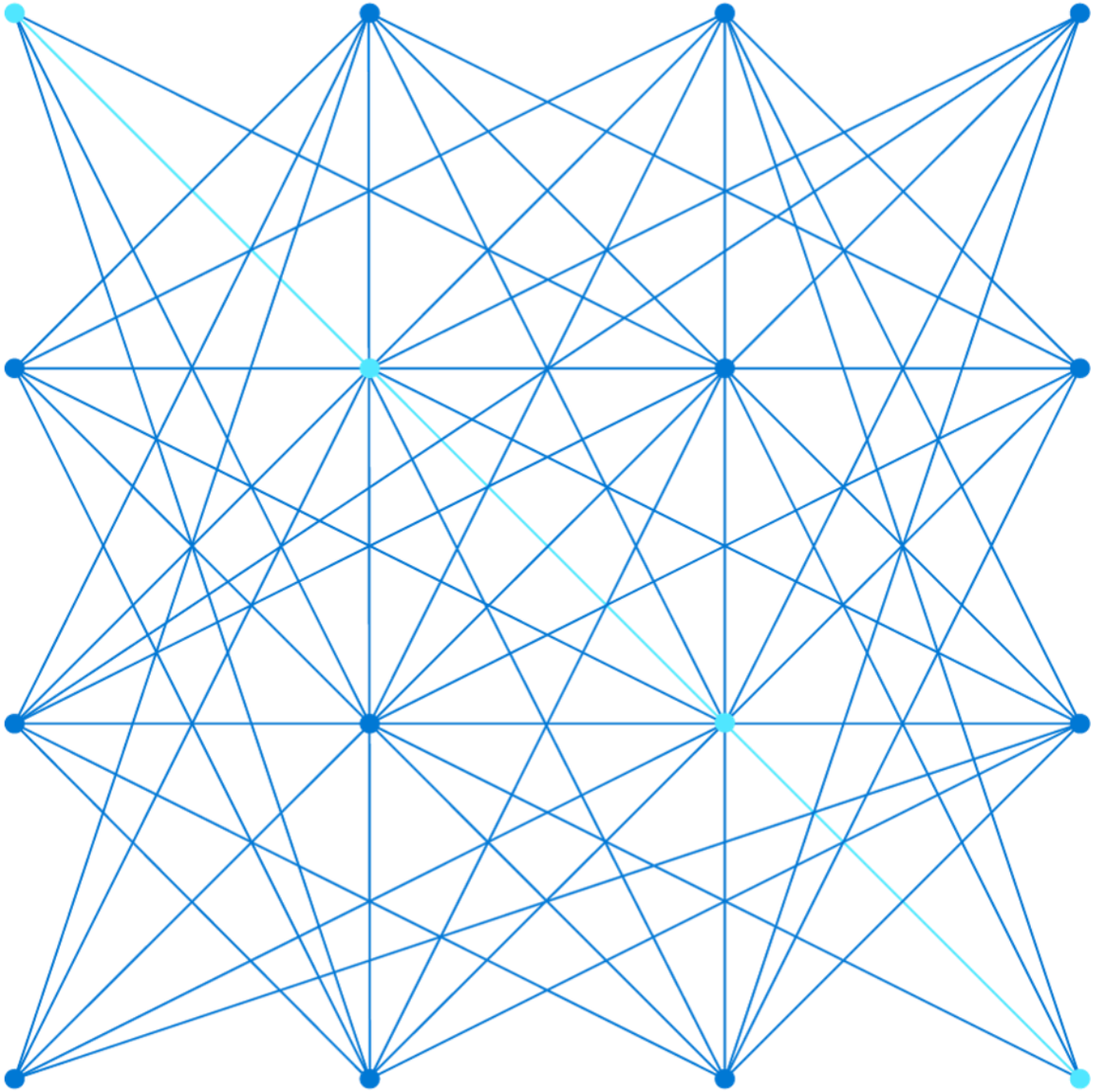
Microsoft Azure

# DP-203T00: Explore compute and storage options for data engineering workloads



# Agenda

Lesson 01 – Introduction to Azure Synapse Analytics

Lesson 02 – Describe Azure Databricks

Lesson 03 – Introduction to Azure Data Lake storage

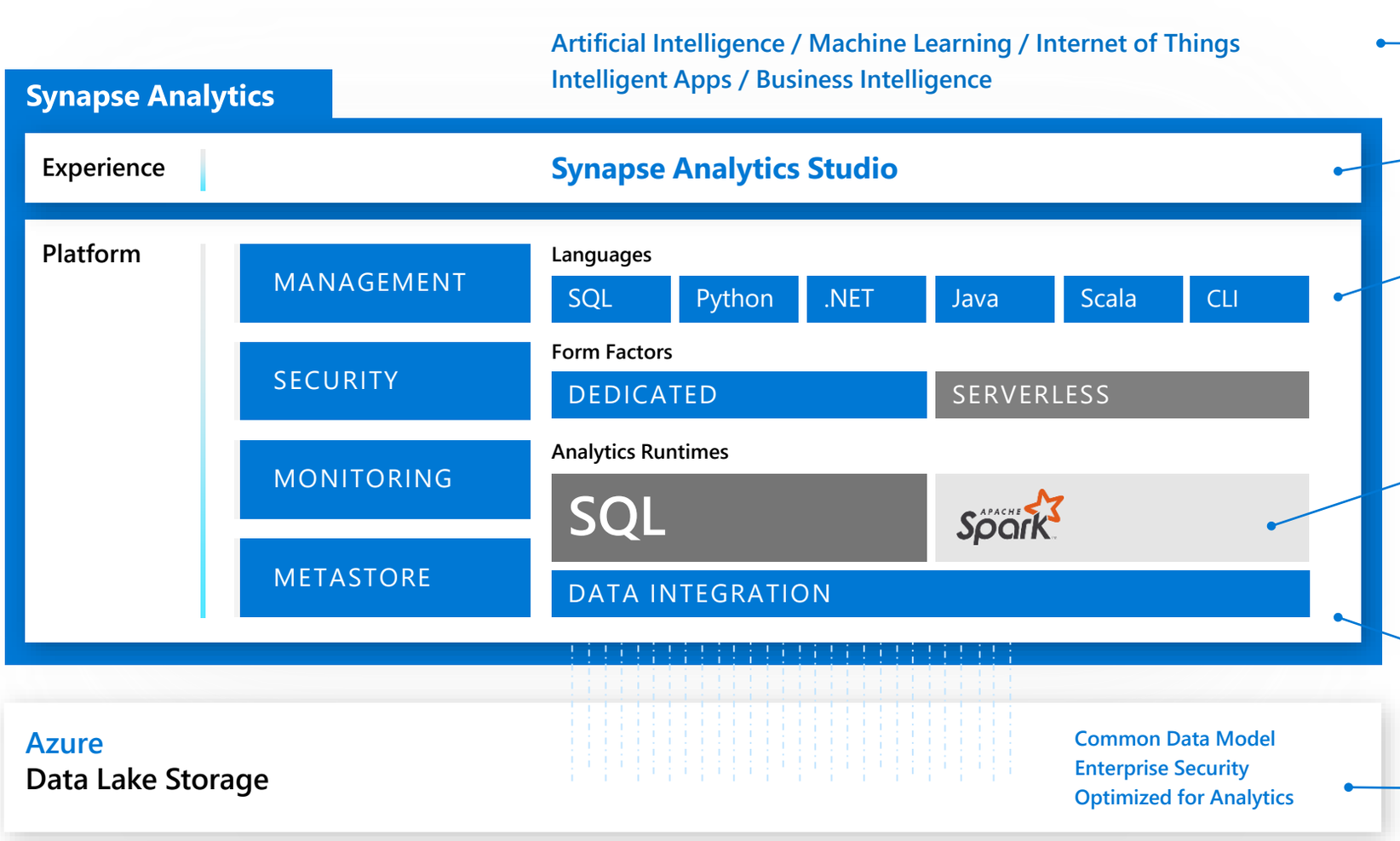
Lesson 04 – Describe Delta Lake architecture

Lesson 05 – Work with data streams by using Azure Stream Analytics

# Lesson 01: Introduction to Azure Synapse Analytics

# Azure Synapse Analytics

Limitless analytics service with unmatched time to insight




Designed for analytics **workloads at any scale**

SaaS **developer experiences** for code free and code first

Multiple **languages** suited to different analytics workloads

Integrated analytics runtimes available as a dedicated and serverless offering

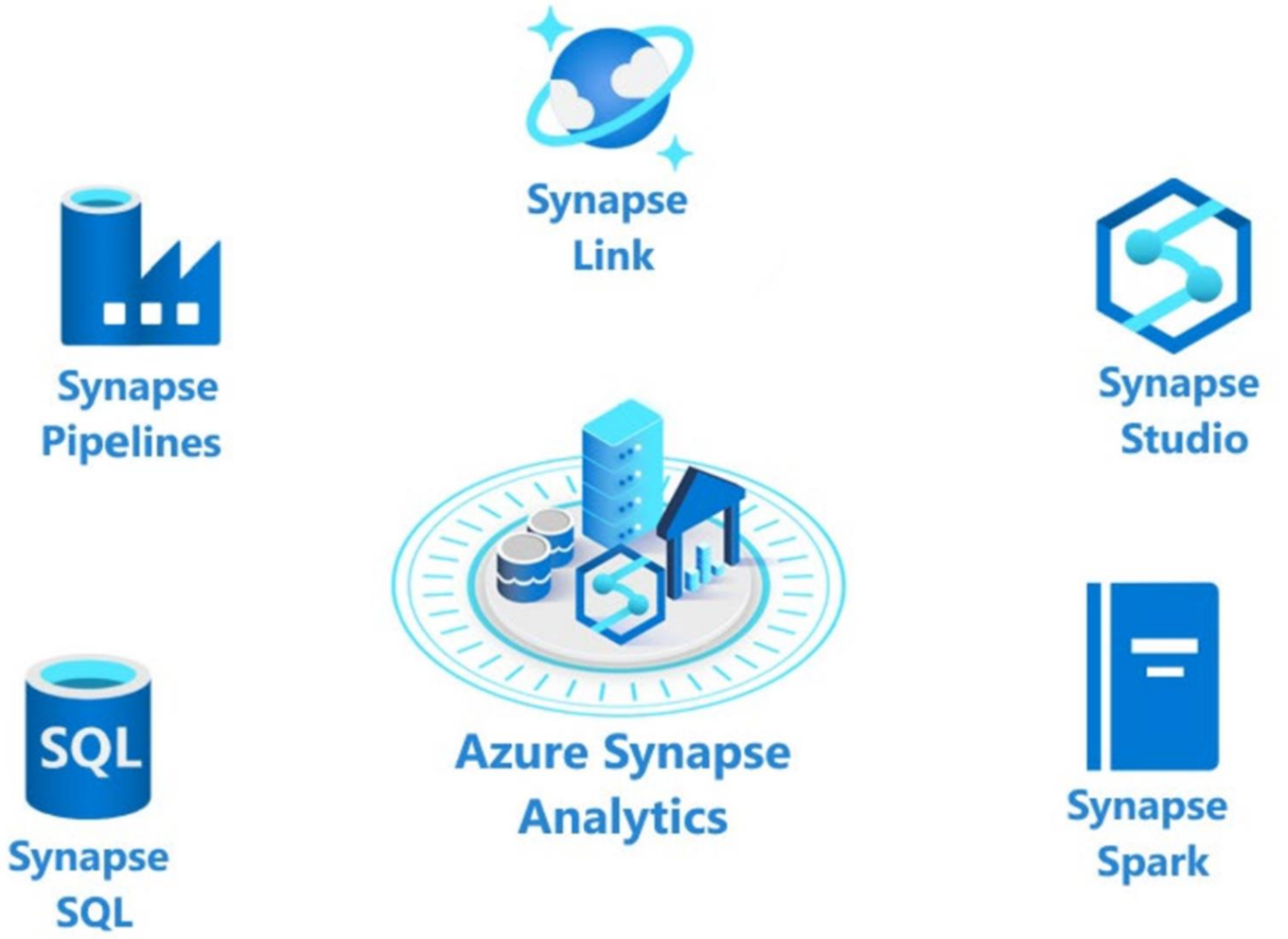
**SQL pools** offering T-SQL for batch, streaming and interactive processing

**Spark pools** for big data processing with Python, Scala, R and .NET

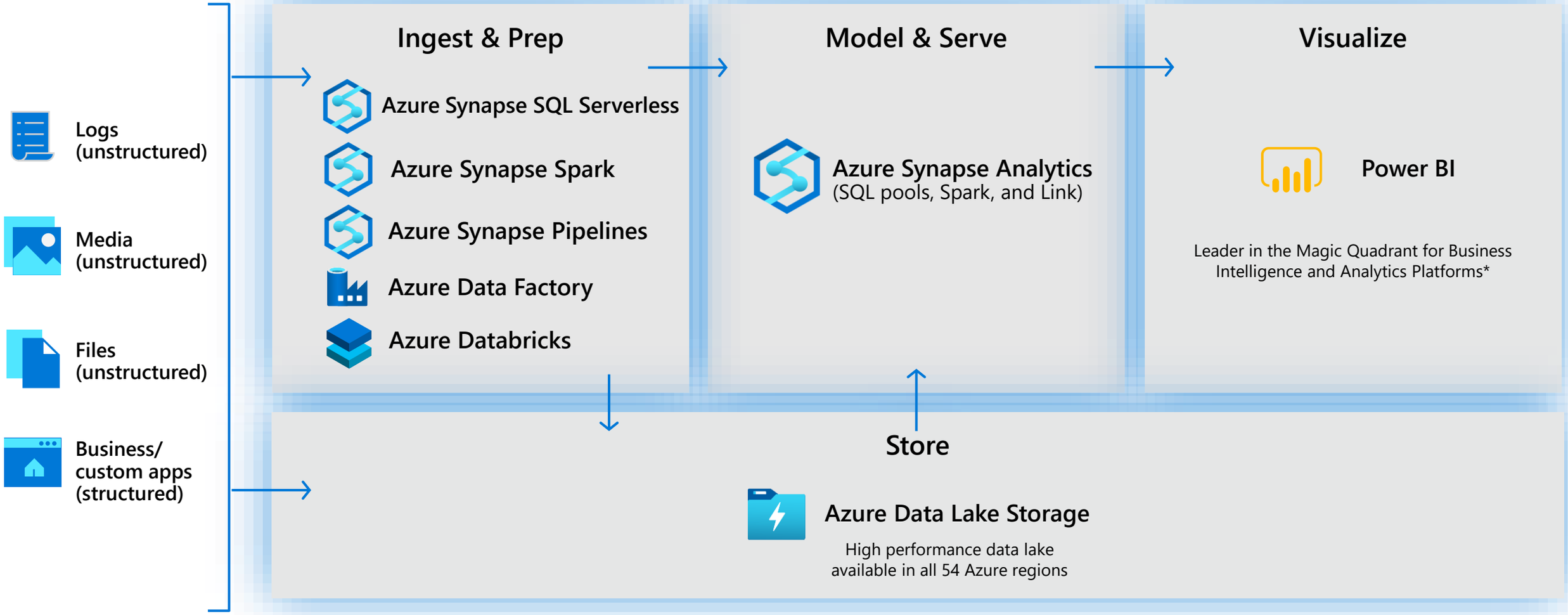
Integrated **platform services** for, management, security, monitoring, and metastore

Data **lake integrated** and Common Data Model aware

# Introduction to Azure Synapse Analytics



# Modern data warehousing pattern with Azure Synapse Analytics



# Lesson 01: Describe Azure Databricks

# What is Azure Databricks

**Apache Spark-based analytics platform:**

Simplifies the provisioning and collaboration of Apache Spark-based analytical solutions dealing with batch and streaming data

**Comprehensive Spark library support:**

Support includes SQL, DataFrames, MLlib, Hyperspace and MSSparkUtil

**Enterprise Security:**

Utilizes the security capabilities of Azure

**Integration with other Cloud Services:**

Can integrate with a variety of Azure data platform services and Power BI

# What is Apache Spark

Apache Spark emerged to provide a parallel processing framework that supports in-memory processing to boost the performance of big-data analytical applications on massive volumes of data

**Interactive Data Analysis:**
Used by business analysts or data engineers to analyze and prepare data

**Streaming Analytics:**
Ingest data from technologies such as Kafka and Flume to ingest data in real-time

**Machine Learning:**
Contains a number of libraries that enables a Data Scientist to perform Machine Learning

## Why use Azure Databricks?

Azure Databricks is a wrapper around Apache Spark that simplifies the provisioning and configuration of a Spark cluster in a GUI interface

## Azure Databricks components:

Spark SQL and DataFrames

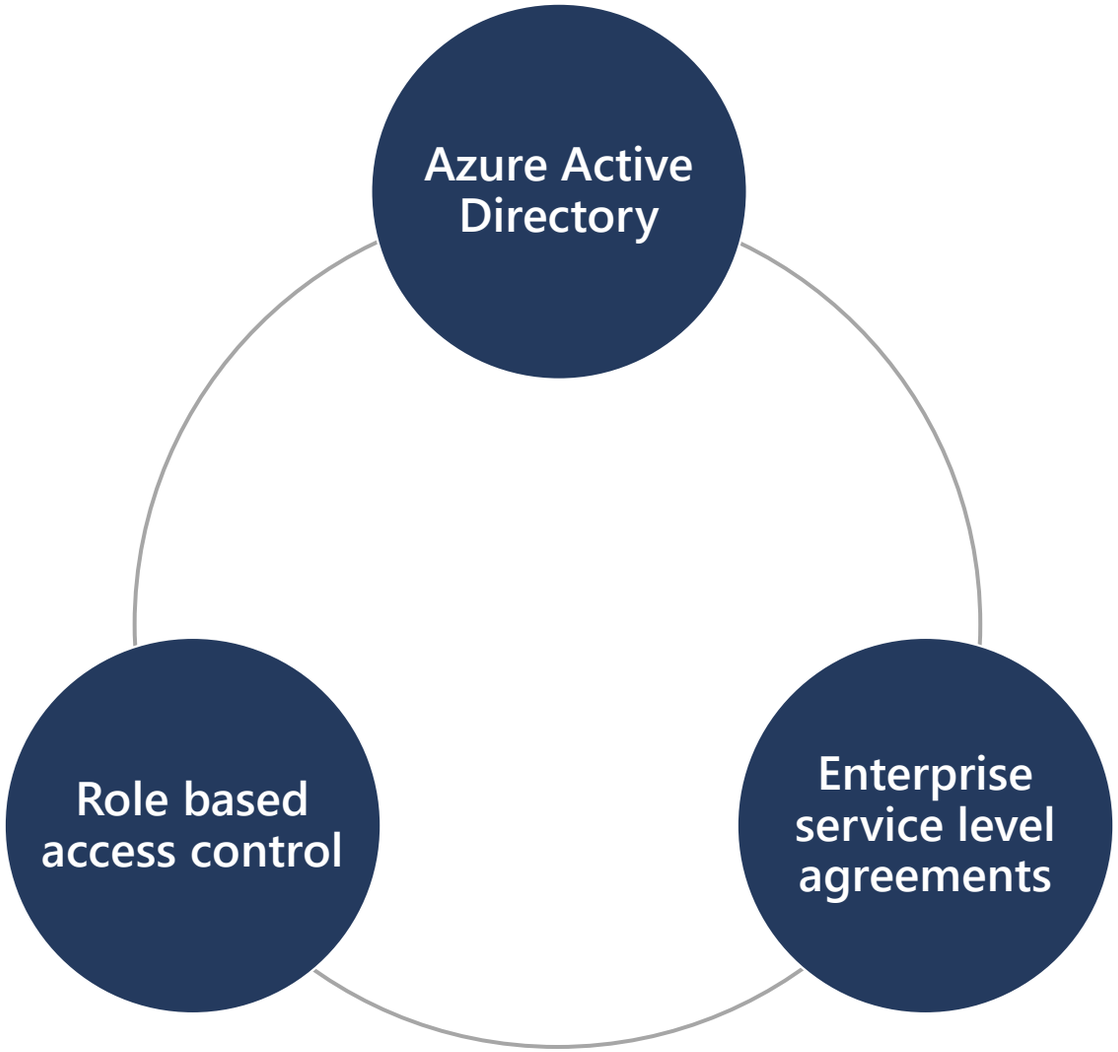
Streaming

Mlib

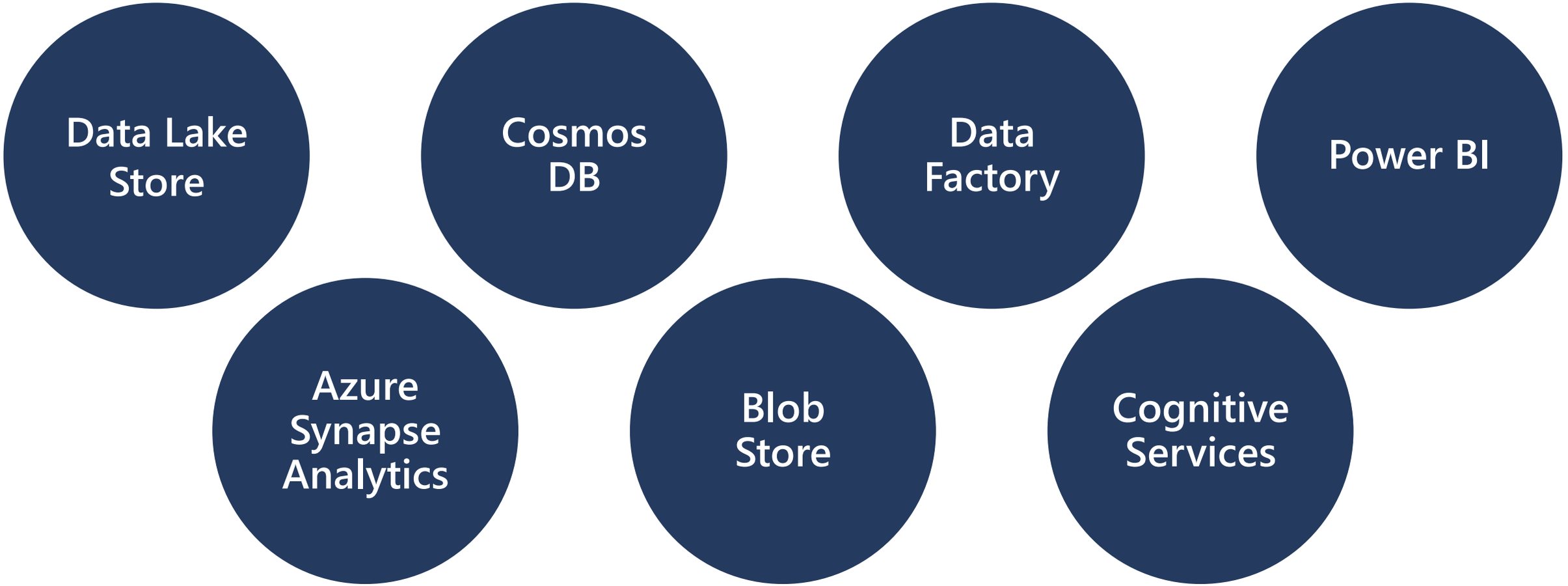
GraphX

Spark Core API

# Enterprise security




# Integration with cloud services

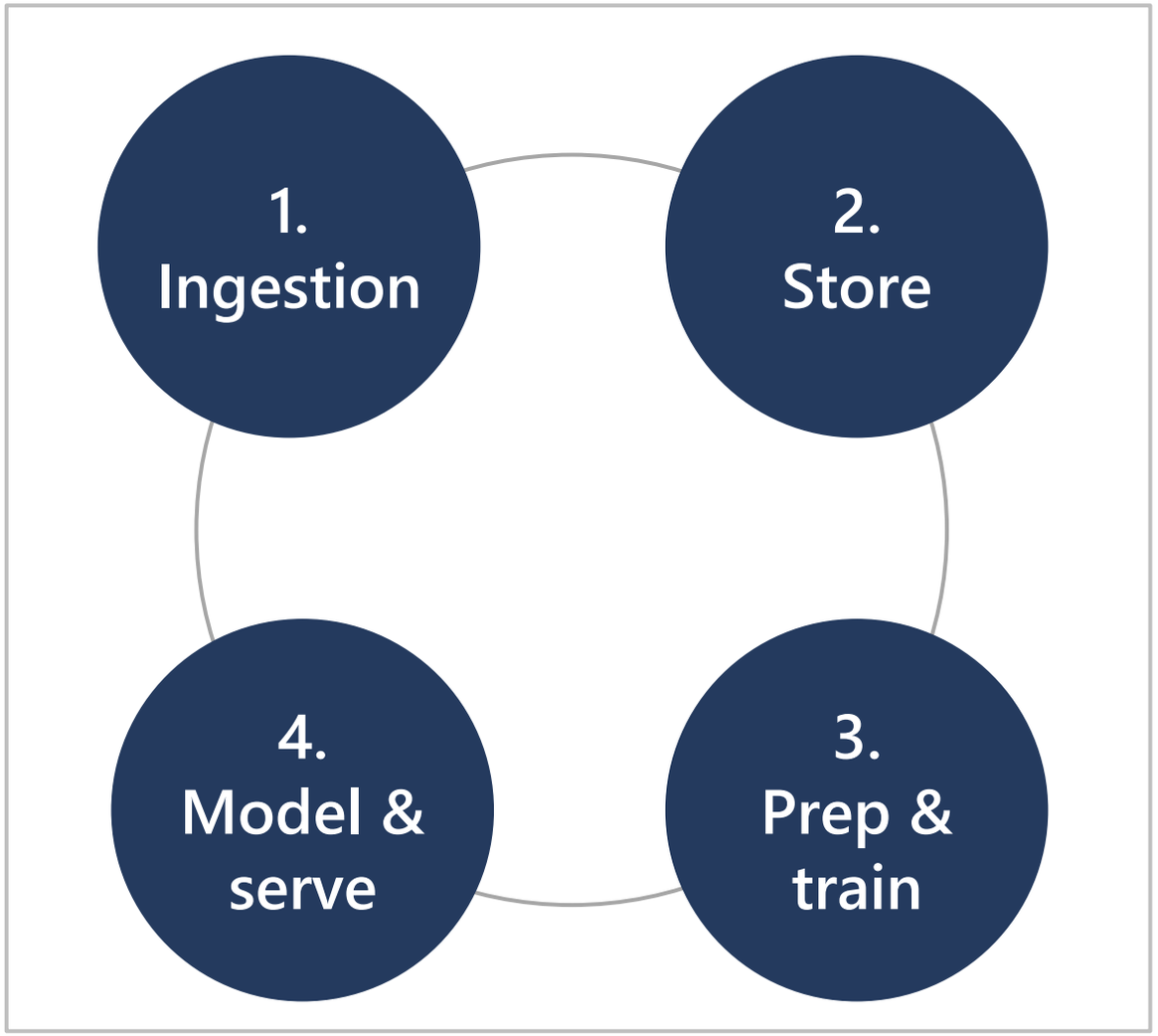


# Spark: what to use when and where

| | Apache Spark | HDInsight | Azure Databricks | Synapse Spark |
|---|---|---|---|---|
| WHAT | Is an Open Source memory optimized system for managing big data workloads | Microsoft implementation of Open Source Spark managed within the realms of Azure | A managed Spark as a Service solution | Embedded Spark capability within Azure Synapse Analytics |
| WHEN | When you want to benefits of spark for big data processing and/or data science work without the Service Level Agreements of a provider | When you want to benefits of OSS spark with the Service Level Agreement of a provider | Provides end to end data engineering and data science solution and management platform | Enables organizations without existing Spark implementations to fire up a Spark cluster to meet data engineering needs without the overheads of the other Spark platforms listed |
| WHO | Open Source Professionals | Open Source Professionals wanting SLA's and Microsoft Data Platform experts | Data Engineers and Data Scientists working on big data projects every day | Data Engineers, Data Scientists, Data Platform experts and Data Analysts |
| WHY | To overcome the limitations of SMP systems imposed on big data workloads | To take advantage of the OSS Big Data Analytics platform with SLA's in place to ensure business continuity | It provides the ability to create and manage an end to end big data/data science project using one platform | It provides the ability to scale efficiently with spark clusters within a one stop shop Data Warehousing platform of Synapse. |

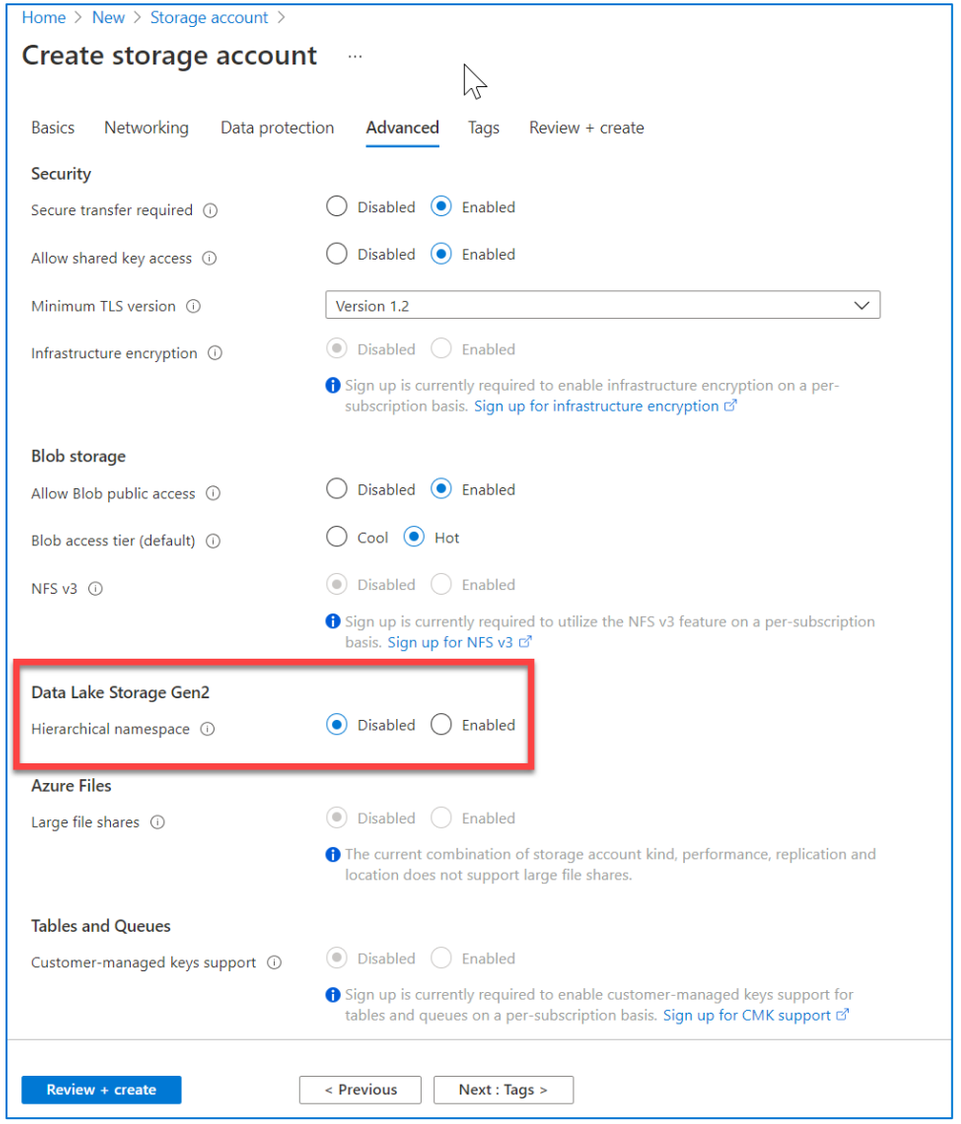
# Lesson 01: Introduction to Azure Data Lake storage

# Processing Big Data with Azure Data Lake Store

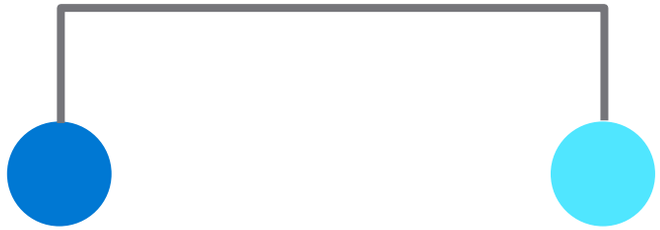
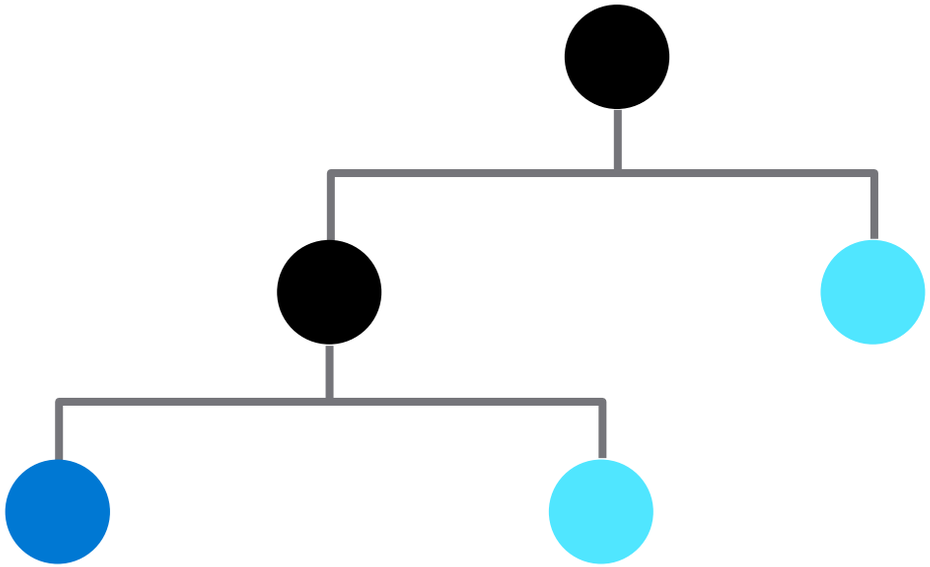



# Introduction to Azure Data Lake storage

- Hadoop compatible
- Security
- Performance
- Redundancy



# Compare Azure Blob Storage and Data Lake Store Gen 2

| Azure Blob<br>Flat namespace | Data Lake (Gen II)<br>Hierarchical namespace |
| --- | --- |
|  |  |

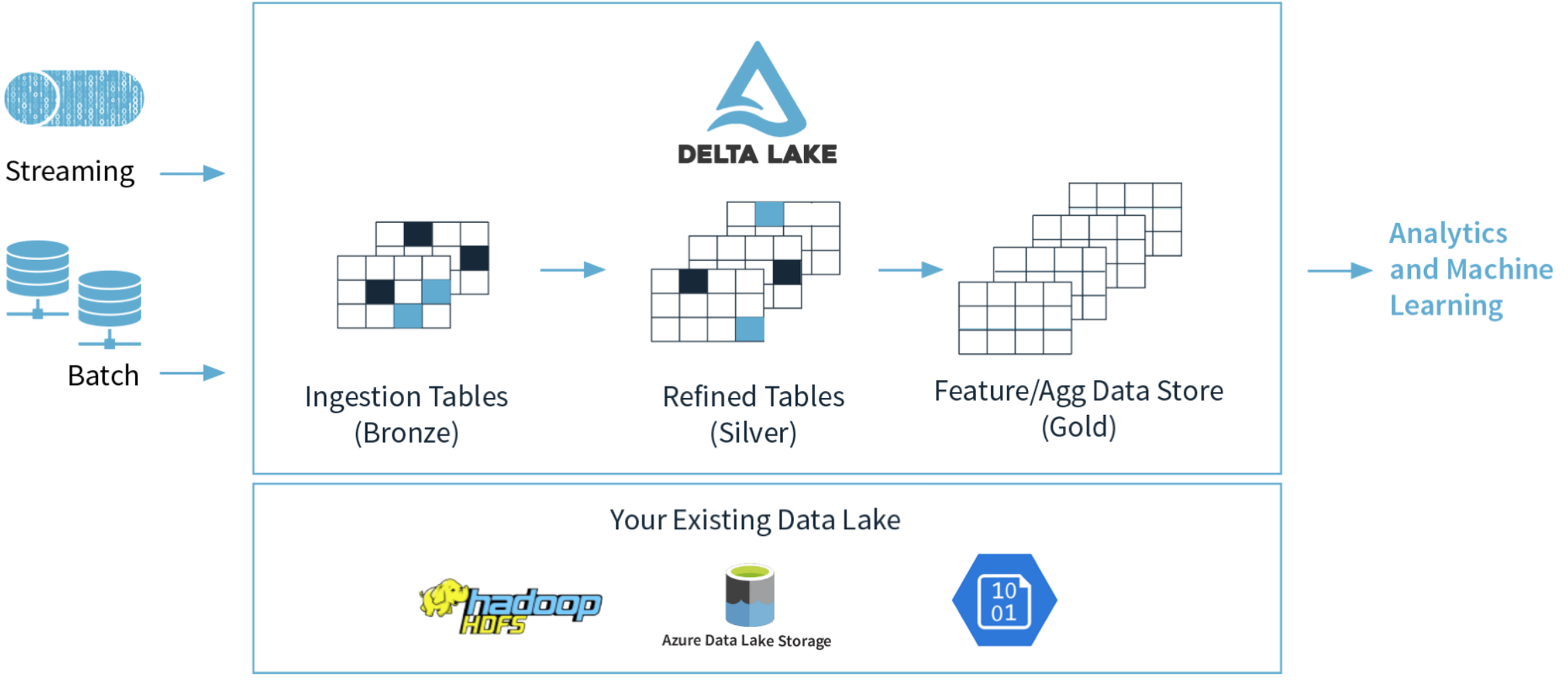
# Big Data use cases

Let’s examine three use cases for leveraging an Azure Data Lake Store

| | |
|---|---|
| **Modern data warehouse** | This architecture sees Azure Data Lake Storage at the heart of the solution for a modern data warehouse. Using Azure Data Factory to ingest data into the Data Lake from a business application, and predictive models built in Azure Databricks, using Azure Synapse Analytics as a serving layer |
| **Advanced analytics** | In this solution, Azure Data factory is transferring terabytes of web logs from a web server to the Data Lake on an hourly basis. This data is provided as features to the predictive model in Azure Databricks, which is then trained and scored. The result of the model is then distributed globally using Azure Cosmos DB, that an application uses |
| **Real time analytics** | In this architecture, there are two ingestion streams. Azure Data Factory is used to ingest the summary files that are generated when the HGV engine is turned off. Apache Kafka provides the real-time ingestion engine for the telemetry data. Both data streams are stored in Data Lake store for use in the future |

# Lesson 01: Describe Delta Lake architecture

# Describe a Delta Lake architecture



# Lesson 01: Work with data streams by using Azure Stream Analytics

# What are data streams

## Data streams:

In the context of analytics, data streams are event data generated by sensors or other sources that can be analyzed by another technology

## Data stream processing approach:

There are two approaches. Reference data is streaming data that can be collected over time and persisted in storage as static data. In contrast, streaming data have relatively low storage requirements. And run computations in sliding windows

## Data streams are used to:

**Analyze data:**
Continuously analyze data to detect issues and understand or respond to them

**Understand systems:**
Understand component or system behavior under various conditions to fuel further enhancements of said system

**Trigger actions:**
Trigger specific actions when certain thresholds are identified

# Event processing

The process of consuming data streams, analyzing them, and deriving actionable insights out of them is called Event Processing and has three distinct components:

| | |
|---|---|
| **Event producer** | Examples include sensors or processes that generate data continuously such as a heart rate monitor or a highway toll lane sensor |
| **Event processor** | An engine to consume event data streams and deriving insights from them. Depending on the problem space, event processors either process one incoming event at a time (such as a heart rate monitor) or process multiple events at a time (such as a highway toll lane sensor) |
| **Event consumer** | An application which consumes the data and takes specific action based on the insights. Examples of event consumers include alert generation, dashboards, or even sending data to another event processing engine |

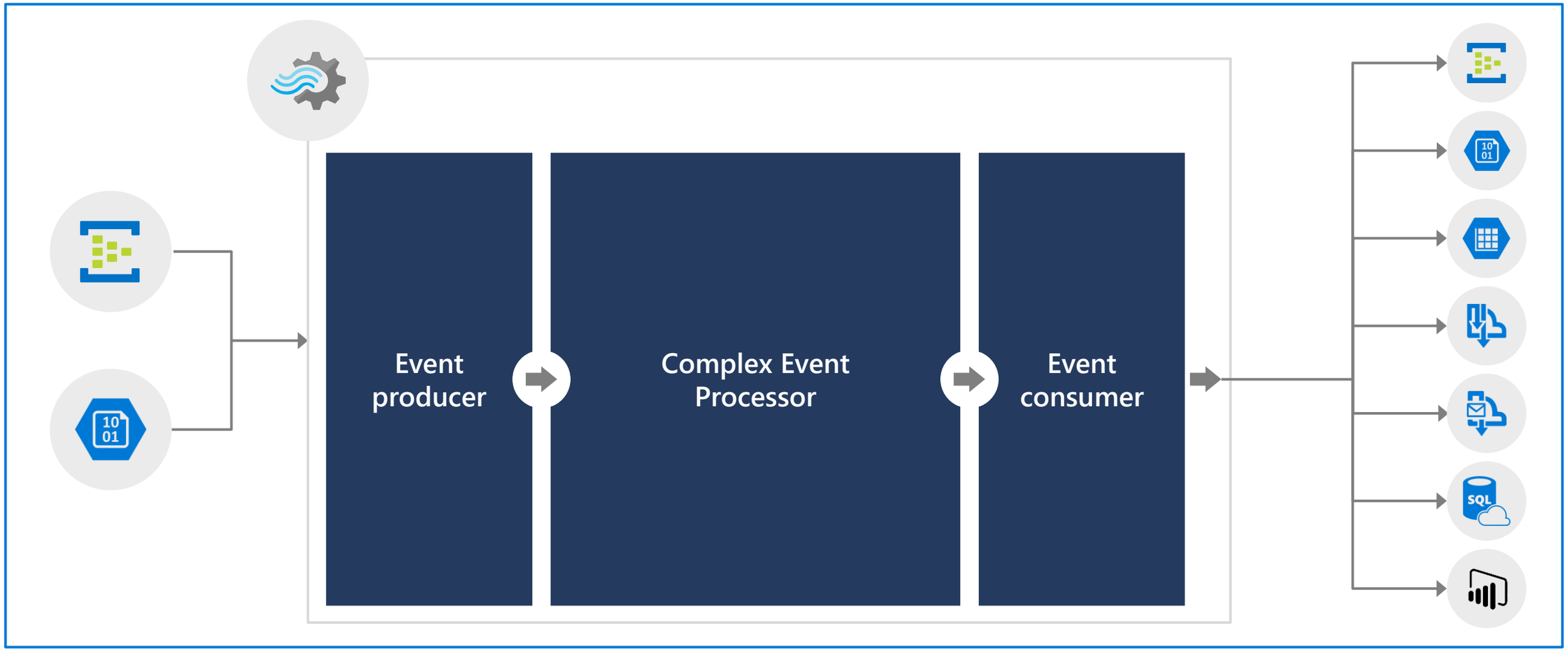
# Processing events with Azure Stream Analytics

Microsoft Azure Stream Analytics is an event processing engine. It enables the consumption and analysis of high volumes of streaming data in real time

| Source | Ingestion | Analytical engine | Destination |
| --- | --- | --- | --- |
| Sensors | Event Hubs | Stream Analytics Query Language | Azure Data Lake |
| Systems | IoT Hubs | .NET SDK | Cosmos DB |
| Applications | Azure Blob Store | | SQL Database |
| | | | Blob Store |
| | | | Power BI |

# Work with data streams by using Azure Stream Analytics

## Complex event processing of Stream Data in Azure



# Review questions

Q01 – Azure Synapse Analytics offers Synapse SQL in two offerings. What are they?

A01 – Dedicated SQL pools, and serverless SQL pools.

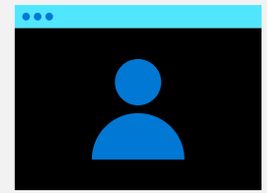
Q02 – Which Azure Storage Account option must be enabled to optimize the storage account as an Azure Data Lake for analytical workloads?

A02 – Hierarchical namespace.

Q03 – Which architecture enriches data through a unified pipeline that allows you to combine batch and streaming workflows?

A03 – Delta lake architecture.

# Lab: Explore compute and storage options for data engineering workloads



http://fmdk.io/dp2031

# Lab overview

This lab teaches ways to structure the data lake, and to optimize the files for exploration, streaming, and batch workloads. The student will learn how to organize the data lake into levels of data refinement as they transform files through batch and stream processing. The students will also experience working with Apache Spark in Azure Synapse Analytics.  They will learn how to create indexes on their datasets, such as CSV, JSON, and Parquet files, and use them for potential query and workload acceleration using Spark libraries including Hyperspace and MSSParkUtils.

## Lab objectives

After completing this lab, you will be able to:

**Work with a Delta Lake architecture**

**Working with Apache Spark in Azure Synapse Analytics**

# Lab review

Q01 – Which PySpark module imports data types to define a schema?

Q02 – Which method defines using a delta lake format when creating a DataFrame?

Q03 – Which library can be used to create indexes on datasets such as CSV, and Parquet, and use them for potential workload acceleration?

# Module summary

In this module, you have learned about:

- Azure Synapse Analytics
- Azure Databricks
- Azure Data Lake
- Delta Lake architectures
- Azure Stream Analytics

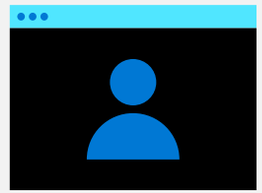
## Next steps

After the course, consider visiting [the Microsoft Customer Case Study site]. Use the search bar to search by an industry such as healthcare or retail, or by a technology such as Azure Synapse Analytics or Azure Databricks. Read through some of the customers stories

Microsoft Azure

# Appendix:

# Optional slide that may help you address some anticipated questions from the students



# Azure Data Platform technologies


Storage Account

- When you need a **low cost, high throughput** data store
- When you need to store **No-SQL** data
- When you **do not need to query** the data directly. **No ad hoc query** support
- Suits the storage of archive or **relatively static data**
- Suits acting as a **HDInsight Hadoop** data store

Data Lake Store

- When you need a **low cost, high throughput** data store
- **Unlimited storage for No-SQL** data
- When you **do not need to query** the data directly. **No ad hoc query** support
- Suits the storage of archive or **relatively static data**
- Suits acting as a **Databricks , HDInsight** and **IoT** data store

Azure Databricks

- **Eases the deployment** of a Spark based cluster
- Enables the **fastest processing** of Machine Learning solutions
- **Enables collaboration** between data engineers and data scientists
- Provides **tight enterprise security integration** with Azure Active Directory
- **Integration with other Azure Services and Power BI**

Azure COSMOS DB

- Provides **global distribution** for both structured and unstructured data stores
- **Millisecond query response** time
- **99.999% availability** of data
- **Worldwide elastic scale** of both the storage and throughput
- **Multiple consistency levels** to control data integrity with concurrency


Azure SQL Database

- When you require a **relational** data store
- When you need to manage **transactional workloads**
- When you need to manage a **high volume on inserts and reads**
- When you need a service that **requires high concurrency**
- When you require a solution that can scale **elastically**

# Azure Data Platform technologies (continued)

Azure Synapse Analytics

- When you require an integrated **relational** and **big data** store
- When you need to manage **data warehouse** and **analytical workloads**
- When you need **low cost storage**
- When you require the ability to **pause and restart the compute**
- When you require a solution that can scale **elastically**

Azure Stream Analytics

- When you require a **fully managed event processing** engine
- When you require **temporal analysis of streaming** data
- Support for analyzing **IoT streaming** data
- Support for analyzing application data through **Event Hubs**
- Ease of use with a **Stream Analytics Query Language**

Azure Data Factory

- When you want to **orchestrate the batch movement** of data
- When you want to connect to **wide range of data platforms**
- When you want to **transform or enrich** the data in movement
- When you want to **integrate with SSIS packages**
- Enables **verbose logging** of data processing activities

Azure HDInsight

- When you need a **low cost, high throughput** data store
- When you need to store **No-SQL** data
- Provides a Hadoop **Platform as a Service** approach
- Suits acting as a **Hadoop, Hbase, Storm or Kafka** data store
- **Eases the deployment and management** of clusters

Azure Purview

- When you require **documentation** of your data stores
- When you require a **multi user** approach to documentation
- When you need to **classify data sources**
- A **fully managed cloud service** whose users can discover the data sources
- When you require **a solution that can help any user** understand their data