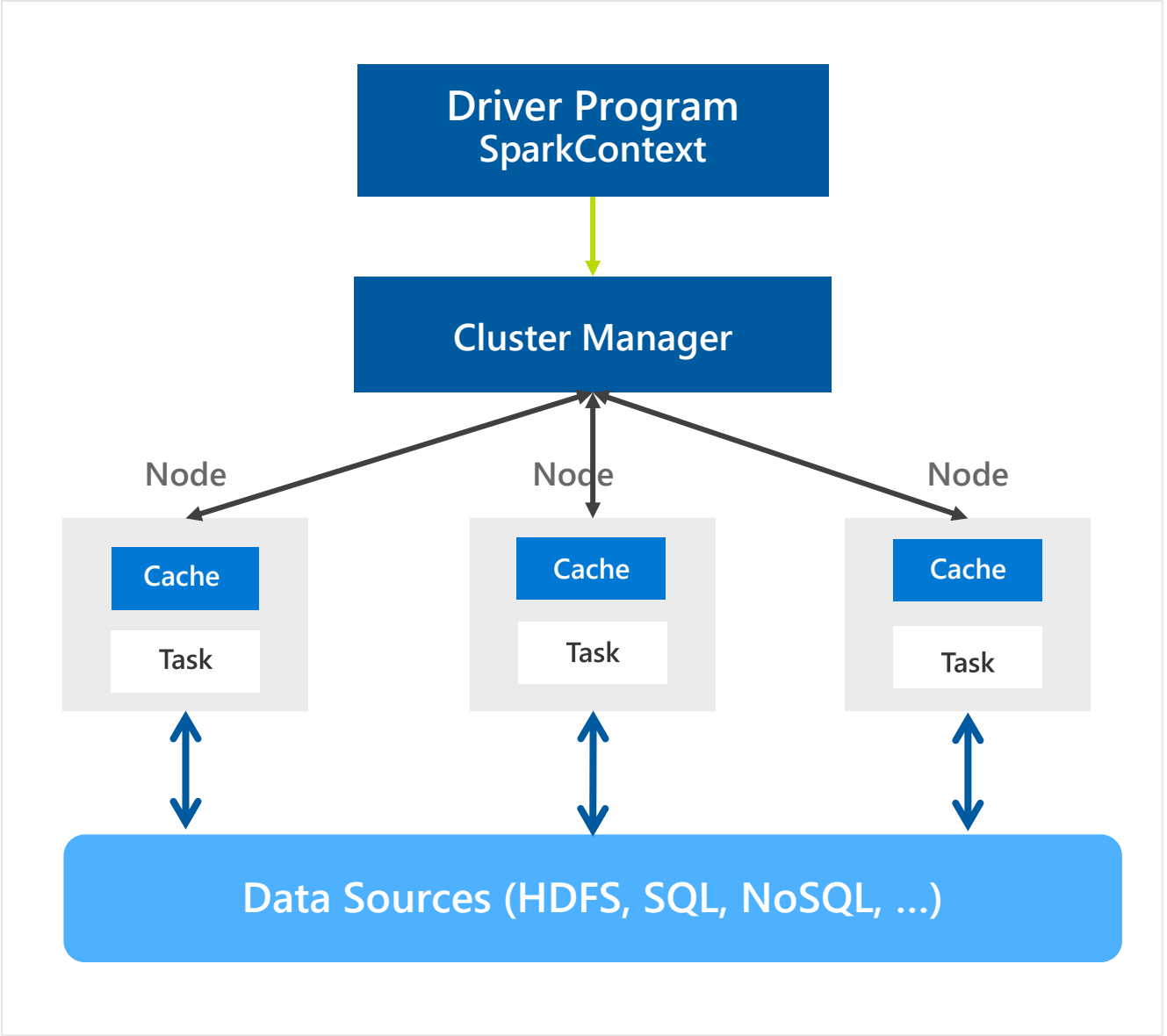
What makes Spark fast

- **In-memory cluster computing**: Spark provides primitives for *in-memory* cluster computing. A Spark job can *load and cache* data into memory and query it repeatedly (iteratively) much quicker than disk-based systems.
- **Scala Integration**: Spark integrates into the Scala programming language, letting you manipulate distributed datasets like local collections. No need to structure everything as map and reduce operations
- **Faster Data-sharing**: Data-sharing between operations is faster as data is in-memory:
  - In (traditional) Hadoop data is shared through HDFS which is expensive. HDFS maintains three replicas.
  - Spark stores data in-memory *without any replication*.



General Spark Cluster Architecture

- 'Driver' runs the user's 'main' function and executes the various parallel operations on the worker nodes.
- The results of the operations are collected by the driver
- The worker nodes read and write data from/to Data Sources including HDFS.
- Worker node also cache transformed data in memory as RDDs (Resilient Data Sets).
- Worker nodes and the Driver Node execute as VMs in public clouds (AWS, Google and Azure).



Spark Component Features

Spark SQL

- Unified data access: Query structured data sets with SQL or DataFrame APIs
- Fast, familiar query language across all your enterprise data
- Use BI tools to connect and query via JDBC or ODBC drivers

Mllib/SparkML

- Predictive and prescriptive analytics
- Machine learning algorithms for:
  - Clustering
  - Classification
  - Regression
  - etc.
- Smart application design from pre-built, out-of-the-box statistical and algorithmic models

Spark Streaming

- Micro-batch event processing for near-real time analytics
- e.g. Internet of Things (IoT) devices, Twitter feeds, Kafka (event hub), etc.
- Spark's engine drives some action or outputs data in batches to various data stores

GraphX

- Represent and analyze systems represented by graph nodes
- Trace interconnections between graph nodes
- Applicable to use cases in transportation, telecommunications, road networks, modeling personal relationships, social media, etc.

Microsoft

Azure Synapse Apache Spark

Architecture Overview

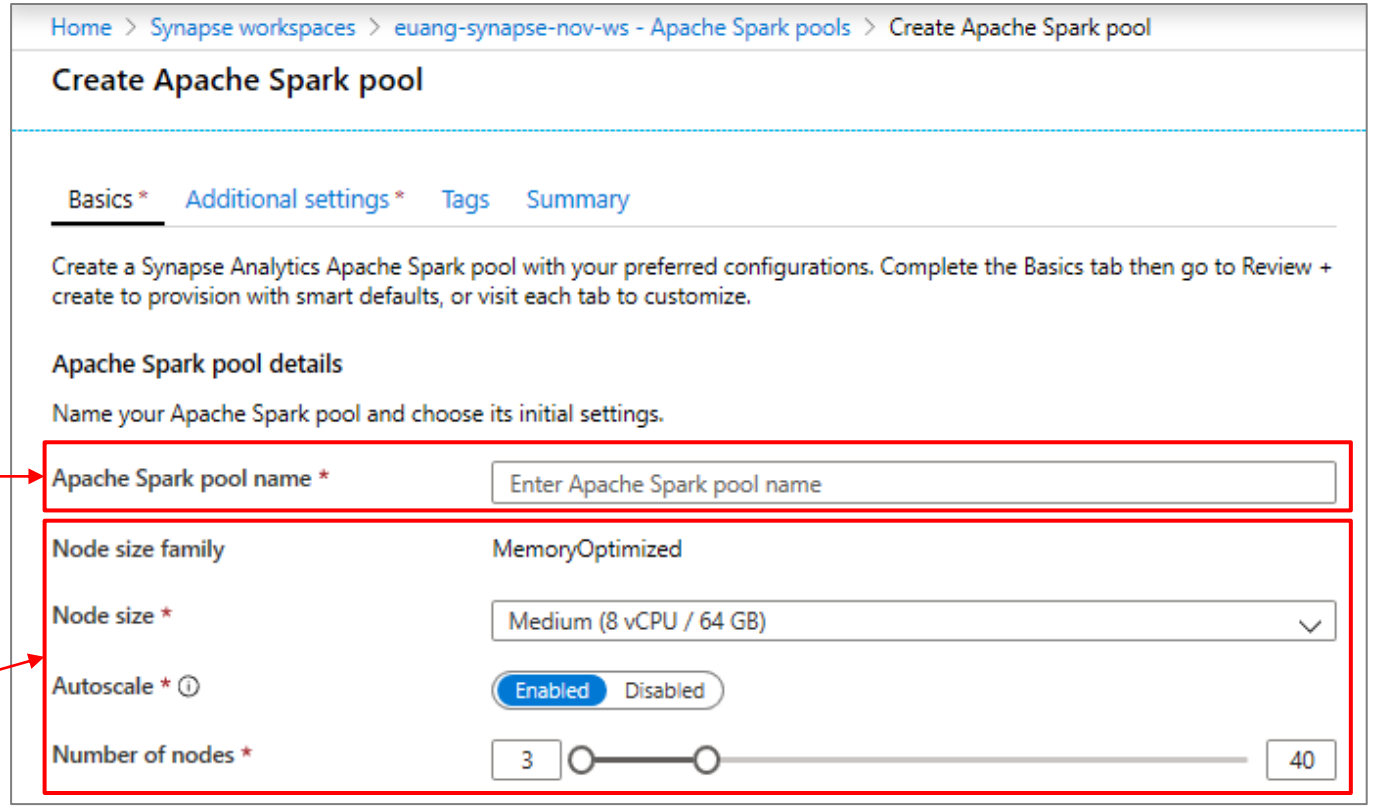
Creating a Spark pool (1 of 2)

Provision Spark Pool through Azure Portal with default settings or per requirements

Basic Settings – Minimum details required from user

Only required field from user

Default Settings

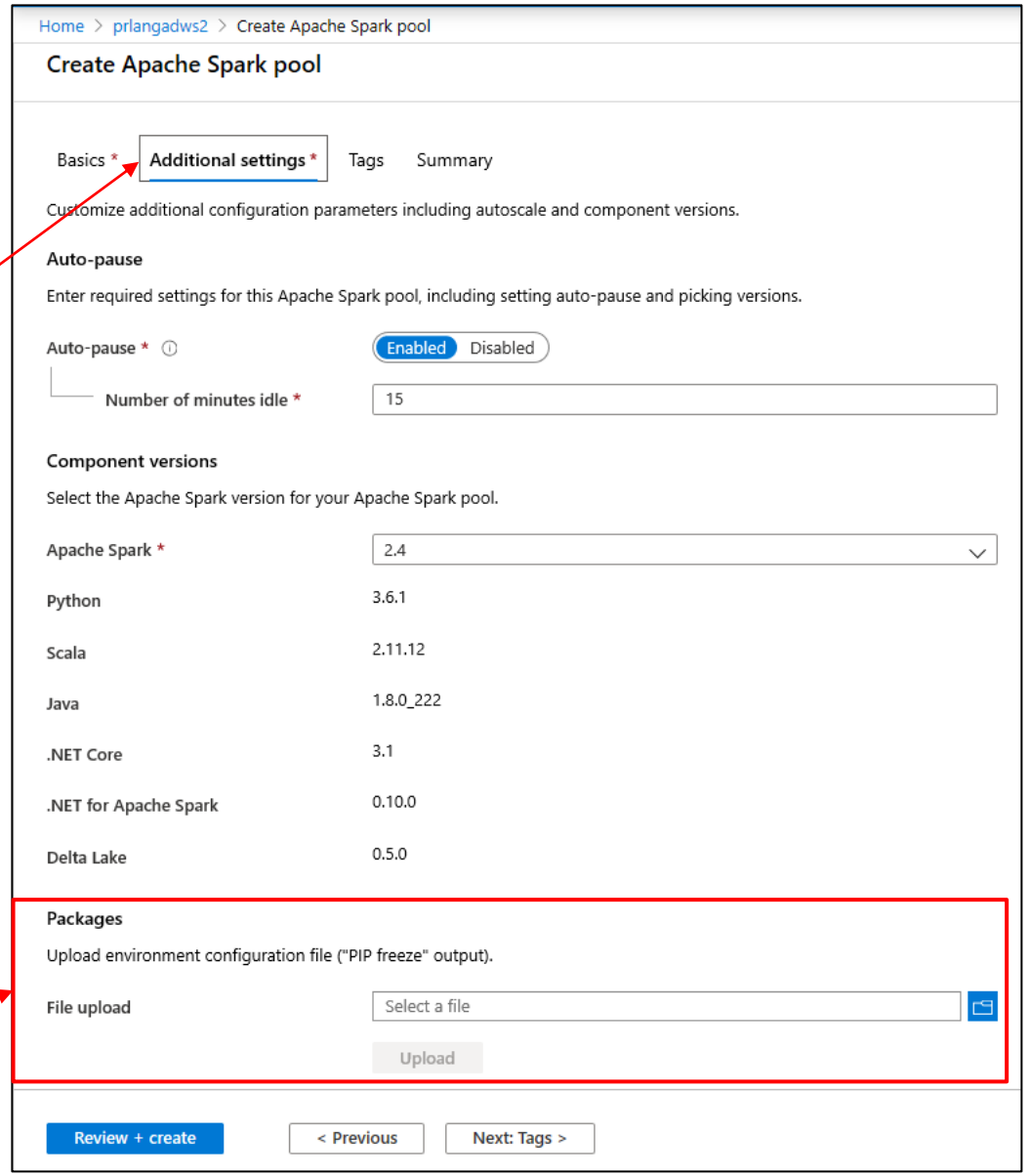


Creating a Spark pool (2 of 2) - optional

Additional Settings offer optional settings to customize Spark pool

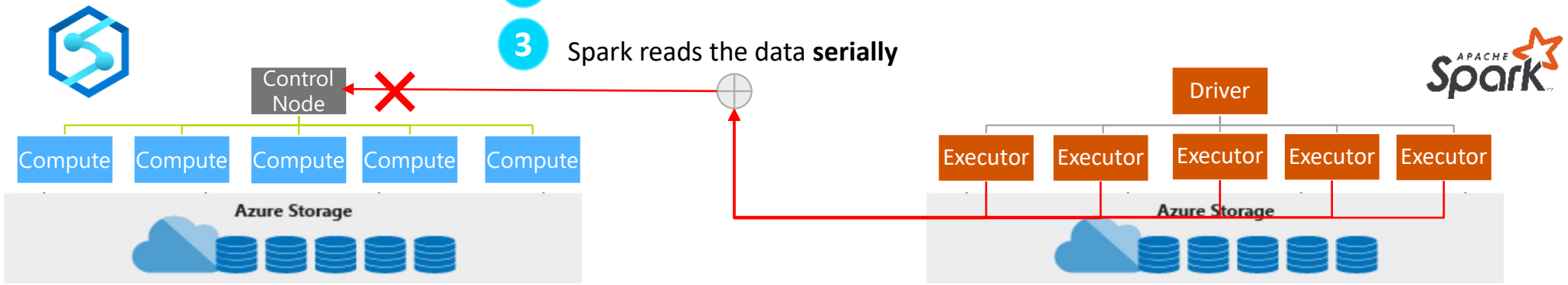
Customize component versions, auto-pause

Import libraries by providing text file containing library name and version



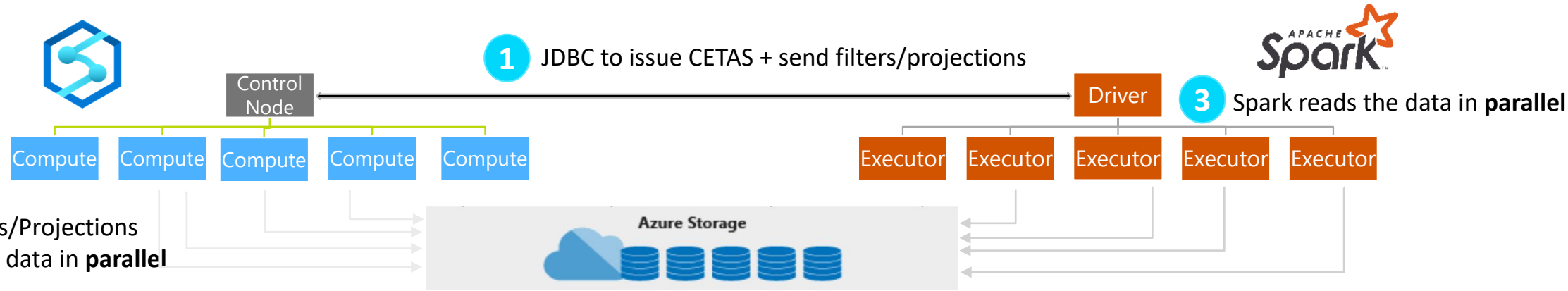
Existing Approach: JDBC

1. JDBC to open connection
2. Apply any Filters/Projections
3. Spark reads the data **serially**



New Approach: JDBC and Polybase

1. JDBC to issue CETAS + send filters/projections
2. Apply any Filters/Projections
   DW exports the data in **parallel**
3. Spark reads the data in **parallel**



User Provisioned Workspace-Default Data Lake

Code-Behind Experience

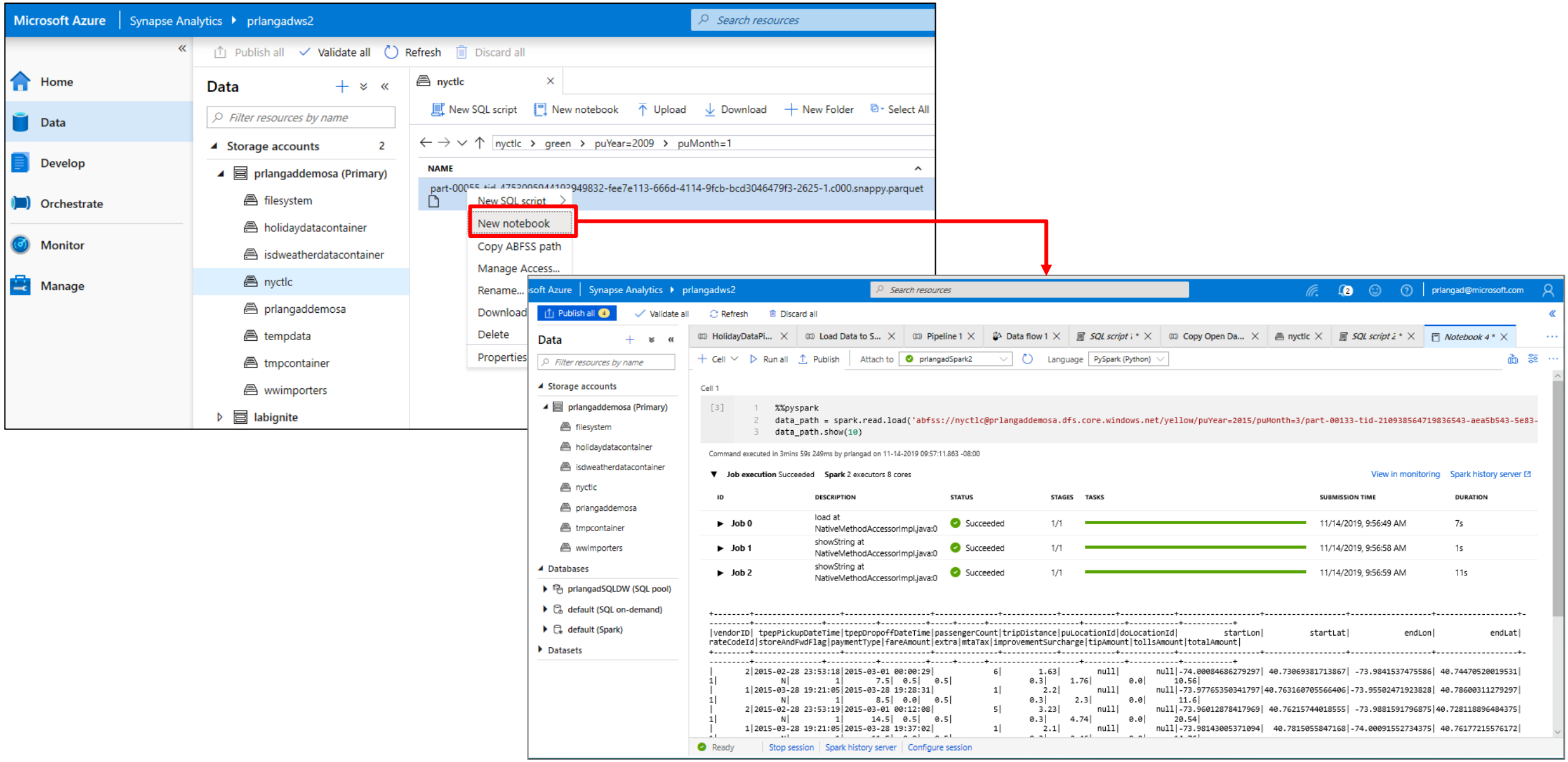
Existing Approach

```
val jdbcUsername = "<SQL DB ADMIN USER>"
val jdbcPwd = "<SQL DB ADMIN PWD>"
val jdbcHostname = "servername.database.windows.net”
val jdbcPort = 1433
val jdbcDatabase ="<AZURE SQL DB NAME>“


val jdbc_url =
s"jdbc:sqlserver://${jdbcHostname}:${jdbcPort};database=${jdbcDatabase};
encrypt=true;trustServerCertificate=false;hostNameInCertificate=*.databas
e.windows.net;loginTimeout=60;“

val connectionProperties = new Properties()

connectionProperties.put("user", s"${jdbcUsername}")
connectionProperties.put("password", s"${jdbcPwd}")

val sqlTableDf = spark.read.jdbc(jdbc_url, “dbo.Tbl1", connectionProperties)
```

New Approach

```
// Construct a Spark DataFrame from dedicated SQL pool
var df = spark.read.sqlanalytics("sql1.dbo.Tbl1")

// Write the Spark DataFrame into dedicated SQL pool
df.write.sqlanalytics(“sql1.dbo.Tbl2”)
```

Create Notebook on files in storage



Develop Hub - Notebooks

Notebooks

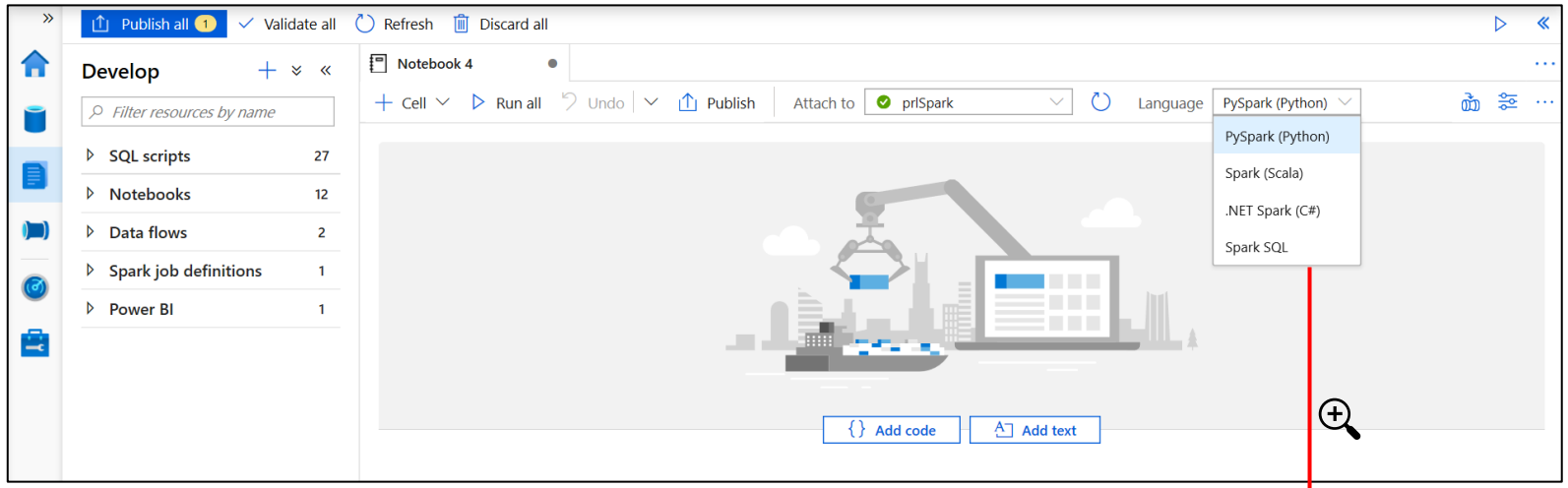
Allows to write multiple languages in one notebook

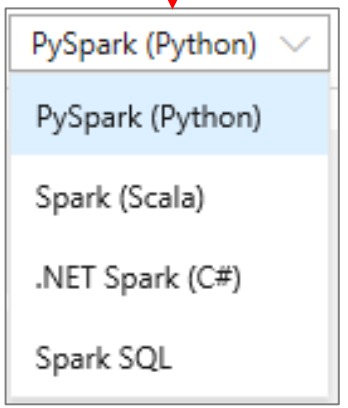
%%<Name of language>

Offers use of temporary tables across languages

Language support for Syntax highlight, syntax error, syntax code completion, smart indent, code folding

Export results

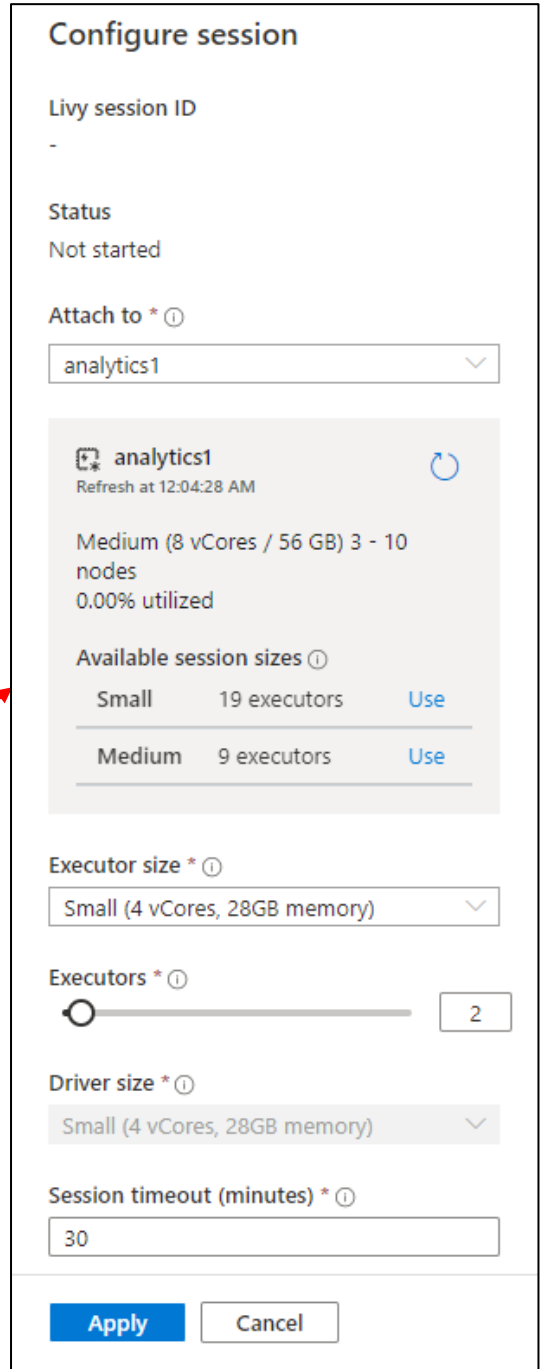




Develop Hub - Notebooks

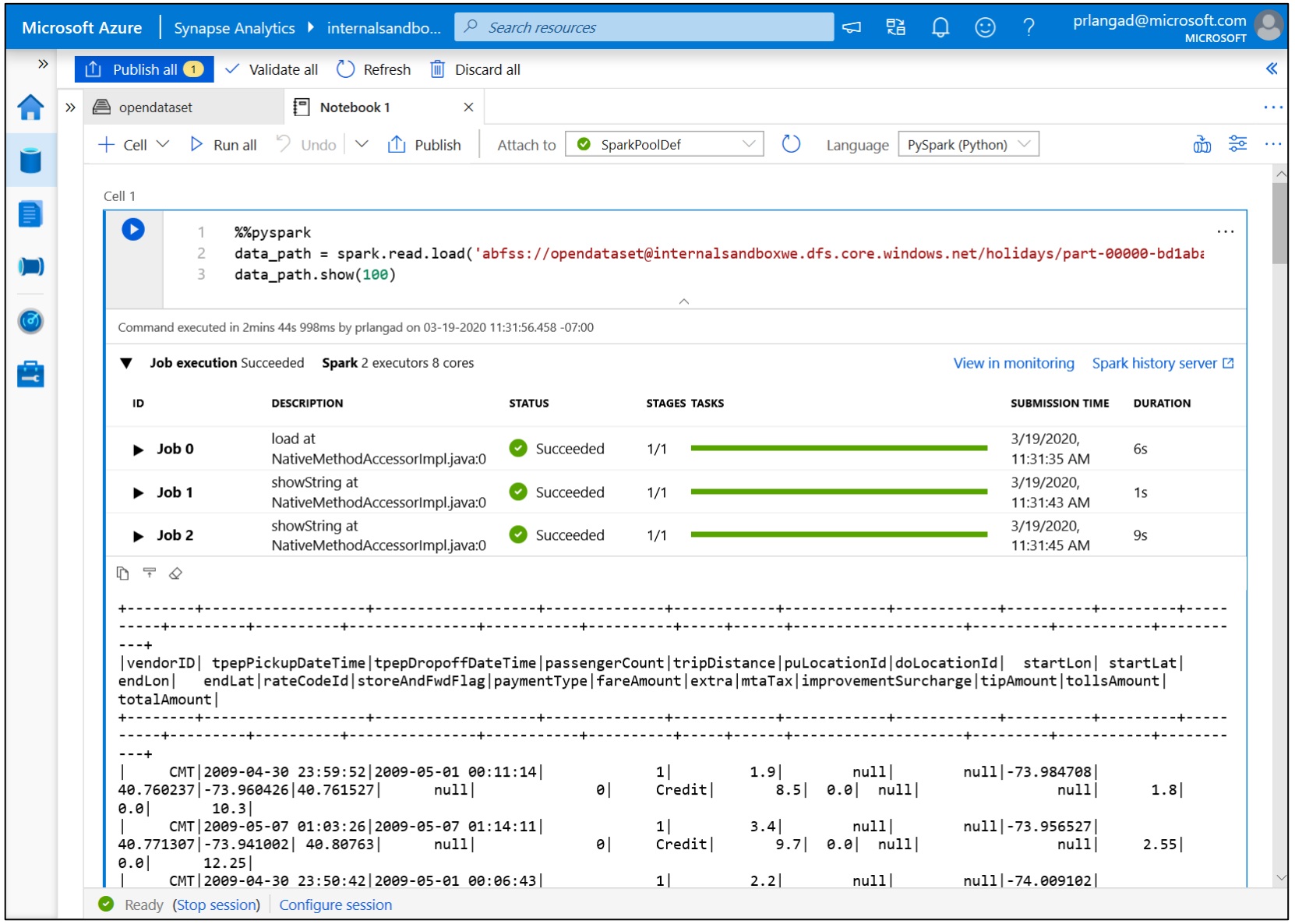
Configure session allows developers to control how many resources are devoted to running their notebook.

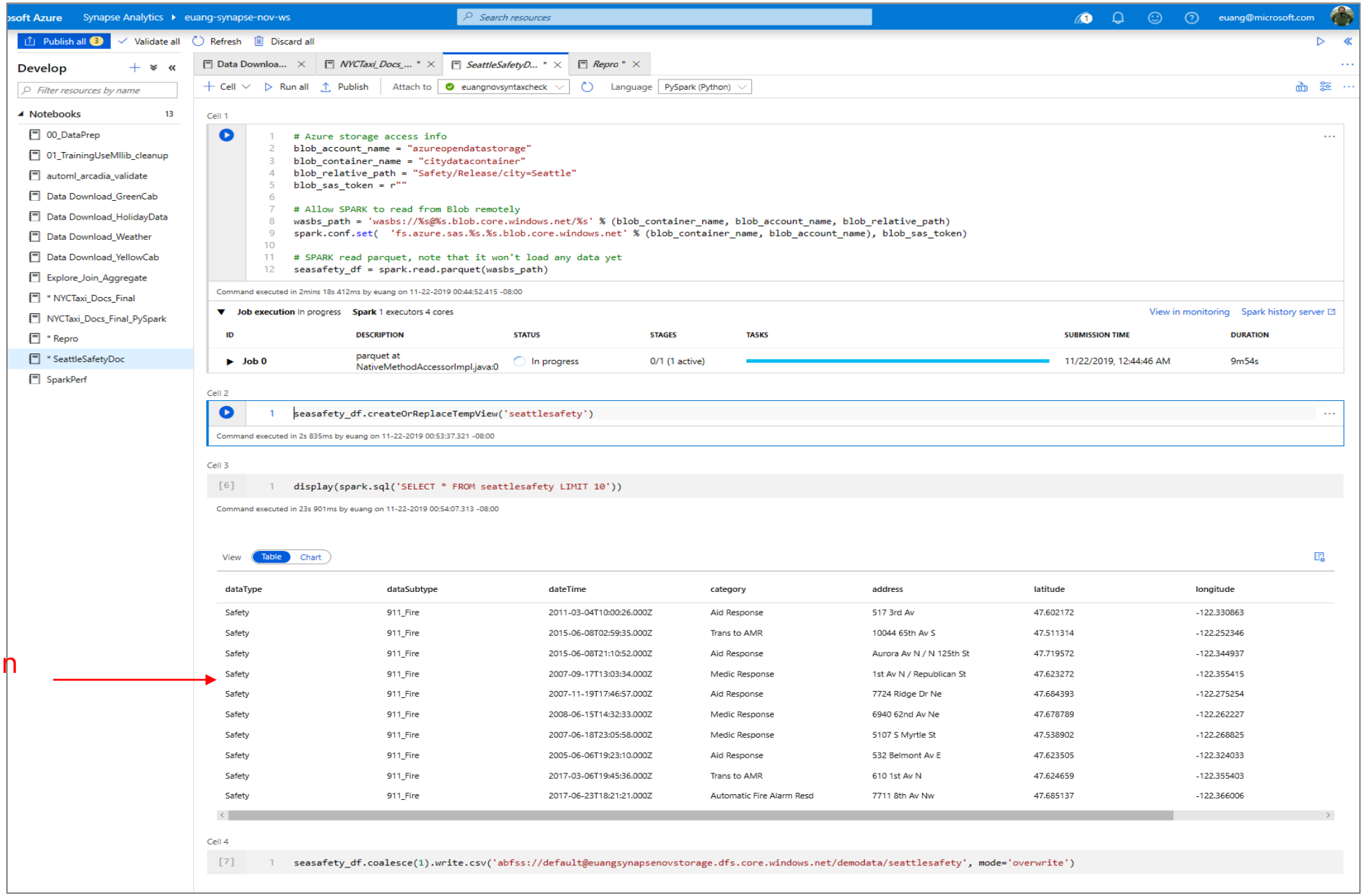
Provides quick links to monitor session and Spark history server



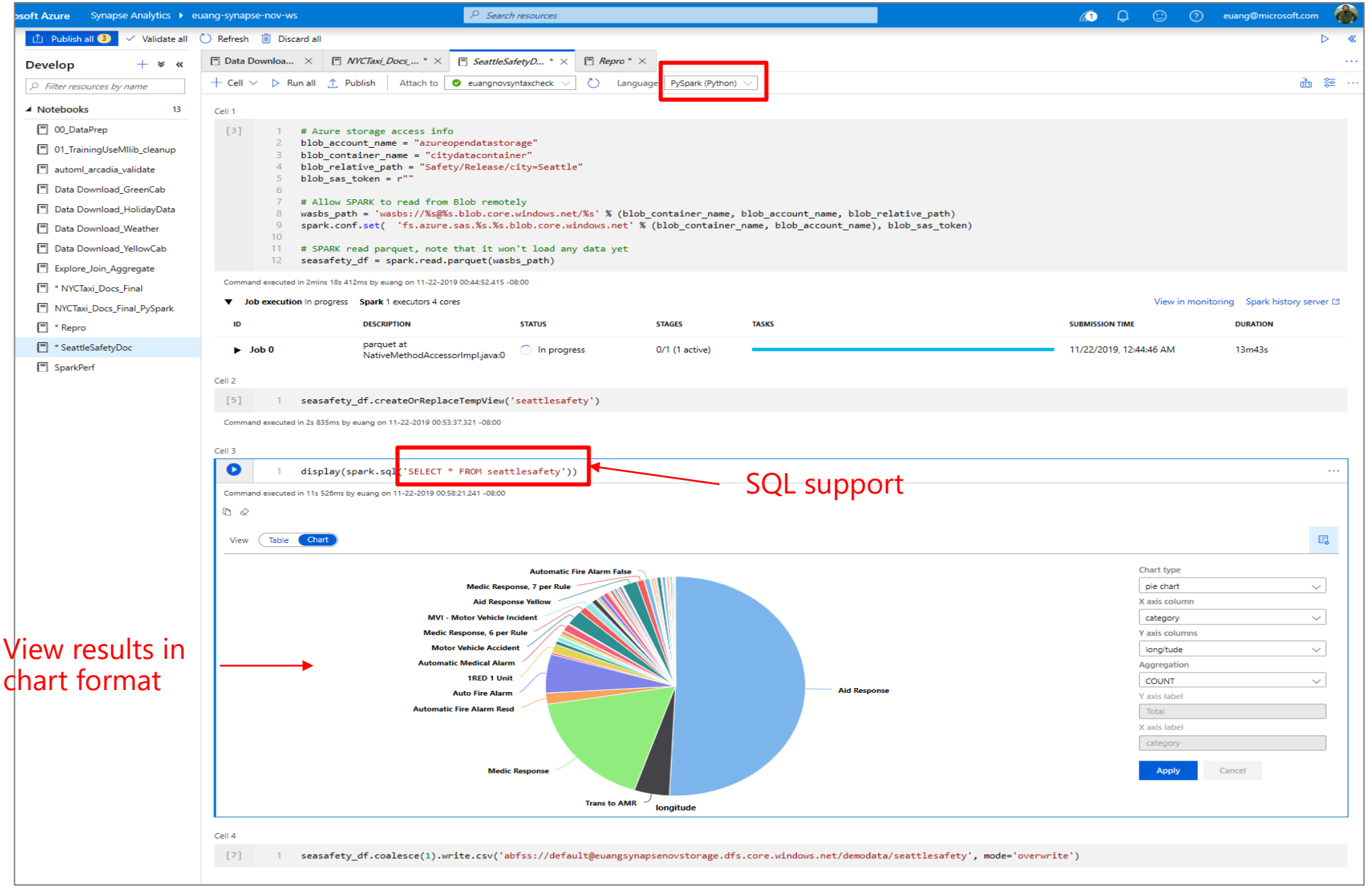
Develop Hub - Notebooks

As notebook cells run, the underlying Spark application status is shown. Providing immediate feedback and progress tracking.





View results in table format



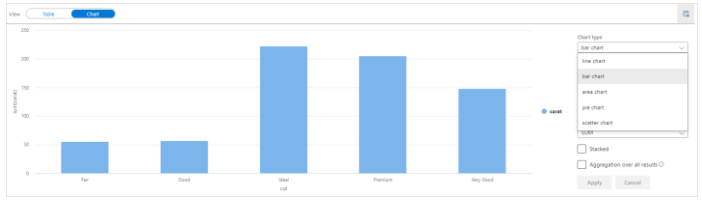
SQL support

View results in chart format

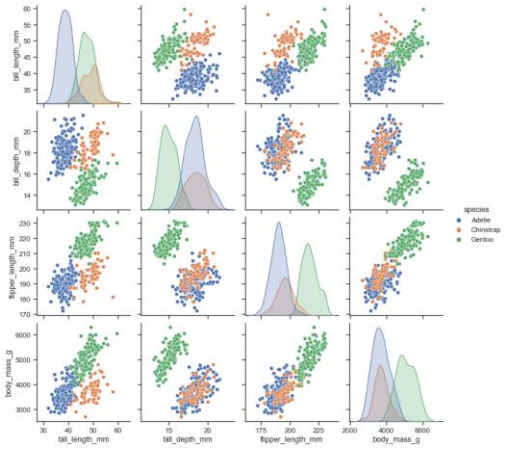
Develop Hub

Explore data by using native visuals in Spark notebooks

Fonction display(df)

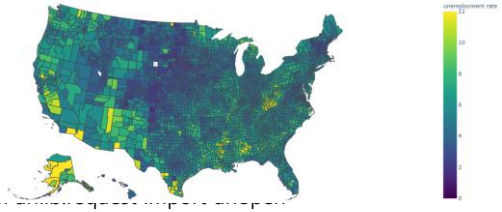


Seaborn



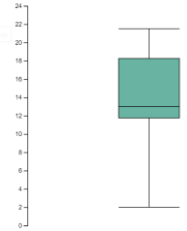
```
import seaborn as sns
sns.set_theme(style="ticks")

df = sns.load_dataset("penguins")
sns.pairplot(df, hue="species")
```

Plotly

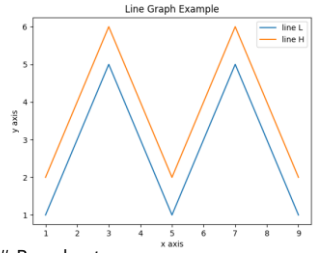


```
import json
with
urlopen('https://raw.githubusercontent.com/plotly/datasets/master/geojson-counties-fips.json') as response:
    counties = json.load(response)

import pandas as pd
df =
pd.read_csv("https://raw.githubusercontent.com/plotly/datasets/master/fips-unemp-16.csv",
                    dtype={"fips": str})

import plotly
import plotly.express as px

fig = px.choropleth(df, geojson=counties, locations='fips',
color='unemp',
                           color_continuous_scale="Viridis",
                           range_color=(0, 12),
                           scope="usa",
                           labels={'unemp':'unemployment rate'}
                          )
fig.update_layout(margin={"r":0,"t":0,"l":0,"b":0})

# create an html document that embeds the Plotly plot
h = plotly.offline.plot(fig, output_type='div')

# display this html
displayHTML(h)
```

displayHTML() option

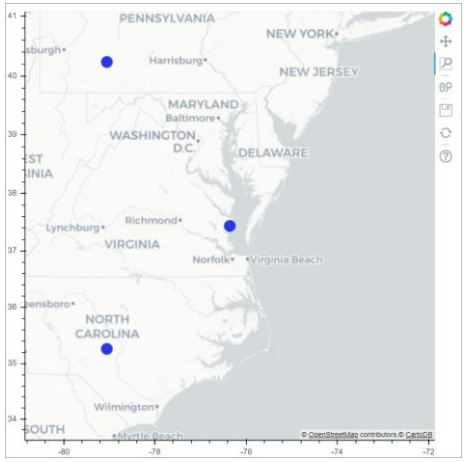


Matplotlib




```
# Bar chart

import matplotlib.pyplot as plt

x1 = [1, 3, 4, 5, 6, 7, 9]
y1 = [4, 7, 2, 4, 7, 8, 3]

x2 = [2, 4, 6, 8, 10]
y2 = [5, 6, 2, 6, 2]

plt.bar(x1, y1, label="Blue Bar", color='b')
plt.bar(x2, y2, label="Green Bar", color='g')
plt.plot()

plt.xlabel("bar number")
plt.ylabel("bar height")
plt.title("Bar Chart Example")
plt.legend()
plt.show()
```

Bokeh




```
from bokeh.plotting import figure, output_file
from bokeh.tile_providers import get_provider, Vendors
from bokeh.embed import file_html
from bokeh.resources import CDN
from bokeh.models import ColumnDataSource

tile_provider = get_provider(Vendors.CARTODBPOSITRON)

# range bounds supplied in web mercator coordinates
p = figure(x_range=(-9000000,-8000000),
y_range=(4000000,5000000),
           x_axis_type="mercator", y_axis_type="mercator")
p.add_tile(tile_provider)

# plot datapoints on the map
source = ColumnDataSource(
    data=dict(x=[ -8800000, -8500000 , -8800000],
            y=[4200000, 4500000, 4900000])
)

p.circle(x="x", y="y", size=15, fill_color="blue", fill_alpha=0.8,
source=source)

# create an html document that embeds the Bokeh plot
html = file_html(p, CDN, "my plot1")

# display this html
displayHTML(html)
```

Library Management - Python

Overview

Customers can add new python libraries at Spark pool level

Benefits

Input requirements.txt in simple pip freeze format

Add new libraries to your cluster

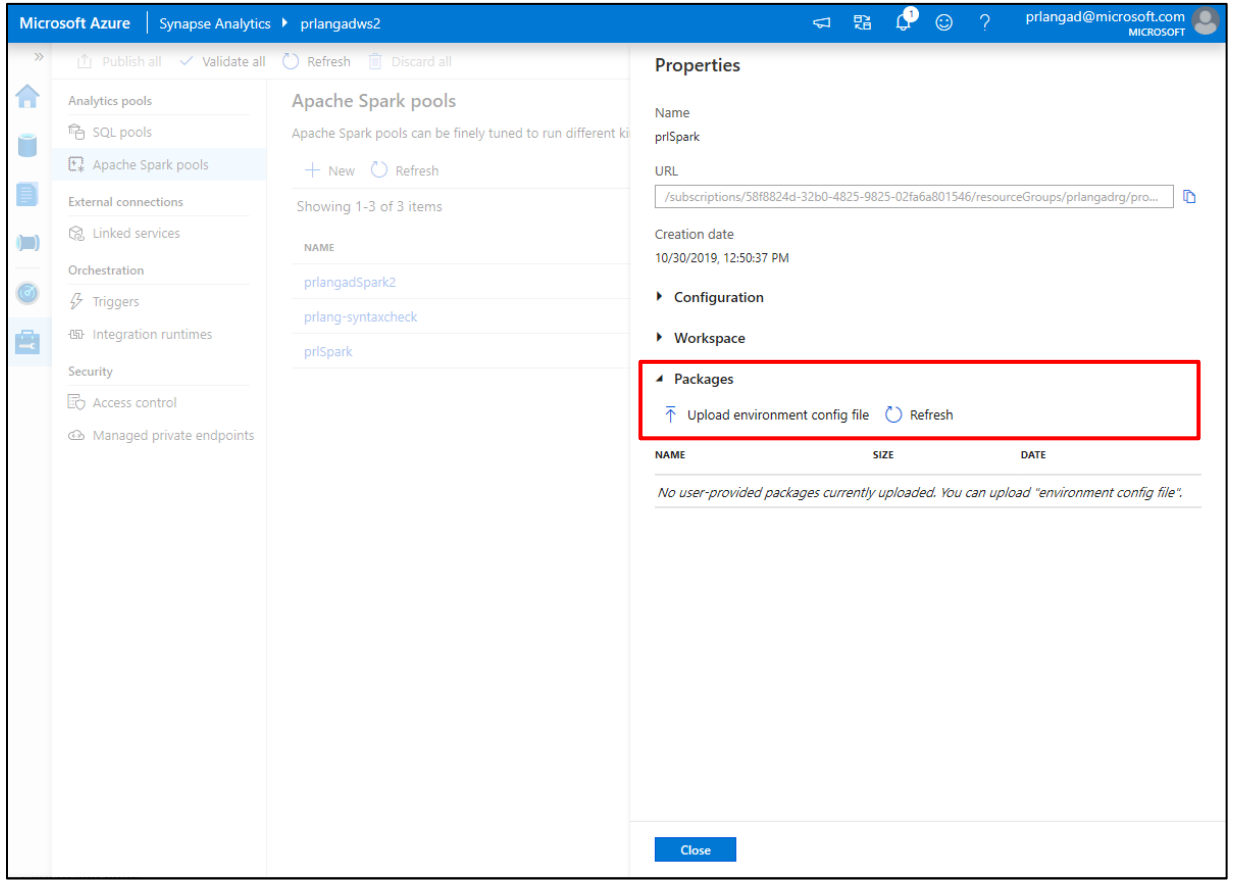
Update versions of existing libraries on your cluster

Ability to specify different requirements file for different pools within the same workspace

Constraints

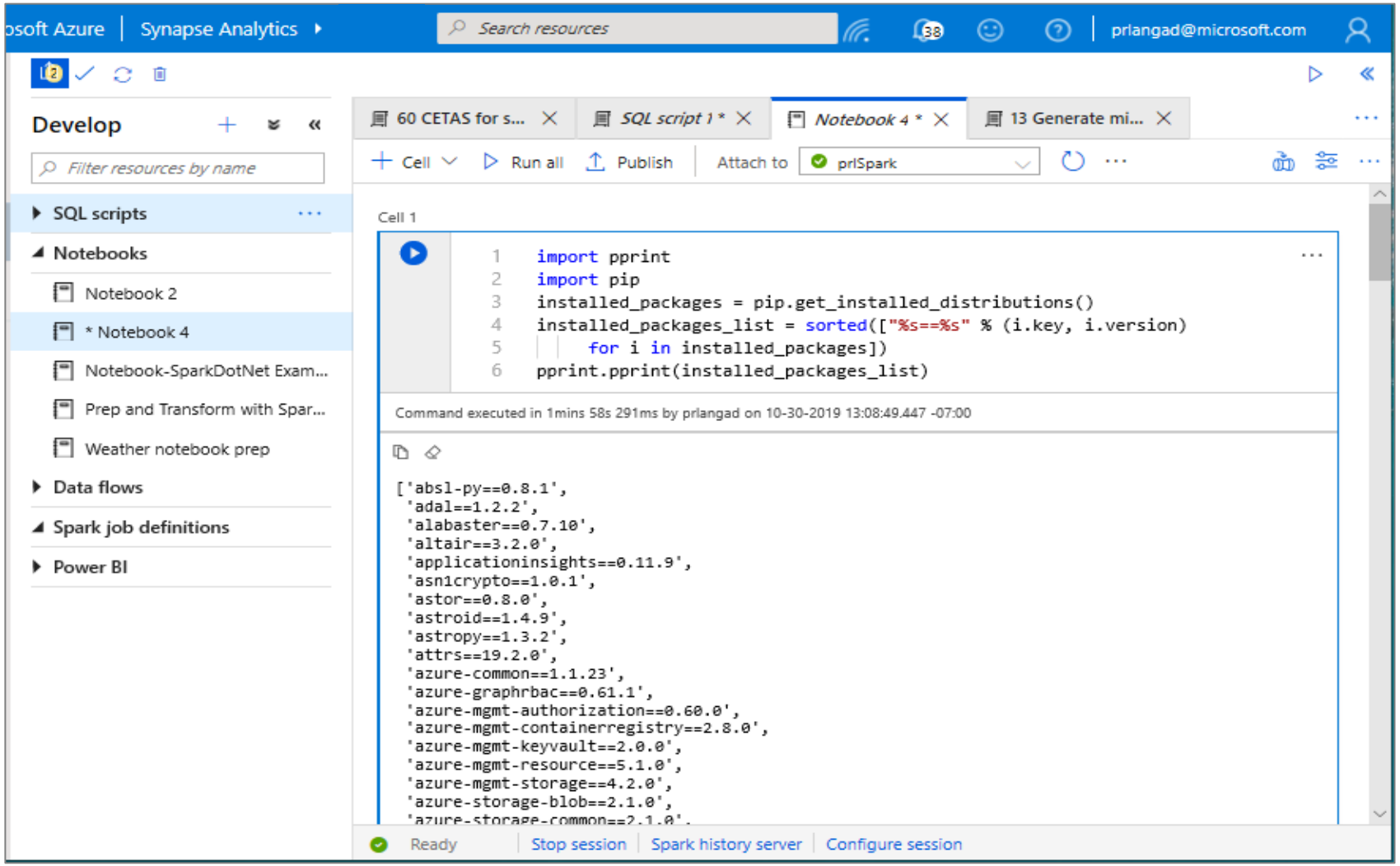
The library version must exist on PyPI repository

Version downgrade of an existing library not allowed



Library Management - Python

Get list of installed libraries with version information



Dataflow Capabilities

Handle upserts, updates, deletes on sql sinks

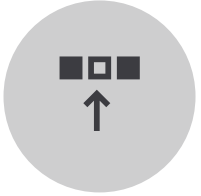
Add new partition methods

Add schema drift support

Add file handling (move files after read, write files to file names described in rows etc)

New inventory of functions (for e.g. Hash functions for row comparison)

Commonly used ETL patterns(Sequence generator/Lookup transformation/SCD…)



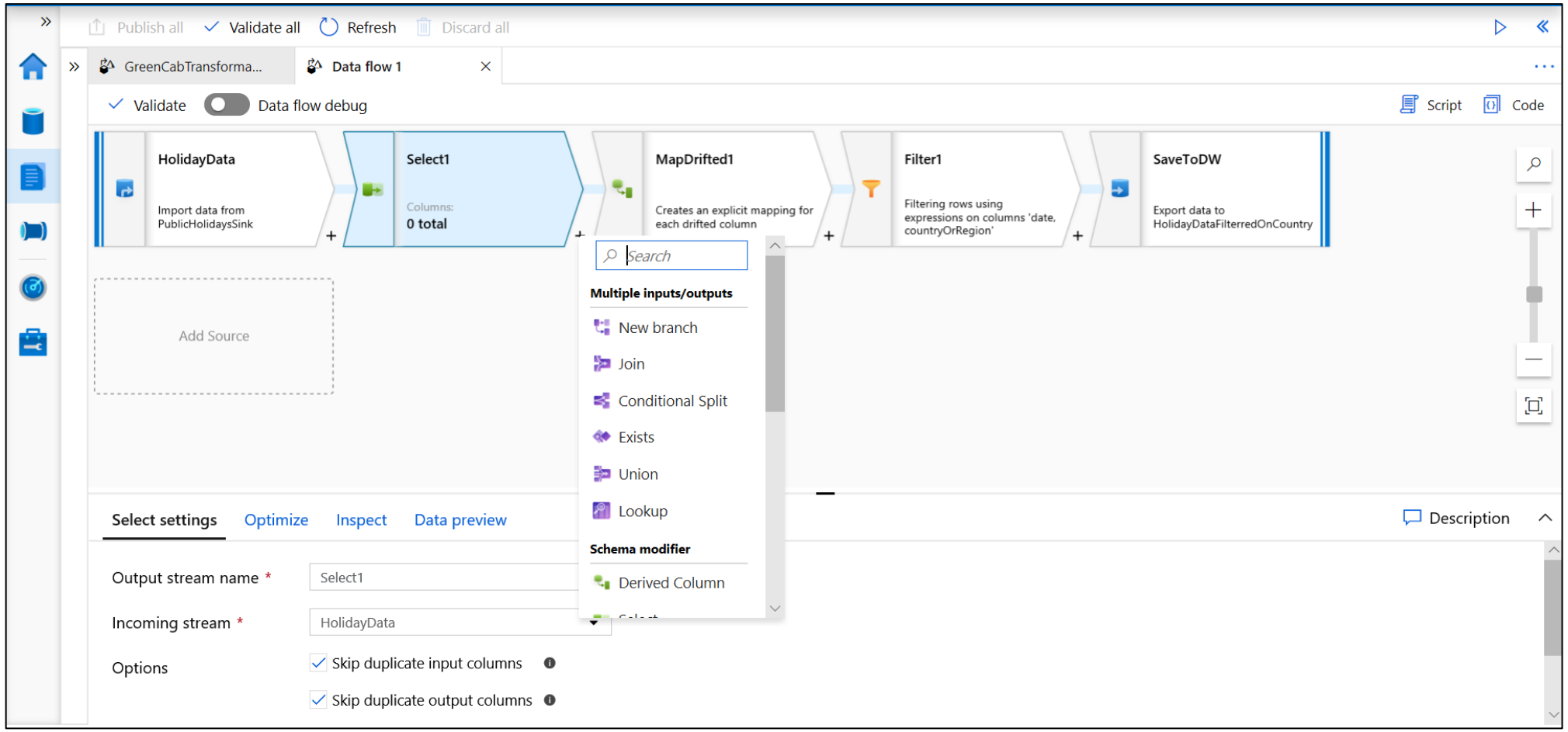
Data lineage – Capturing sink column lineage & impact analysis(invaluable if this is for enterprise deployment)

Implement commonly used ETL patterns as templates(SCD Type1, Type2, Data Vault)

Develop Hub - Data Flows

Data flows are a visual way of specifying how to transform data.

Provides a code-free experience.



Spark ML Algorithms

Spark ML Algorithms

Classification and Regression	• Linear Models (SVMs, logistic regression, linear regression) • Naïve Bayes • Decision Trees • Ensembles of trees (Random Forest, Gradient-Boosted Trees) • Isotonic regression
Clustering	• k-means and streaming k-means • Gaussian mixture • Power iteration clustering (PIC) • Latent Dirichlet allocation (LDA)
Collaborative Filtering	• Alternating least squares (ALS)
Dimensionality Reduction	• SVD • PCA
Frequent Pattern Mining	• FP-growth • Association rules
Basic Statistics	• Summary statistics • Correlations • Stratified sampling • Hypothesis testing • Random data generation

SynapseML

Simple and Distributed Machine Learning

Get Started

Coming from MMLSpark? We have been renamed to SynapseML!

Cognitive Services | Deep Learning | Responsible AI | LightGBM | OpenCV

```
from synapse.ml.cognitive import *

sentiment_df = (TextSentiment()
    .setTextCol("text")
    .setLocation("eastus")
    .setSubscriptionKey(key)
    .setOutputCol("sentiment")
    .setErrorCol("error")
    .setLanguageCol("language")
    .transform(input_df))
```

Read more

Microsoft Spark Utilities

Overview

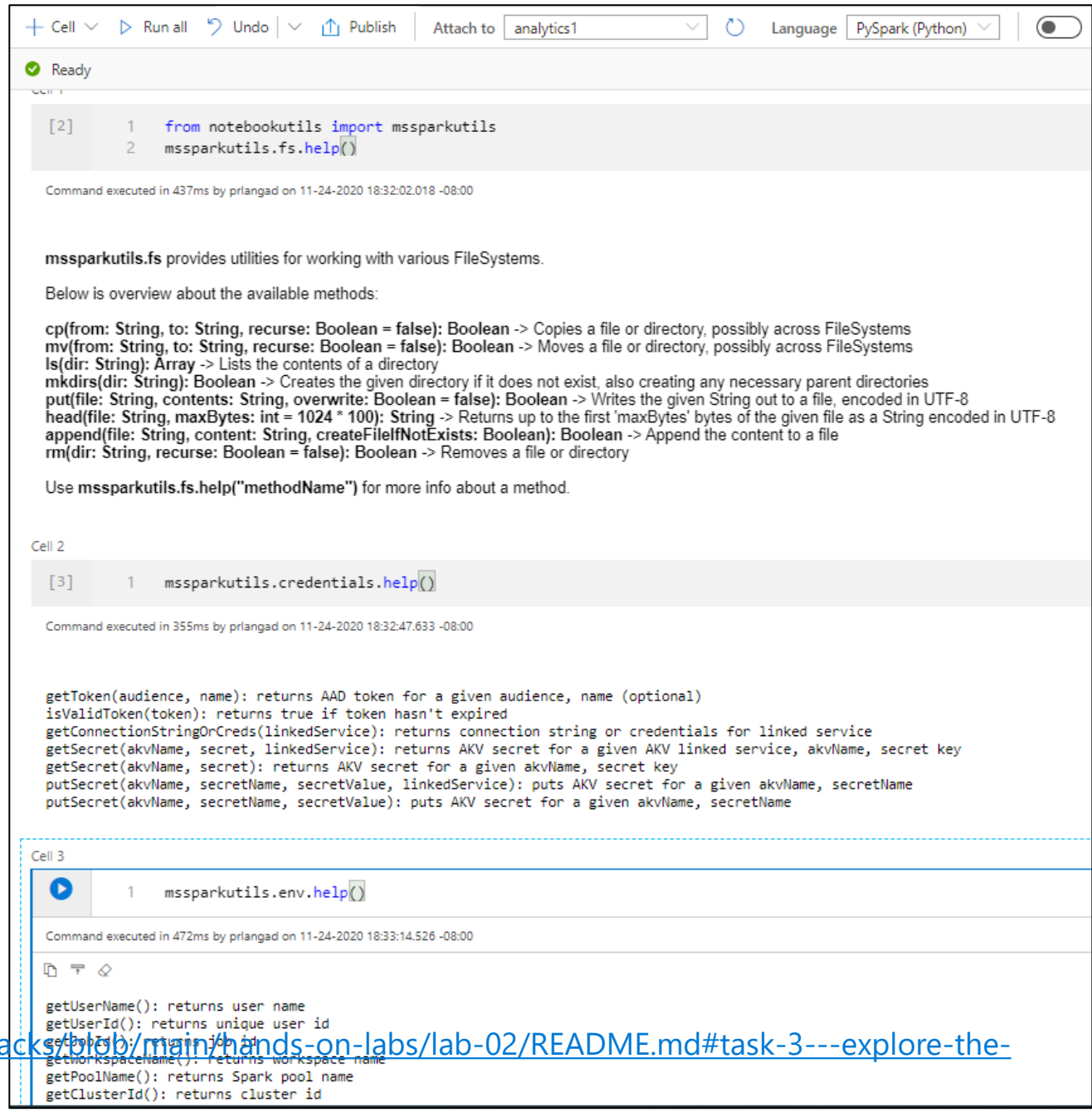
It provides utilities for working with file systems, including ADLS Gen2 and Azure Blob Storage.

Benefits

It supports multiple methods for file systems such as List, Copy, Move, Write, Append, Delete file or directory, View file properties, Create new directory, Preview file content.

It supports environment utilities to get username, user id, job id, workspace name, pool name, cluster id.

It supports to get the access tokens of linked services and manage secrets in Azure Key Vault.



https://github.com/solliancenet/azure-synapse-analytics-ga-content-packs/blob/main/hands-on-labs/lab-02/README.md#task-3---explore-the-data-lake-storage-with-the-mssparkutil-library

Hyperspace

Overview

Hyperspace introduces the ability for Apache Spark users to create indexes on their data

Benefits

It helps accelerate your workloads or queries containing filters on predicates with high selectivity or a join that requires heavy shuffles.

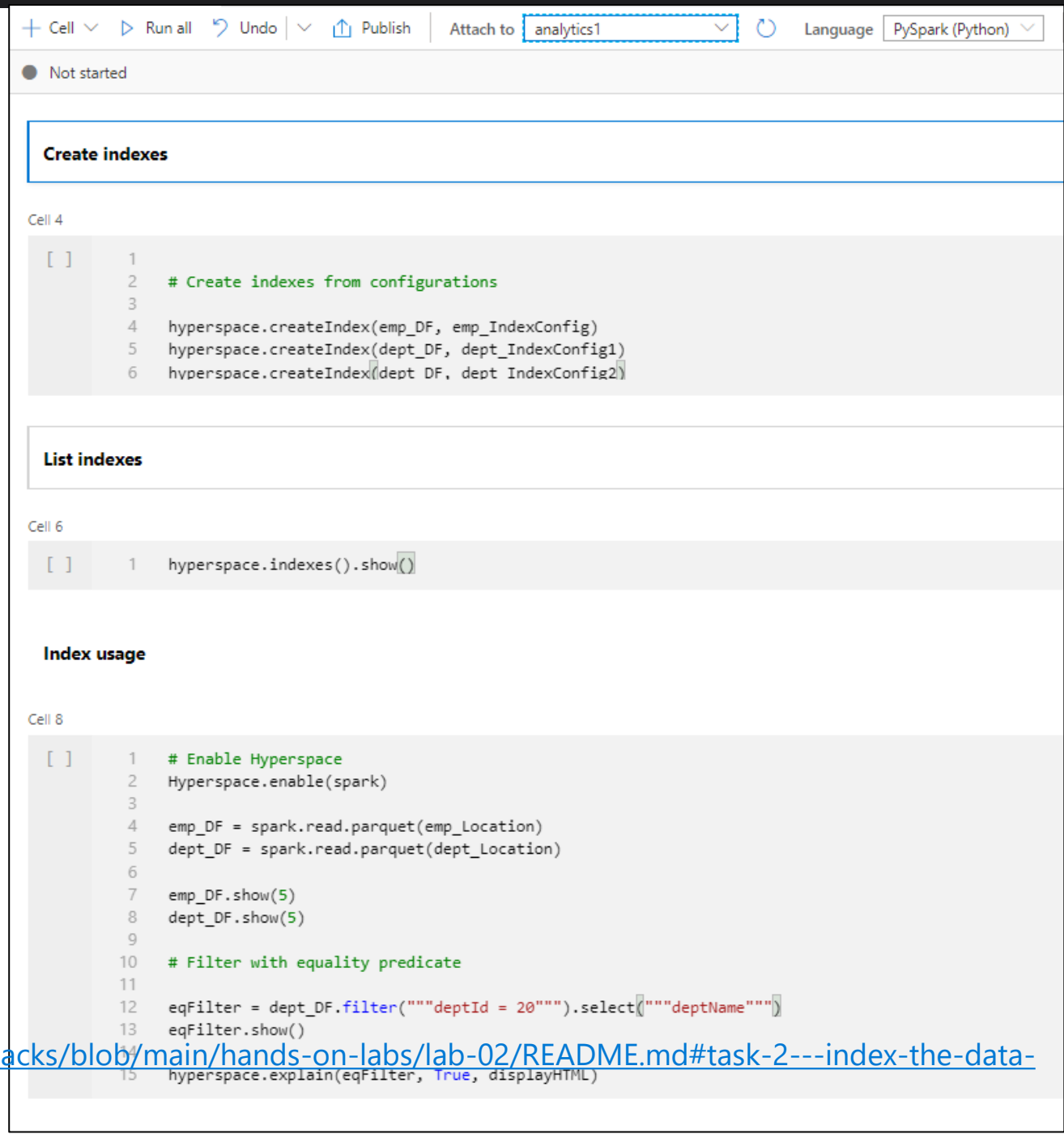
Maintain the indexes through a multi-user concurrency model.

Leverage these indexes automatically, within your Spark workloads, without any changes to your application code for query/workload acceleration.

It supports index operations as create index, list index, restore index, delete index, vacuum index

Languages supported: Scala, Python, .NET

https://github.com/solliancenet/azure-synapse-analytics-ga-content-packs/blob/main/hands-on-labs/lab-02/README.md#task-2---index-the-data-lake-storage-with-hyperspace



Spark CDM connector

Overview

It offers Spark dataframes to read and write entities in a CDM folder.

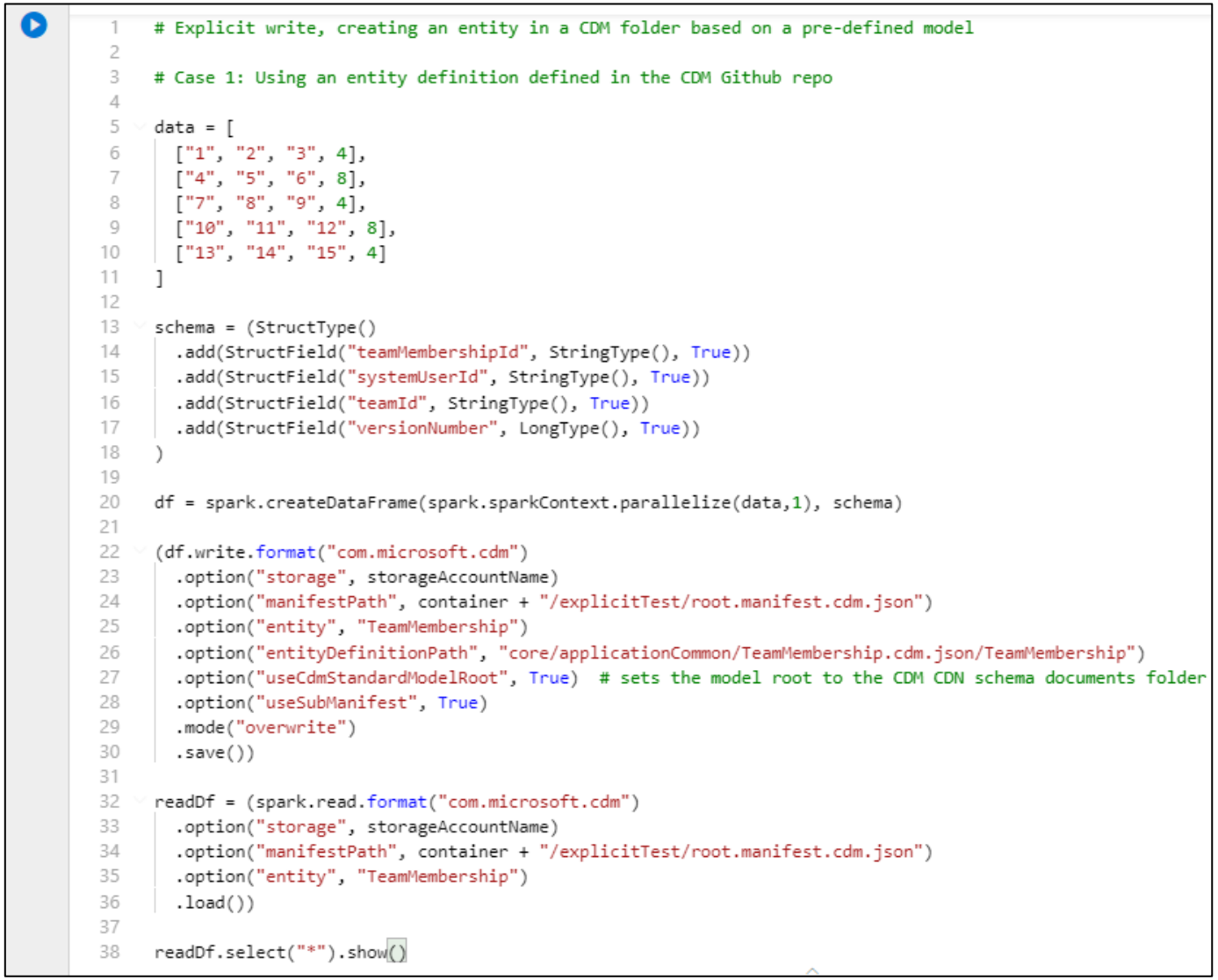
Benefits

It supports use of Managed Identities for Azure resources to mediate access to the Azure datalake storage.

Writes from a Spark dataframe to an entity in a CDM folder based on dataframe schema or CDM entity definition.

Supports data in Apache Parquet format and CSV format.

The CDM connector is pre-installed and supports languages: Python, Scala



```python
# Explicit write, creating an entity in a CDM folder based on a pre-defined model

# Case 1: Using an entity definition defined in the CDM Github repo

data = [
  ["1", "2", "3", 4],
  ["4", "5", "6", 8],
  ["7", "8", "9", 4],
  ["10", "11", "12", 8],
  ["13", "14", "15", 4]
]

schema = (StructType()
  .add(StructField("teamMembershipId", StringType(), True))
  .add(StructField("systemUserId", StringType(), True))
  .add(StructField("teamId", StringType(), True))
  .add(StructField("versionNumber", LongType(), True))
)

df = spark.createDataFrame(spark.sparkContext.parallelize(data,1), schema)

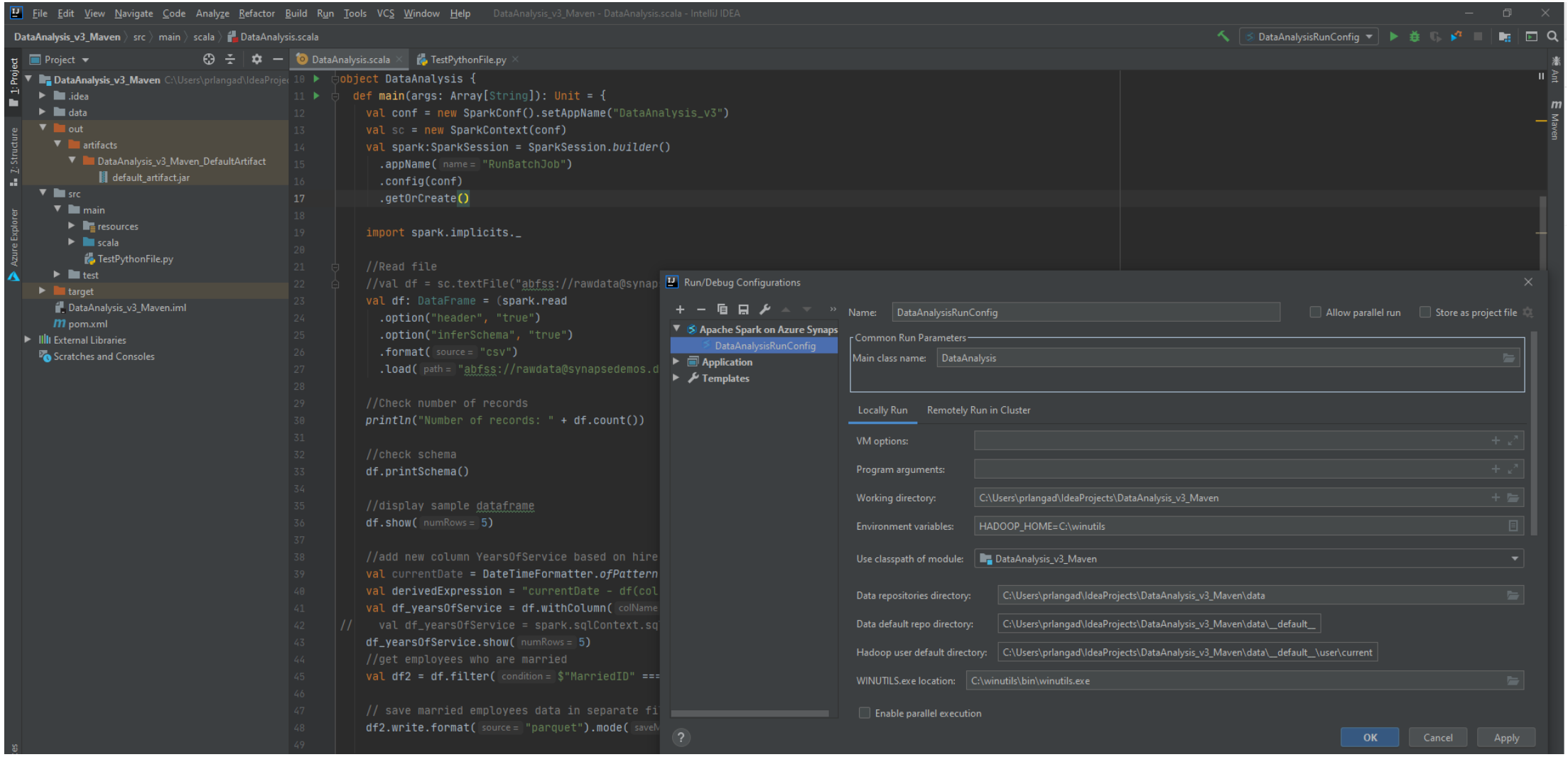
(df.write.format("com.microsoft.cdm")
  .option("storage", storageAccountName)
  .option("manifestPath", container + "/explicitTest/root.manifest.cdm.json")
  .option("entity", "TeamMembership")
  .option("entityDefinitionPath", "core/applicationCommon/TeamMembership.cdm.json/TeamMembership")
  .option("useCdmStandardModelRoot", True)  # sets the model root to the CDM CDN schema documents folder
  .option("useSubManifest", True)
  .mode("overwrite")
  .save())

readDf = (spark.read.format("com.microsoft.cdm")
  .option("storage", storageAccountName)
  .option("manifestPath", container + "/explicitTest/root.manifest.cdm.json")
  .option("entity", "TeamMembership")
  .load())

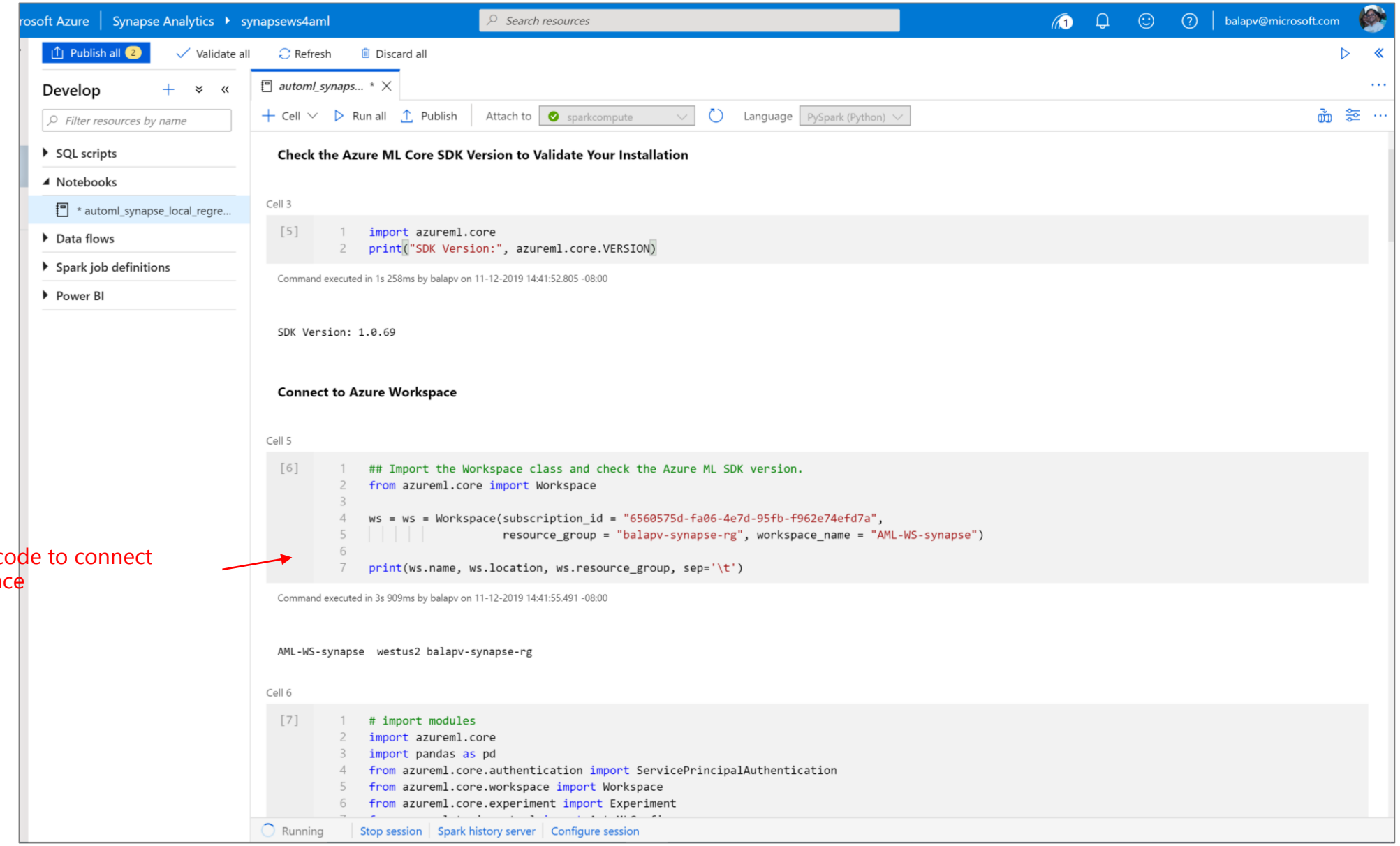
readDf.select("*").show()
```

IntelliJ IDE

Use the Azure Toolkit for IntelliJ plug-in to develop Apache Spark applications and submit applications to Spark pools.

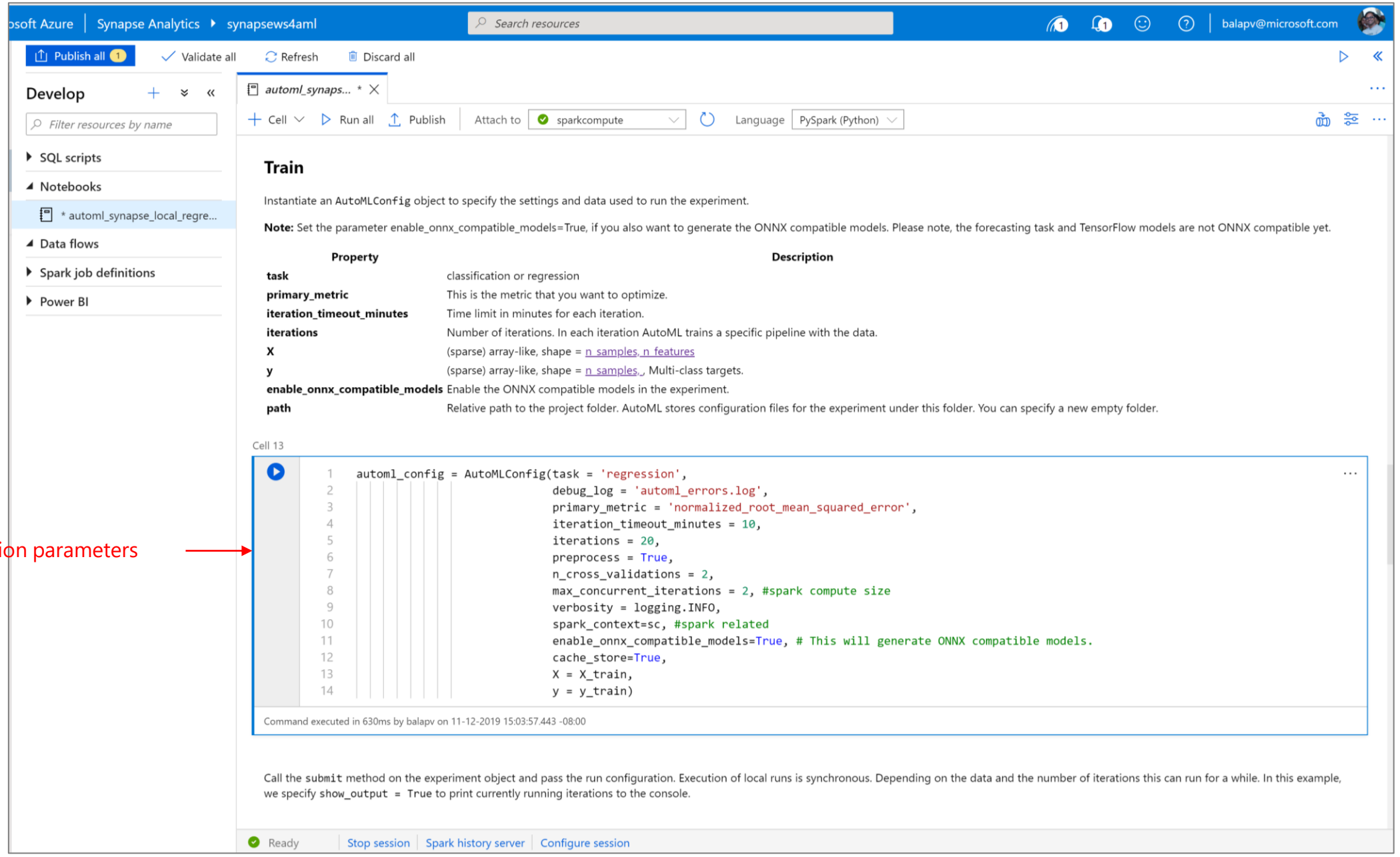


Synapse Notebook: Connect to AML workspace



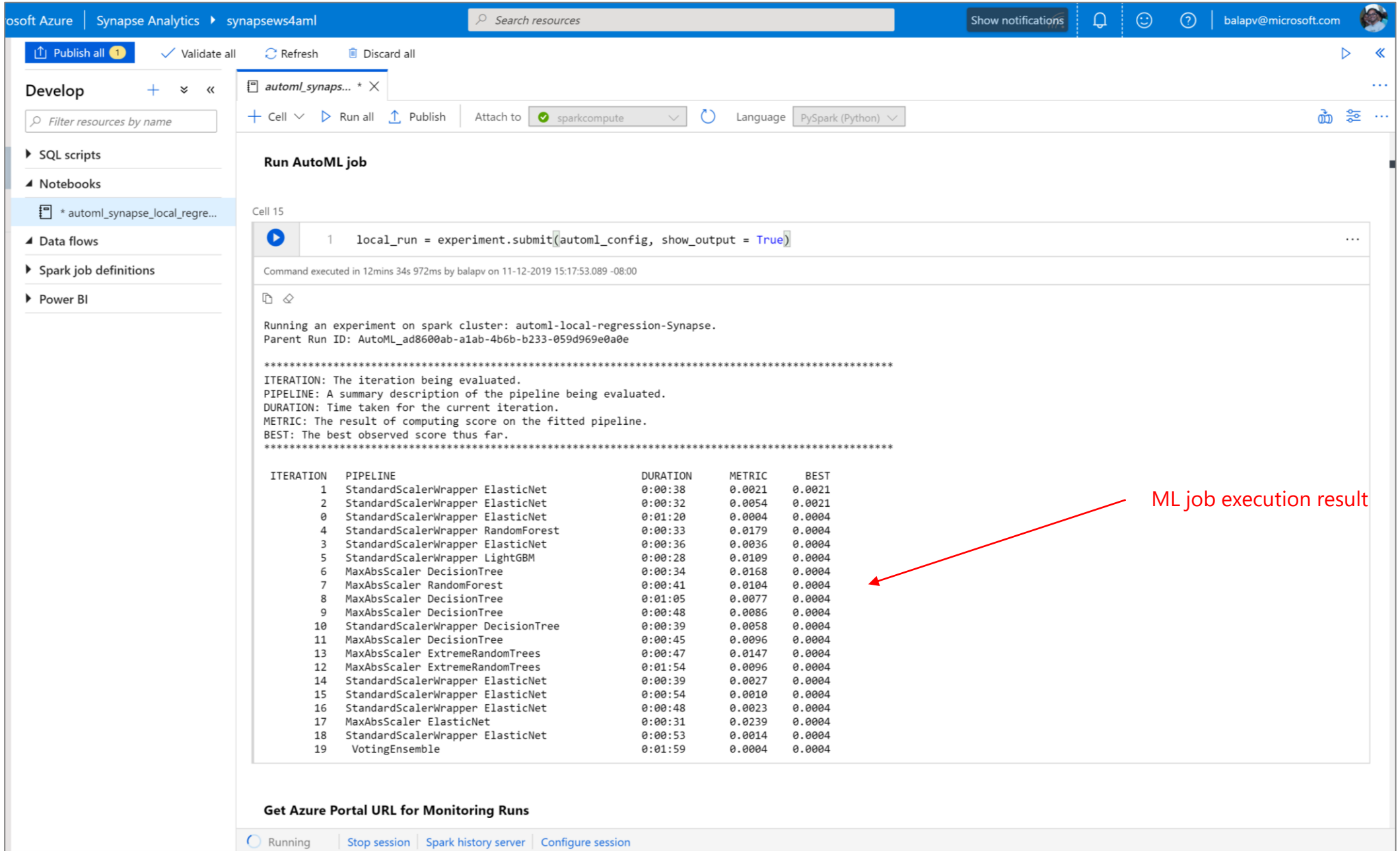
Simple code to connect workspace

Synapse Notebook: Configure AML job to run on Synapse



Configuration parameters

Synapse Notebook: Run AML job



Predict

Overview

It provides ability to import existing machine learning models and score them within provisioned SQL. It takes ONNX (Open Neural Network Exchange) and data as inputs and generates prediction based on model.

Benefits

1. It empowers data engineers to successfully deploy machine learning models with the familiar T-SQL interface

2. It offers seamless collaboration with data scientists

3. It generates new columns, but the number of columns and their data types depends on the type of model that was used for prediction.

Syntax:

```
PREDICT
(
MODEL = @model | model_literal,
DATA = object AS <table_alias>
)
WITH ( <result_set_definition> )
<result_set_definition> ::=
{
{ column_name
data_type
}
[,...n ]
}
MODEL = @model | model_literal
```

Example:

```
DECLARE @model varbinary(max) = (SELECT Model FROM Models WHERE Id = <>);
SELECT d.*, p.Score
FROM PREDICT(MODEL = @model,
DATA = dbo.mytable AS d) WITH (Score float) AS p;
```

Monitor Hub - Spark applications

Overview

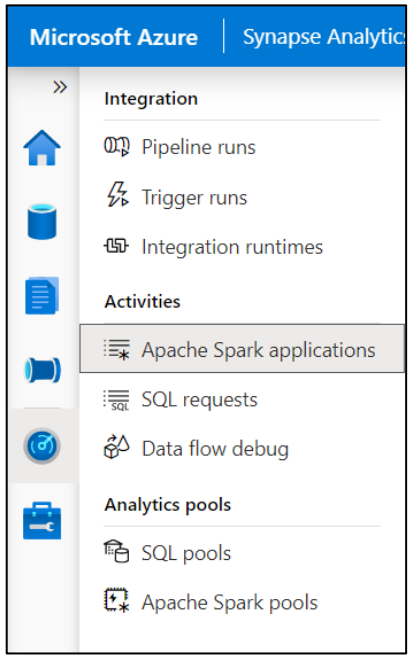
Monitor Spark pools, Spark applications for the status of activities

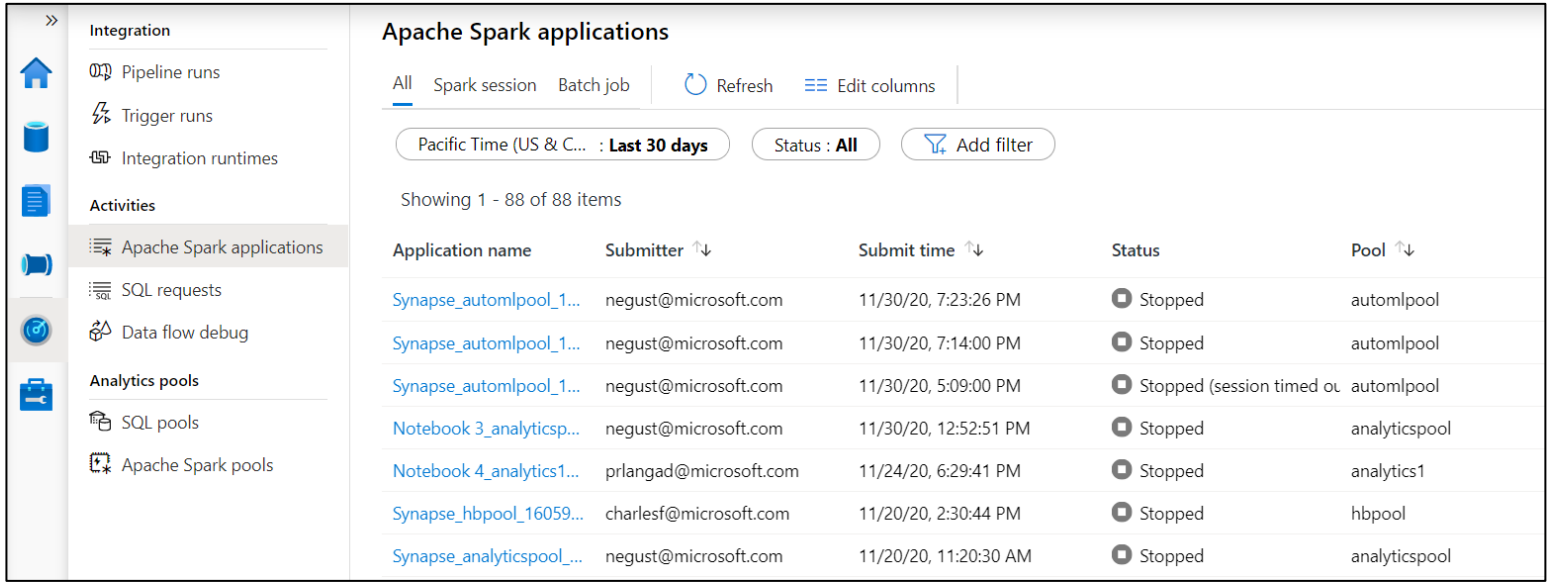
Benefits

Apply filter for pool to get Apache Spark Applications per pool

Additional available filters include

1. Application Name
2. Livy ID
3. Status
4. End time





Azure Synapse Analytics

Synapse (SQL & Spark) serverless SQL pool

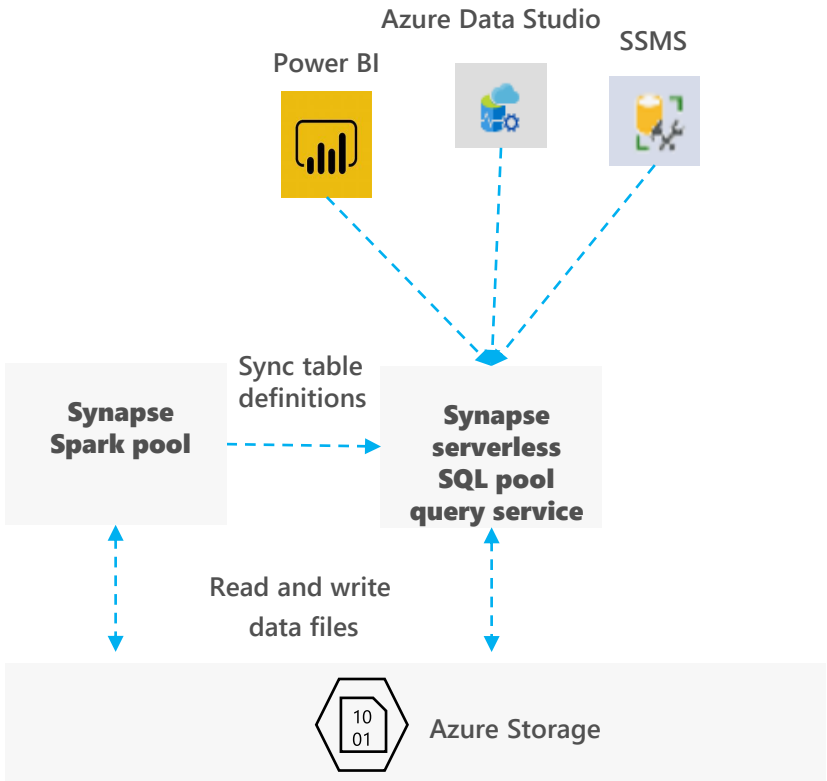
serverless SQL pool

Overview

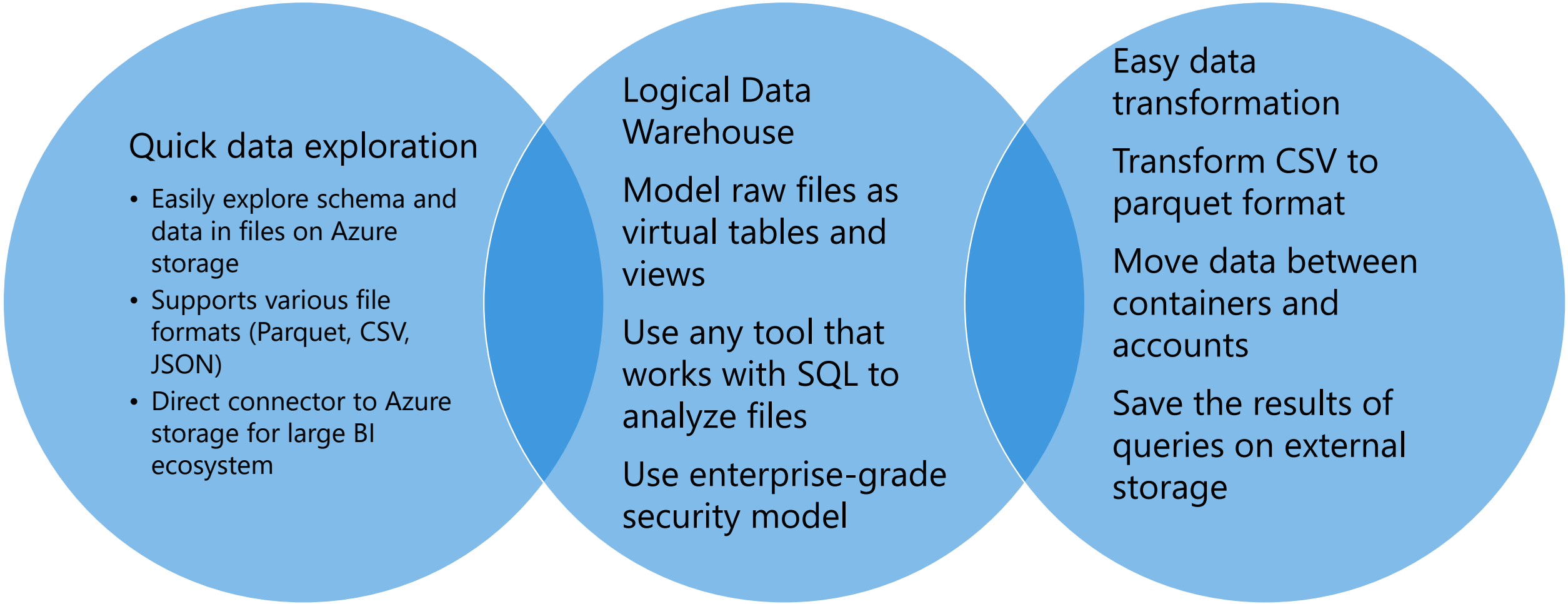
An interactive query service that enables you to use standard T-SQL queries over files in Azure storage.

Benefits

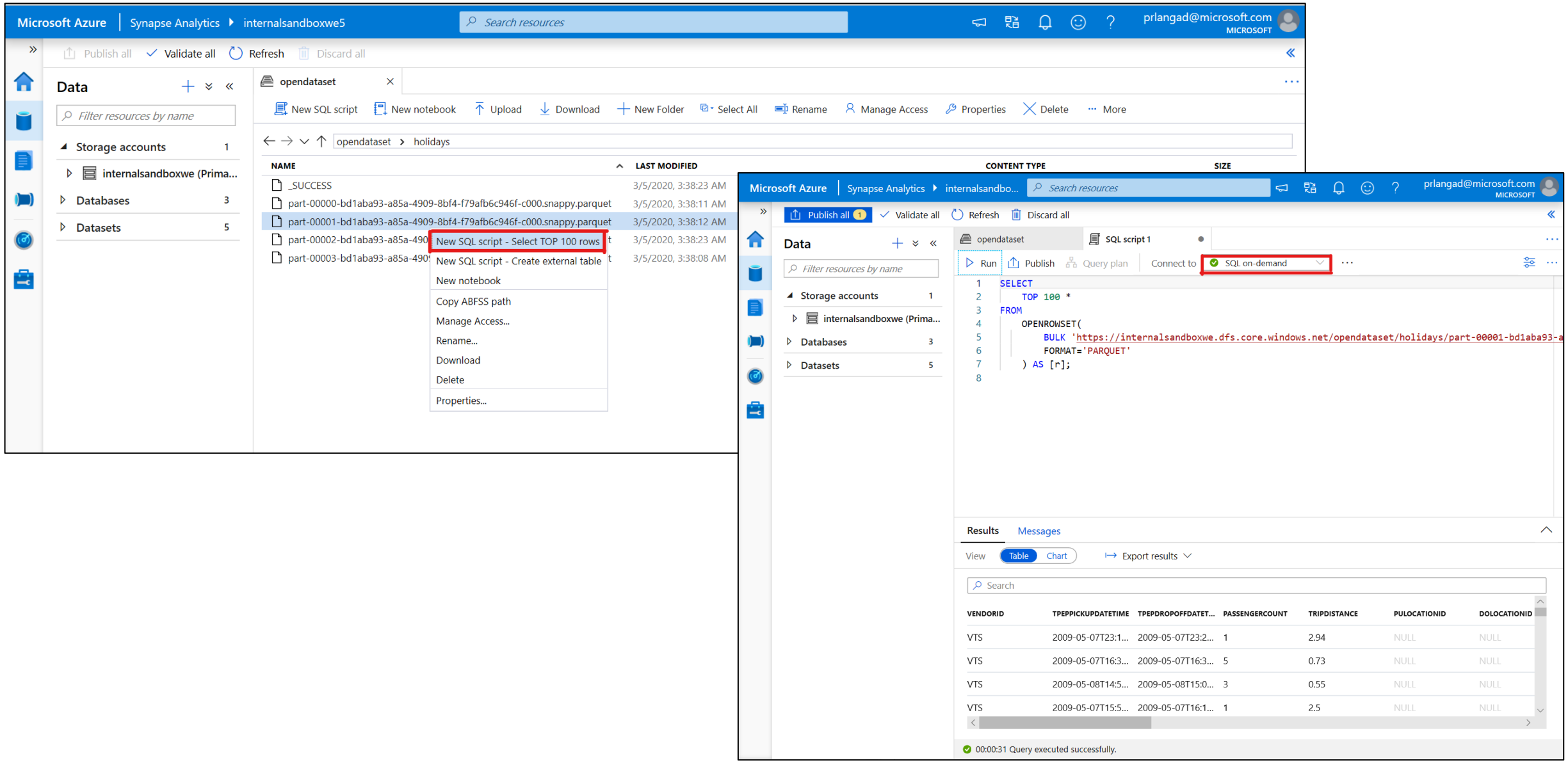
- Use SQL to work with files on Azure storage
  - Directly query files on Azure storage using T-SQL
  - Logical Data Warehouse on top of Azure storage
  - Easy data transformation of Azure storage files
- Supports any tool or library that uses T-SQL to query data
- Automatically synchronize tables from Spark
- Serverless
  - No infrastructure, no upfront cost, no resource reservation
  - Pay only for query execution (per data processed)



Recommended usage scenarios



Easily explore files on storage



Easily query files in various formats

Overview

Use OPENROWSET function to access data stored in various file formats

Benefits

Enables you to read CSV, parquet, Delta and JSON files

Provides unified T-SQL interface for all file types

Use standard SQL language to transform and analyze returned data

- Use JSON functions to get the data from underlying files.
- Use JSON functions to get data from PARQUET nested types

```
SELECT TOP 10 *
FROM OPENROWSET(
        BULK 'https://XYZ.blob.core.windows.net/csv/taxi/*.csv',
        FORMAT = 'CSV')
WITH (
        country_code VARCHAR(4),
        country_name VARCHAR(50),
        year INT,
        population INT
        ) AS nyc
```

```
SELECT TOP 10 *
FROM OPENROWSET(
        BULK 'https://XYZ.blob.core.windows.net/csv/taxi/*.parquet',
        FORMAT = 'PARQUET') AS nyc
```

```
SELECT TOP 10 *
   JSON_VALUE(jsonContent, '$.countryCode') AS country_code,
   JSON_VALUE(jsonContent, '$.countryName') AS country_name,
   JSON_VALUE(jsonContent, '$.year')  AS year
   JSON_VALUE(jsonContent, '$.population')  AS population
FROM  OPENROWSET(
      BULK 'https://XYZ.blob.core.windows.net/json/taxi/*.json',
      FORMAT='CSV',
      FIELDTERMINATOR ='0x0b',
      FIELDQUOTE = '0x0b',
      ROWTERMINATOR = '0x0b'
   )
   WITH ( jsonContent varchar(MAX)   ) AS json_line
```

	country_code	country_name	year	population
1	LU	Luxembourg	2017	594130

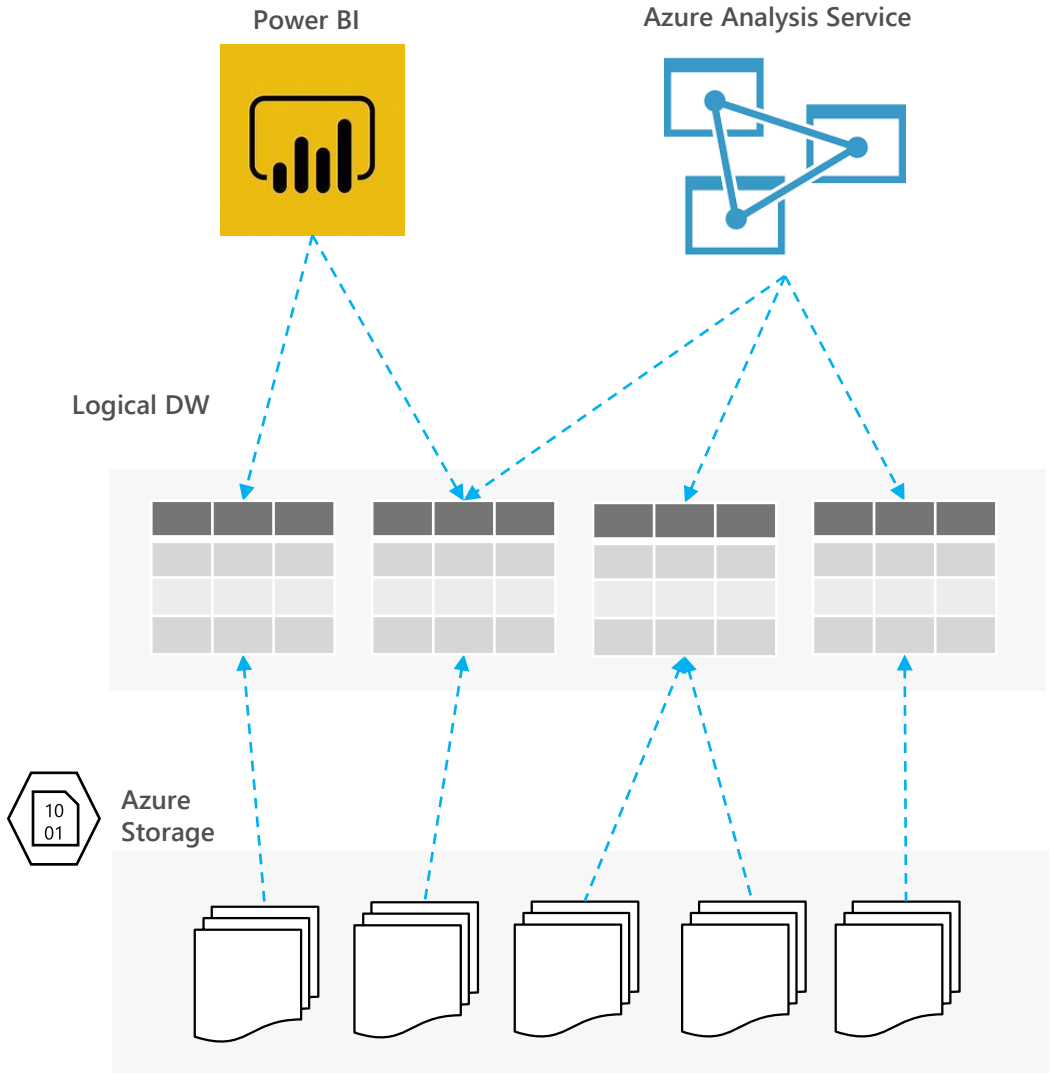
Synapse serverless SQL pool as a logical data warehouse

Overview

Logical relational layer on top of physical files in Azure Storage.

Benefits

- Abstract physical storage and file formats using well understandable relational concepts such as tables and views.
- Direct connector to Azure storage for large ecosystem of BI tools
- BI tools that use SQL can work with files on storage
  - Analytic tools use external tables that represent proxy to actual files.
  - No need for custom connectors in BI tools.
- Provides complex data processing (joining and aggregation) on top of raw files.
- Apply enterprise-ready security model and access control using battle-tested SQL Server permission model on top of Azure storage files



Logical Data Warehouse views

Overview

serverless SQL pool logical data warehouse views are created on external files placed in customer Azure storage

Benefits

Create SQL views on externally stored data

Access files using the view from various tools and language

Leverage rich T-SQL language to process and analyze data in external files exposed via views

Create PowerBI reports on the views created on external data

```
USE [mydbname]
GO

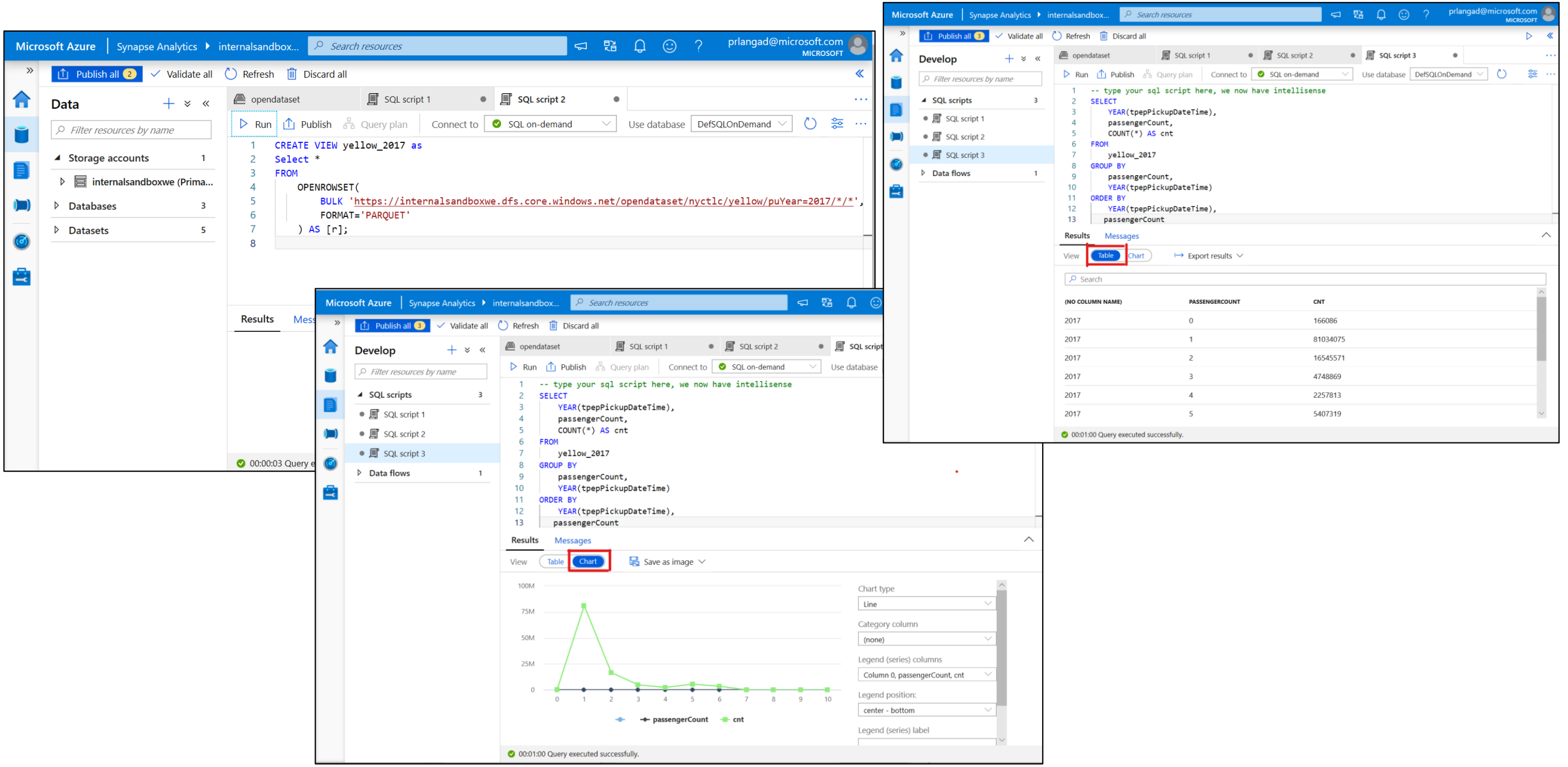
DROP VIEW IF EXISTS  populationView
GO

CREATE VIEW populationView AS
SELECT *
FROM OPENROWSET(
      BULK 'https://XYZ.blob.core.windows.net/csv/population/*.csv',
      FORMAT = 'CSV',
      FIELDTERMINATOR =',',
      ROWTERMINATOR = '\n'
   )
WITH (
   [country_code] VARCHAR (5) ,
   [country_name] VARCHAR (100),
   [year] smallint,
   [population] bigint
) AS [r]
```

```
SELECT
   country_name, population
FROM populationView
WHERE
   [year] = 2019
ORDER BY
   [population] DESC
```

	country_name	population
1	China	1389618778
2	India	1311559204
3	United States	331883986
4	Indonesia	264935824
5	Pakistan	210797836
6	Brazil	210301591
7	Nigeria	208679114
8	Bangladesh	161062905
9	Russia	141944641
10	Mexico	127318112

Creating views



Logical Data Warehouse - tables

Overview

Create external tables that reference external files in your serverless SQL pool logical data warehouse

Benefits

Create external tables that reference set of files on Azure storage.

Join and transform multiple tables in the same query.

Enables you to analyze external files with the same experience that you have in classic databases.

Manage column statistics in external tables.

Manage access rights per table.

Create PowerBI reports on the views created on external data

```
USE [mydbname]
GO

DROP TABLE IF EXISTS dbo.Population
GO
CREATE EXTERNAL TABLE dbo.Population (
   country_code VARCHAR (5) COLLATE Latin1_General_BIN2,
   country_name VARCHAR (100) COLLATE Latin1_General_BIN2,
   year smallint,
   population bigint
)
WITH(
      LOCATION = '/csv/population/population-*.csv',
      DATA_SOURCE = MyAzureStorage,
      FILE_FORMAT = MyAzureCSVFormat
)
```

```
CREATE STATISTICS stat_country_name
ON dbo.Population(country_name);
```

```
SELECT
   country_name, population
FROM population
WHERE year = 2019
ORDER BY population DESC
```

	country_name	population
1	China	1389618778
2	India	1311559204
3	United States	331883986
4	Indonesia	264935824
5	Pakistan	210797836
6	Brazil	210301591
7	Nigeria	208679114
8	Bangladesh	161062905
9	Russia	141944641
10	Mexico	127318112

Easy data transformation

Overview

Easily perform data transformations of Azure Storage files using SQL queries

Optimize data pipeline - achieve more using serverless SQL pool

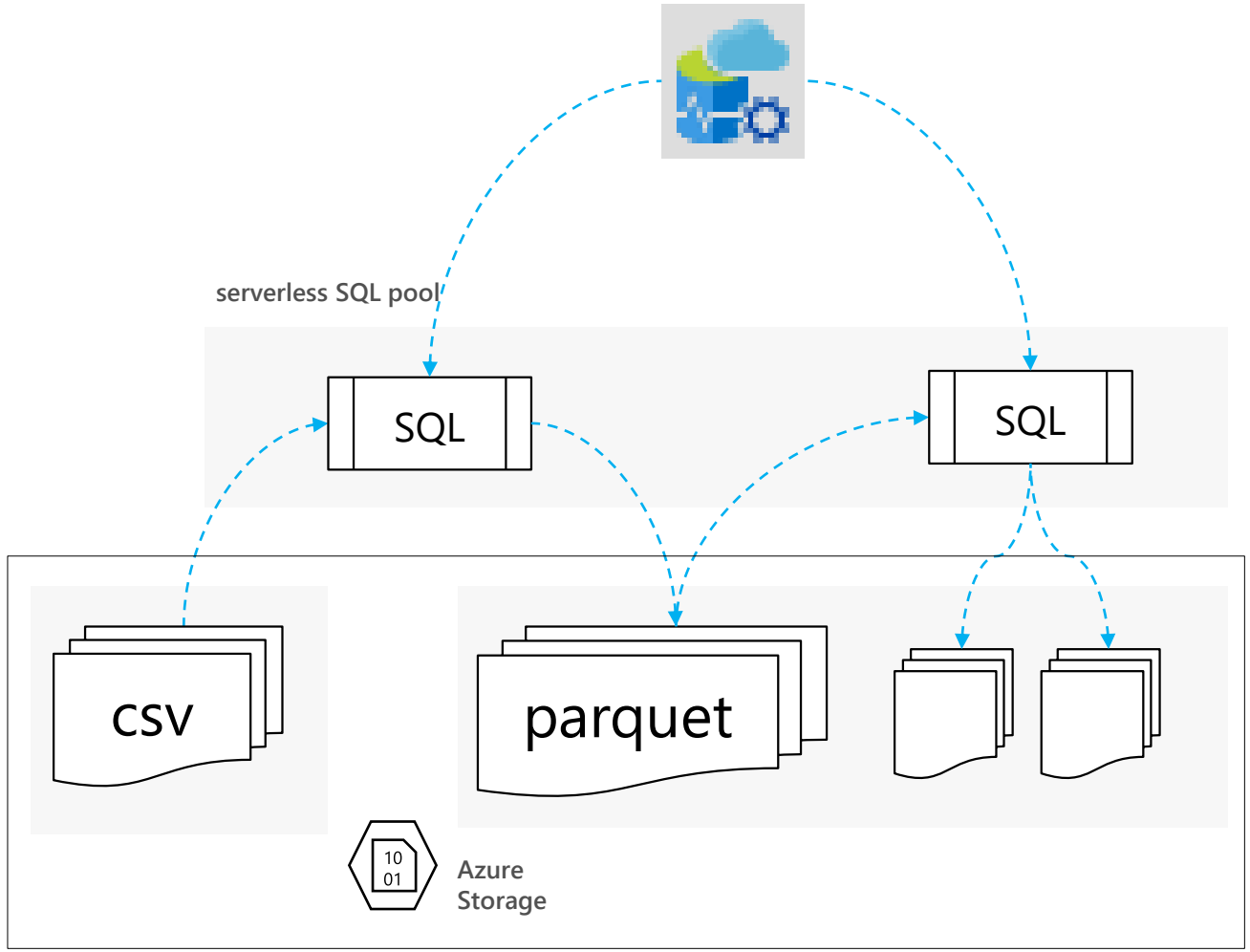
Benefits

Single statement transformations:

- convert CSV or JSON files to Parquet
- copy files from one storage account to another
- re-partition data to new location(s)
- store results of your query on Azure Storage

SQL ETL pipelines

- Use SQL commands to transform data
- Chain SQL statement for build ETL process
- Materialize reports created on the current snapshot of data



Automatic syncing of Spark tables

Overview

Tables created in Spark pool are automatically created as external tables that reference external files in your serverless SQL pool logical data warehouse

Benefits

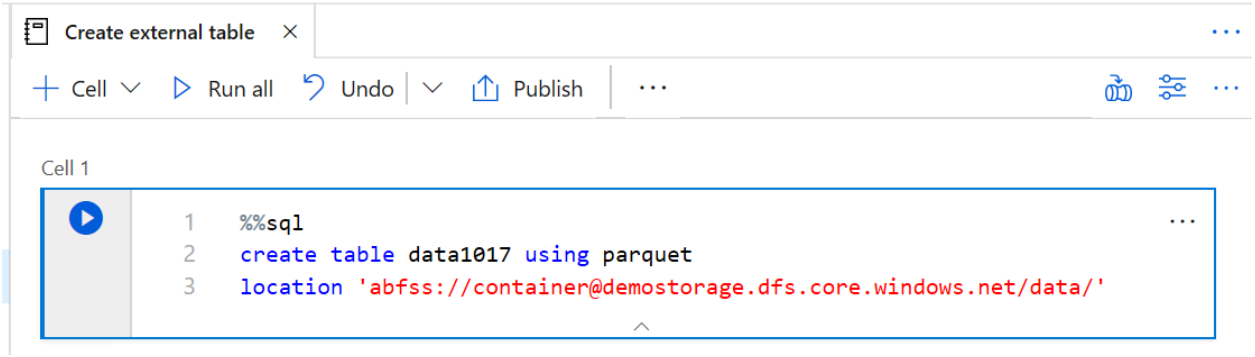
Tables designed using Spark languages are immediately available in serverless SQL pool.

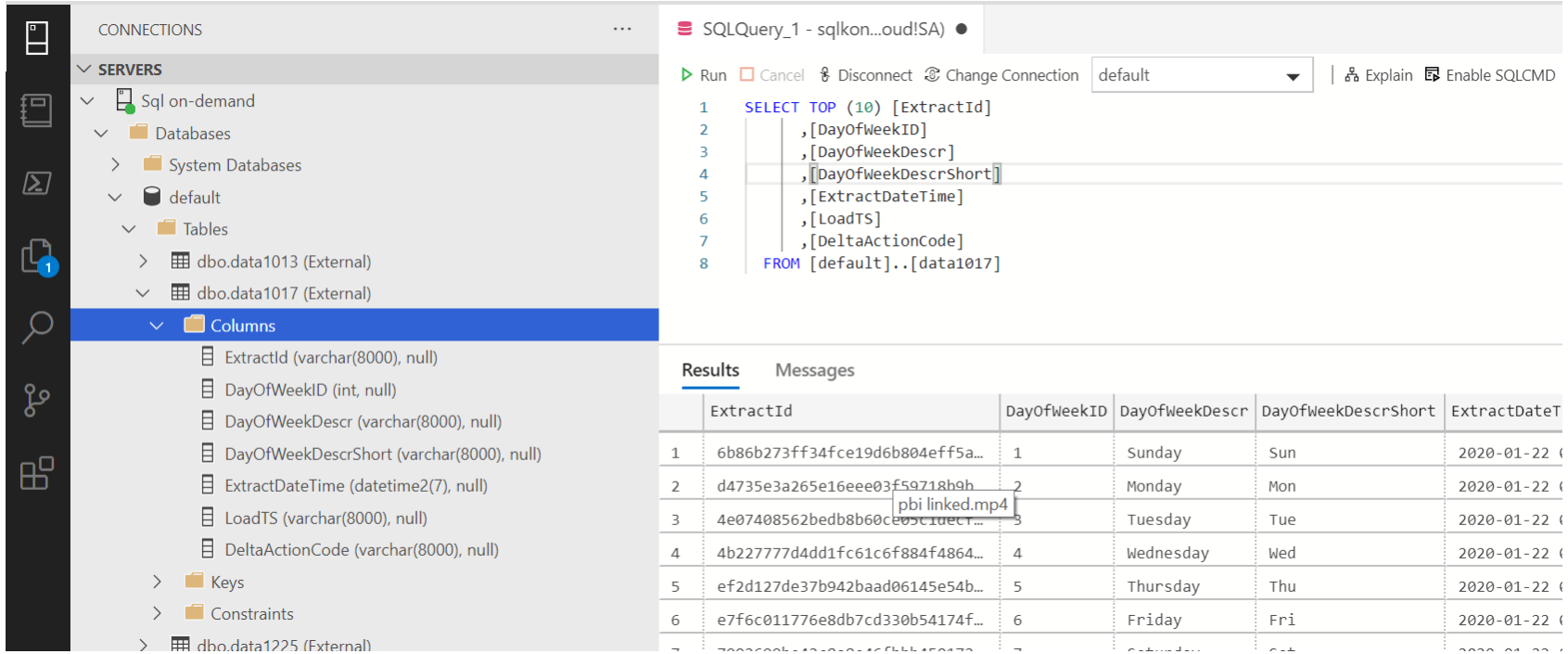
Schema definition matches original

Spark table updates are applied in serverless SQL pool

No need to manually create SQL tables that match Spark tables

Spark and serverless SQL pool tables references the same external files.





Logical Data Warehouse - tables

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GO

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GO
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   country_code VARCHAR (5) COLLATE Latin1_General_BIN2,
   country_name VARCHAR (100) COLLATE Latin1_General_BIN2,
   year smallint,
   population bigint
)
WITH(
      LOCATION = '/csv/population/population-*.csv',
      DATA_SOURCE = MyAzureStorage,
      FILE_FORMAT = MyAzureCSVFormat
)
```

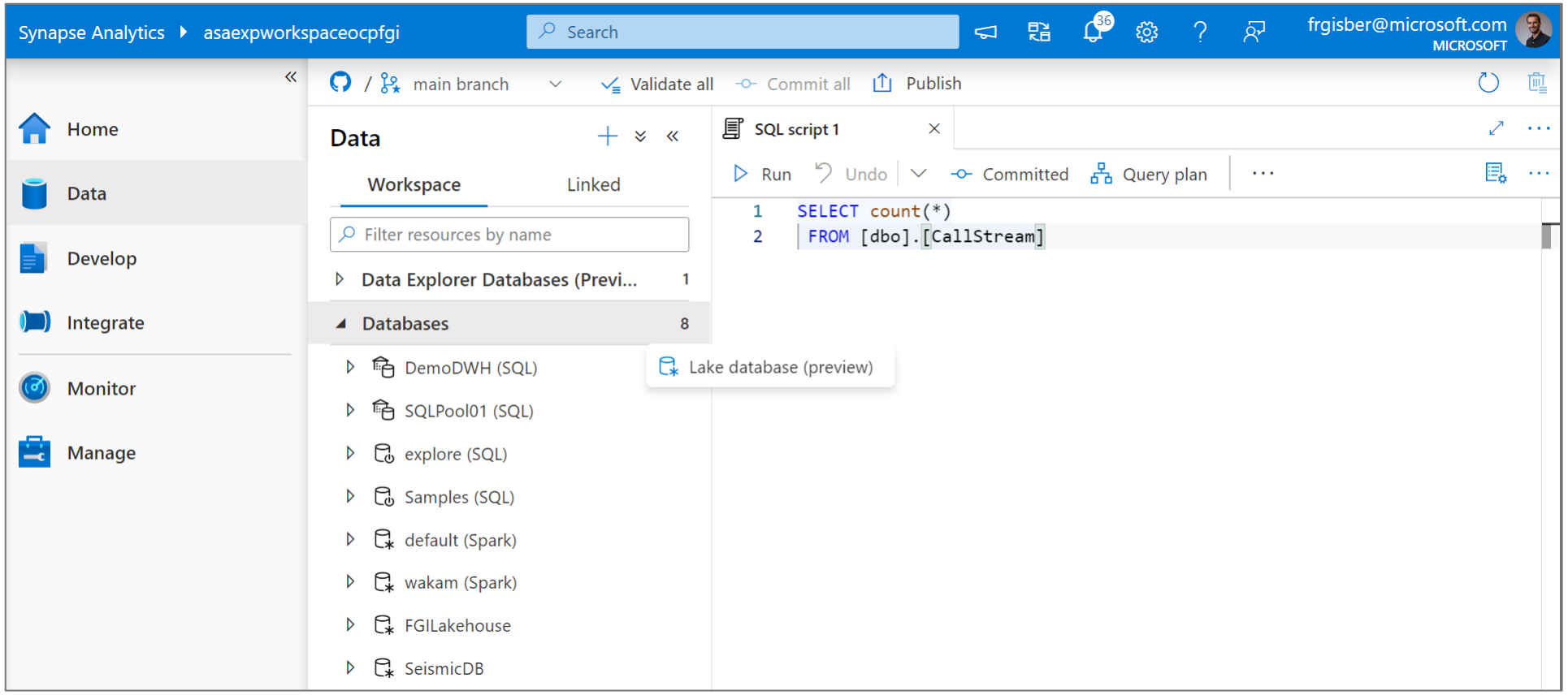
```
CREATE STATISTICS stat_country_name
ON dbo.Population(country_name);
```

```
SELECT
   country_name, population
FROM population
WHERE year = 2019
ORDER BY population DESC
```

	country_name	population
1	China	1389618778
2	India	1311559204
3	United States	331883986
4	Indonesia	264935824
5	Pakistan	210797836
6	Brazil	210301591
7	Nigeria	208679114
8	Bangladesh	161062905
9	Russia	141944641
10	Mexico	127318112

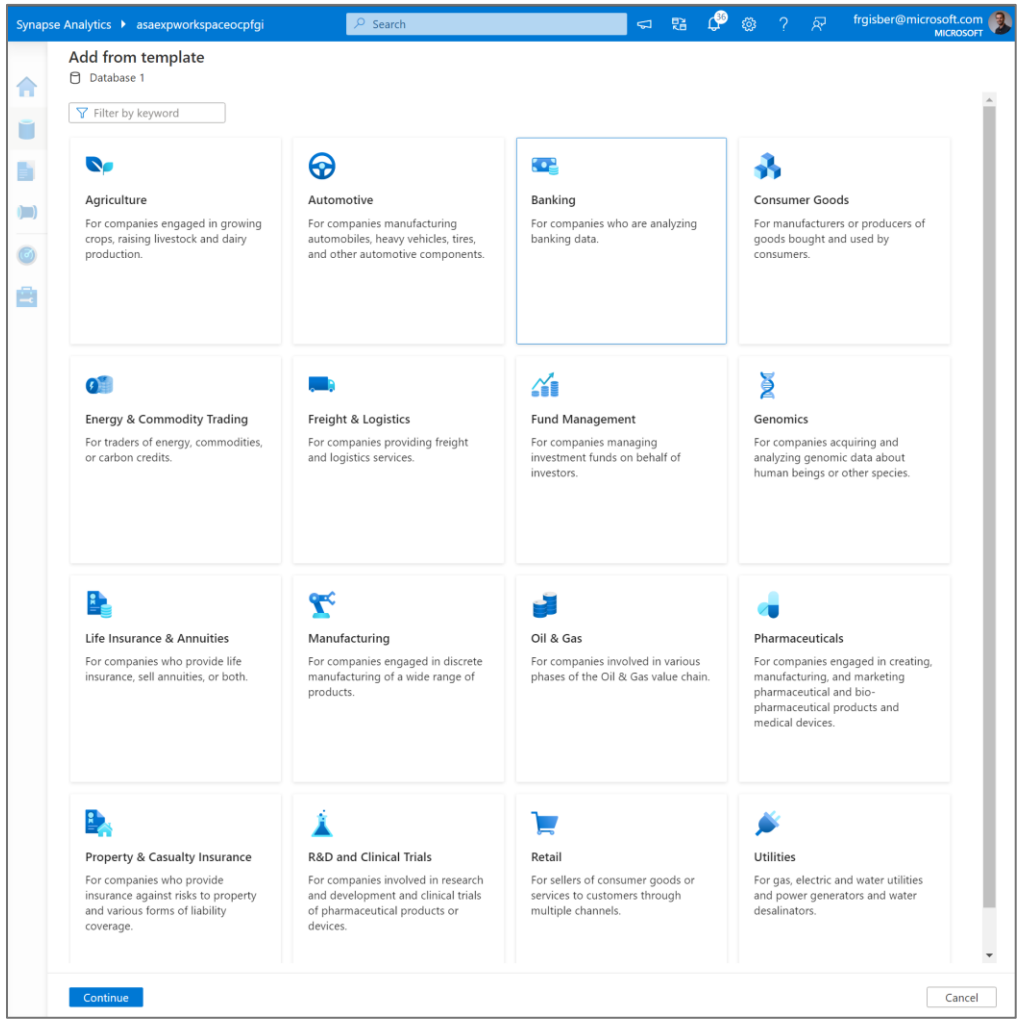
Lakehouse Database Engine

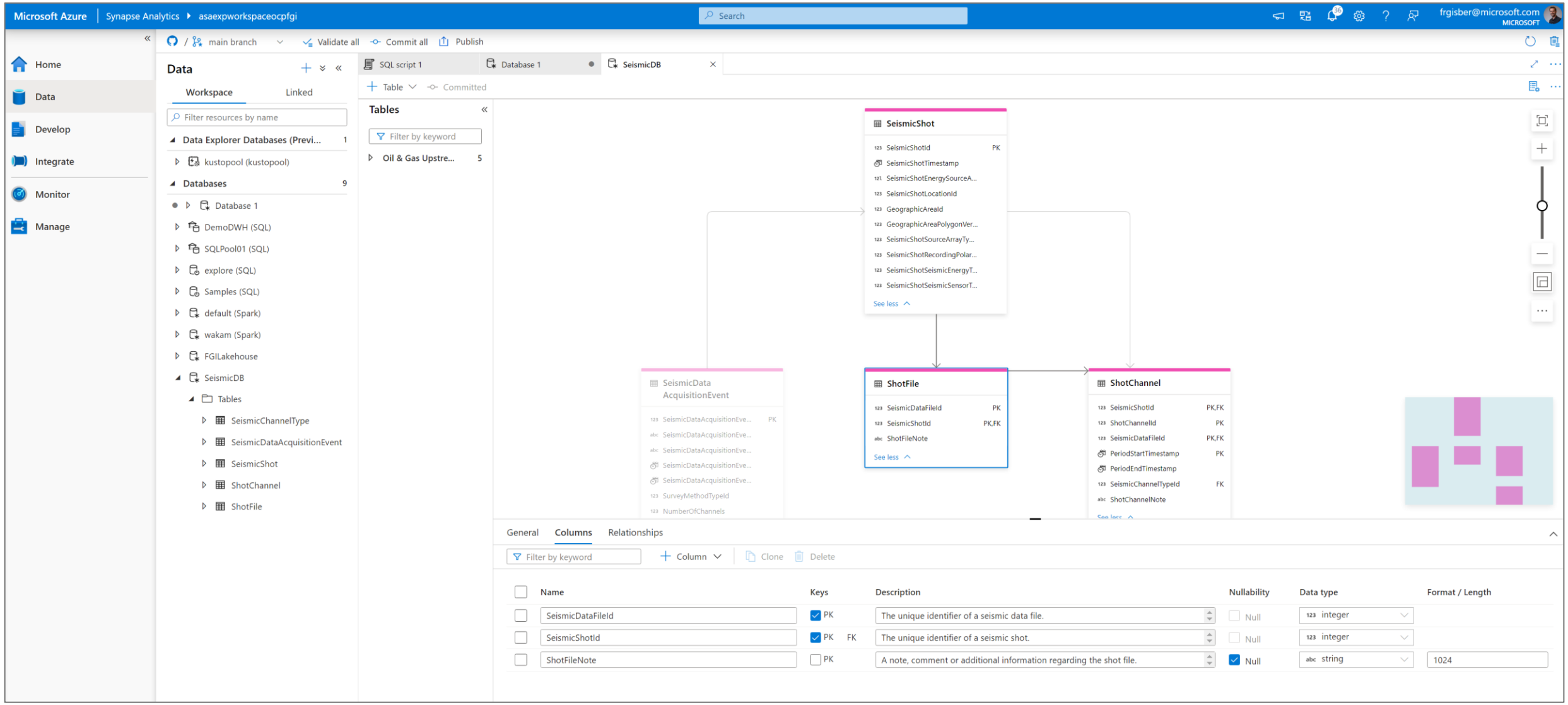
New Lakehouse Database capabilities based on Synapse Spark



Data Lakehouse database

Based on entities templates or custom design




Microsoft Azure
Synapse Analytics
asaexpworkspaceocpfgi
Search
frgisber@microsoft.com
MICROSOFT
Home
Data
Develop
Integrate
Monitor
Manage
main branch
Validate all
Commit all
Publish
Data
Workspace
Linked
Filter resources by name
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Databases 9
Database 1
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SQLPool01 (SQL)
explore (SQL)
Samples (SQL)
default (Spark)
wakam (Spark)
FGILakehouse
SeismicDB
Tables
SeismicChannelType
SeismicDataAcquisitionEvent
SeismicShot
ShotChannel
ShotFile
SQL script 1
Database 1
SeismicDB
Table
Committed
Tables
Filter by keyword
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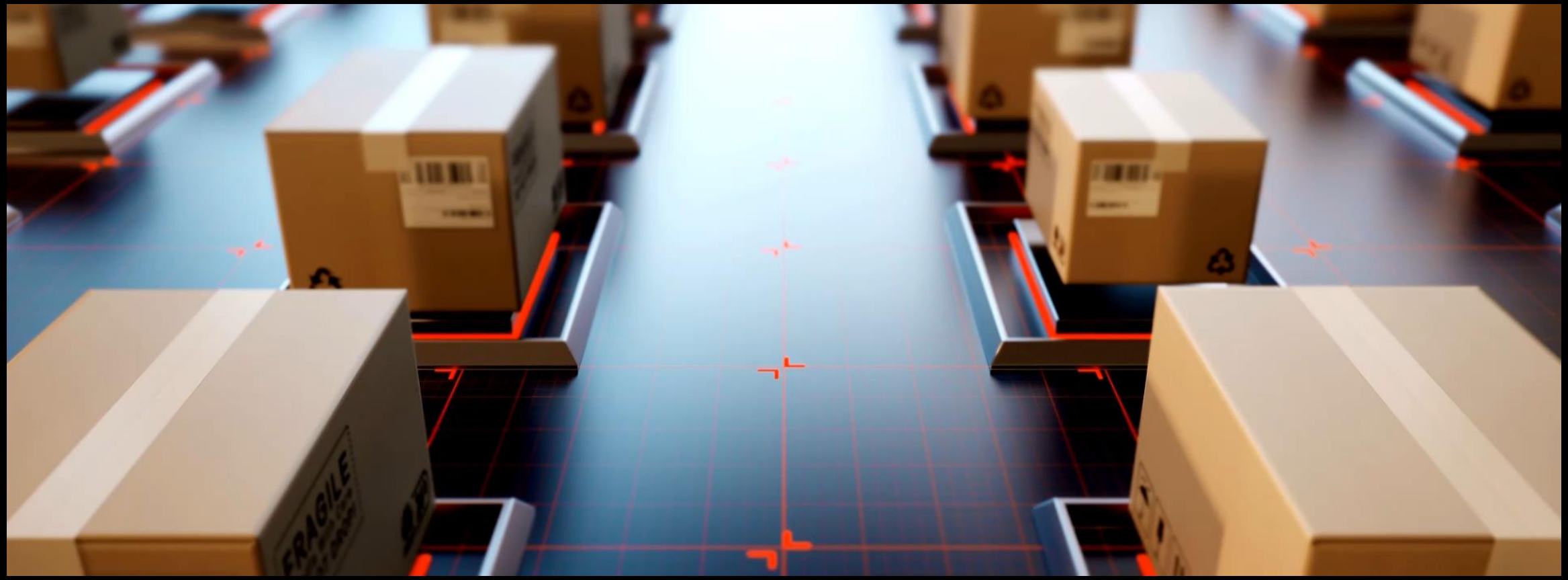
SeismicShot
SeismicShotId PK
SeismicShotTimestamp
SeismicShotEnergySourceA...
SeismicShotLocationId
GeographicAreaId
GeographicAreaPolygonVer...
SeismicShotSourceArrayTy...
SeismicShotRecordingPolar...
SeismicShotSeismicEnergyT...
SeismicShotSeismicSensorT...
See less
SeismicData AcquisitionEvent
SurveyMethodTypeId
NumberOfChannels
ShotFile
SeismicDataFileId PK
SeismicShotId PK,FK
ShotFileNote
See less
ShotChannel
SeismicShotId PK,FK
ShotChannelId PK
SeismicDataFileId PK,FK
PeriodStartTimestamp PK
PeriodEndTimestamp
SeismicChannelTypeId FK
ShotChannelNote
General
Columns
Relationships
Filter by keyword
Column
Clone
Delete
Name
Keys
Description
Nullability
Data type
Format / Length
SeismicDataFileId
PK
The unique identifier of a seismic data file.
Null
integer
SeismicShotId
PK FK
The unique identifier of a seismic shot.
Null
integer
ShotFileNote
PK
A note, comment or additional information regarding the shot file.
Null
string
1024

Demo



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Event Webinar (Les jeudis de la Data & AI) - L200/300	Date	Duration (min)	Link
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Les solutions SQL dans Azure (PaaS, IaaS, SaaS)	29/09/2022	120	https://msevents.microsoft.com/event?id=502366997
Déploiement et sécurisation des workspaces Azure Machine learning	06/10/2022	120	https://msevents.microsoft.com/event?id=1505714138
Azure Scale Analytics - Architectures Data Mesh dans Azure avec Azure Synapse, Microsoft Purview et Azure Data Share	13/10/2022	120	https://msevents.microsoft.com/event?id=139685175
MLOps avec Azure Machine Learning	20/10/2022	120	https://msevents.microsoft.com/event?id=1245885767
SQL Server 2022 et hybridation native avec Azure SQL Managed Instance	10/11/2022	120	https://msevents.microsoft.com/event?id=145826476
Machine Learning dans Azure Synapse Analytics	17/11/2022	120	https://msevents.microsoft.com/event?id=3637723312
Azure Cosmos DB et IA	24/11/2022	120	https://msevents.microsoft.com/event?id=2646013445
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La gouvernance de données dans Azure avec Microsoft Purview	15/12/2022	120	https://msevents.microsoft.com/event?id=1499560981
MLOps avec Azure Machine Learning	12/01/2023	120	https://msevents.microsoft.com/event?id=4115194515
Data processing dans Azure ave Azure Synapse, Azure Batch, Spark, Notebook, etc.	19/01/2023	120	https://msevents.microsoft.com/event?id=1537241181
Déploiement et sécurisation des workspace Azure Synapse	26/01/2023	120	https://msevents.microsoft.com/event?id=1806467748
Azure Machine Learning pour les Citizen Data Scientists	09/02/2023	120	En cours
PowerBI - Self Service Analytics	16/02/2023	120	https://msevents.microsoft.com/event?id=1401519679
L'IA responsable avec Azure machine learning	09/03/2023	120	https://msevents.microsoft.com/event?id=2072953112
Machine Learning dans Azure Synapse Analytics	16/03/2023	120	https://msevents.microsoft.com/event?id=3413014857
Les bases de données Open Source dans le cloud Azure	23/03/2023	120	https://msevents.microsoft.com/event?id=2727487131
Hybridation des services de Machine Learning Azure	06/04/2023	120	https://msevents.microsoft.com/event?id=1624914222
La gouvernance de données dans Azure avec Microsoft Purview	13/04/2023	120	https://msevents.microsoft.com/event?id=3909342839
Les solutions SQL dans Azure (PaaS, IaaS, SaaS)	04/05/2023	120	https://msevents.microsoft.com/event?id=1162207895
Data processing dans Azure ave Azure Synapse, Azure Batch, Spark, Notebook, etc.	16/05/2023	120	https://msevents.microsoft.com/event?id=3517068442
Hybridation des services de données Azure	24/05/2023	120	https://msevents.microsoft.com/event?id=2996507398
Self Service Analytics	01/06/2023	120	En cours

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