


Azure Data Fundamentals

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1 Explorer core data concepts



LEARNING PATH

Microsoft Azure Data Fundamentals: Explore core data concepts

2 Modules

Beginner Data Analyst Azure

Data structures in which this data is organized often represents entities that are important to an organization

Structured data

Structured data is data that adheres to a fixed schema, so all of the data has the same fields or properties.

Structured data is often stored in a database in which multiple tables can reference one another by using key values in a relational model.

Customer				
ID	FirstName	LastName	Email	Address
1	Joe	Jones	joe@litware.com	1 Main St.
2	Samir	Nadoy	samir@northwind.com	123 Elm Pl.

Semi-structured data

Semi-structured data is information that has some structure, but which allows for some variation between entity instances. For example, while most customers may have an email address, some might have multiple email addresses, and some might have none at all.

One common format for semi-structured data is JavaScript Object Notation (JSON).

```
1 {  
2   "name": "espen",  
3   "mail": {  
4     "1": "ek.mail.com",  
5     "2": "ek.gmail.com"  
6   }  
7 }
```

Unstructured data

Not all data is structured or even semi-structured. For example, documents, images, audio and video data, and binary files might not have a specific structure. This kind of data is referred to as unstructured data.



Data stores

File stores

Databases

File storage

Delimited txt, csv,JSON, XML, BLOB Binary Large Object (images, video, audio)

Databases

Relational databases are commonly used to store and query structured data, SQL.

Customer		
ID	Email	Address
1	joe@litware.com	1 Main St.
2	samir@northwind.com	123 Elm Pl.

Non relational databases are data management systems that dont apply a relational schema to the data., NoSQL.

Products	
Key	Value
123	"Hammer (\$2.99)"
162	"Screwdriver (\$3.49)"
201	"Wrench (\$4.25)"

Transactional data processing OLTP

A transactional data processing system is what most people consider the primary function of business computing. A transactional system records transactions that encapsulate specific events that the organization wants to track. A transaction could be financial, such as the movement of money between accounts in a banking system, or it might be part of a retail system, tracking payments for goods and services from customers.

OLTP

The work performed by transactional systems is often referred to as Online Transactional Processing (OLTP).

OLTP solutions rely on a database system in which data storage is optimized for both read and write operations in order to support transactional workloads in which data records are created, retrieved, updated, and deleted (often referred to as CRUD operations). These operations are applied transactionally, in a way that ensures the integrity of the data stored in the database. To accomplish this, OLTP systems enforce transactions that support so-called ACID semantics:

Atomicity – each transaction is treated as a single unit, which succeeds completely or fails completely. For example, a transaction that involved debiting funds from one account and crediting the same amount to another account must complete both actions. If either action can't be completed, then the other action must fail.

Consistency – transactions can only take the data in the database from one valid state to another. To continue the debit and credit example above, the completed state of the transaction must reflect the transfer of funds from one account to the other.

Isolation – concurrent transactions cannot interfere with one another, and must result in a consistent database state.

Durability – when a transaction has been committed, it will remain committed. After the account transfer transaction has completed, the revised account balances are persisted so that even if the database system were to be switched off, the committed transaction would be reflected when it is switched on again.

2 Explorer data roles and services

#Identify data services

Some of the most commonly used cloud services for data are described below.

[Identify data services - Learn | Microsoft Docs](#)

Azure SQL



Azure SQL is the collective name for a family of relational database solutions based on the Microsoft SQL Server database engine. Specific Azure SQL services include:

- **Azure SQL Database** – a fully managed platform-as-a-service (PaaS) database hosted in Azure
- **Azure SQL Managed Instance** – a hosted instance of SQL Server with automated maintenance, which allows more flexible configuration than Azure SQL DB but with more administrative responsibility for the owner.
- **Azure SQL VM** – a virtual machine with an installation of SQL Server, allowing maximum configurability with full management responsibility.

Azure Database for open-source relational databases



Azure includes managed services for popular open-source relational database systems, including:

- **Azure Database for MySQL** - a simple-to-use open-source database management system that is commonly used in *Linux, Apache, MySQL, and PHP* (LAMP) stack apps.
- **Azure Database for MariaDB** - a newer database management system, created by the original developers of MySQL. The database engine has since been rewritten and optimized to improve performance. MariaDB offers compatibility with Oracle Database (another popular commercial database management system).
- **Azure Database for PostgreSQL** - a hybrid relational-object database. You can store data in relational tables, but a PostgreSQL database also enables you to store custom data types, with their own non-relational properties.

Azure Cosmos DB



Azure Cosmos DB is a global-scale non-relational (*NoSQL*) database system that supports multiple application programming interfaces (APIs), enabling you to store and manage data as JSON documents, key-value pairs, column-families, and graphs.

Azure Storage



Azure Storage is a core Azure service that enables you to store data in:

- **Blob containers** - scalable, cost-effective storage for binary files.
- **File shares** - network file shares such as you typically find in corporate networks.
- **Tables** - key-value storage for applications that need to read and write data values quickly.

Data engineers use Azure Storage to host *data lakes* - blob storage with a hierarchical namespace that enables files to be organized in folders in a distributed file system.

Azure Data Factory



Azure Data Factory is an Azure service that enables you to define and schedule data pipelines to transfer and transform data. You can integrate your pipelines with other Azure services, enabling you to ingest data from cloud data stores, process the data using cloud-based compute, and persist the results in another data store.

Azure Synapse Analytics



Azure Synapse Analytics is a comprehensive, unified data analytics solution that provides a single service interface for multiple analytical capabilities, including:

- **Pipelines** - based on the same technology as Azure Data Factory.
- **SQL** - a highly scalable SQL database engine, optimized for data warehouse workloads.
- **Apache Spark** - an open-source distributed data processing system that supports multiple programming languages and APIs, including Java, Scala, Python, and SQL.
- **Azure Synapse Data Explorer** - a high-performance data analytics solution that is optimized for real-time querying of log and telemetry data using Kusto Query Language (KQL).

Azure Databricks



Azure Databricks is an Azure-integrated version of the popular Databricks platform, which combines the Apache Spark data processing platform with SQL database semantics and an integrated management interface to enable large-scale data analytics.

Data engineers can use existing Databricks and Spark skills to create analytical data stores in Azure Databricks.

Azure HDInsight



Azure HDInsight is an Azure service that provides Azure-hosted clusters for popular Apache open-source big data processing technologies, including:

- **Apache Spark** - a distributed data processing system that supports multiple programming languages and APIs, including Java, Scala, Python, and SQL.
- **Apache Hadoop** - a distributed system that uses *MapReduce* jobs to process large volumes of data efficiently across multiple cluster nodes. MapReduce jobs can be written in Java or abstracted by interfaces such as Apache Hive - a SQL-based API that runs on Hadoop.
- **Apache HBase** - an open-source system for large-scale NoSQL data storage and querying.
- **Apache Kafka** - a message broker for data stream processing.
- **Apache Storm** - an open-source system for real-time data processing through a topology of *spouts* and *bolts*.

Azure Stream Analytics



Azure Stream Analytics is a real-time stream processing engine that captures a stream of data from an input, applies a query to extract and manipulate data from the input stream, and writes the results to an output for analysis or further processing.

Data engineers can incorporate Azure Stream Analytics into data analytics architectures that capture streaming data for ingestion into an analytical data store or for real-time visualization.

Azure Data Explorer



Azure Data Explorer is a standalone service that offers the same high-performance querying of log and telemetry data as the Azure Synapse Data Explorer runtime in Azure Synapse Analytics.

Data analysts can use Azure Data Explorer to query and analyze data that includes a timestamp attribute, such as is typically found in log files and *Internet-of-things* (IoT) telemetry data.

Azure Purview



Azure Purview provides a solution for enterprise-wide data governance and discoverability. You can use Azure Purview to create a map of your data and track data lineage across multiple data sources and systems, enabling you to find trustworthy data for analysis and reporting.

Data engineers can use Azure Purview to enforce data governance across the enterprise and ensure the integrity of data used to support analytical workloads.

Microsoft Power BI



Microsoft Power BI is a platform for analytical data modeling and reporting that data analysts can use to create and share interactive data visualizations. Power BI reports can be created by using the Power BI Desktop application, and the published and delivered through web-based reports and apps in the Power BI service, as well as in the Power BI mobile app.

3 Explorer relational in Azure



LEARNING PATH

Microsoft Azure Data Fundamentals: Explore relational data in Azure

2 Modules

Beginner

Data Analyst

Azure

Understand relational data

In a relational database, you model collections of entities from the real world as tables.

Understand normalization

Normalization is a term used by database professionals for a schema design process that minimizes data duplication and enforces data integrity.

While there are many complex rules that define the process of refactoring data into various levels (or forms) of normalization, a simple definition for practical purposes is:

- Separate each entity into its own table.
- Separate each discrete attribute into its own column.
- Uniquely identify each entity instance (row) using a primary key.
- Use foreign key columns to link related entities.

Explorer SQL

SELECT, INSERT, UPDATE, DELETE, CREATE, and DROP to accomplish almost everything that you need to do with a database.

- Data Definition Language (DDL), CREATE, ALTER, DROP, RENAME
- Data Control Language (DCL), GRANT, DENY, REVOKE
- Data Manipulation Language (DML), SELECT, INSERT, UPDATE, DELETE
- VIEW
- Stored procedure
- Index

4 Explorer relational database services in Azure



Explore relational database services in Azure

36 min • Module • 6 Units

#Describe Azure SQL services and capabilities

[Describe Azure SQL services and capabilities - Learn | Microsoft Docs](#)

Azure SQL is a collective term for a family of Microsoft SQL




SQL Server on Azure Virtual Machines (VMs) - A virtual machine running in Azure with an installation of SQL Server. The use of a VM makes this option an infrastructure-as-a-service (IaaS) solution that virtualizes hardware infrastructure for compute, storage, and networking in Azure; making it a great option for "lift and shift" migration of existing on-premises SQL Server installations to the cloud.

Azure SQL Managed Instance - A platform-as-a-service (PaaS) option that provides near-100% compatibility with on-premises SQL Server instances while abstracting the underlying hardware and operating system. The service includes automated software update management, backups, and other maintenance tasks, reducing the administrative burden of supporting a database server instance

Azure SQL Database - A fully managed, highly scalable PaaS database service that is designed for the cloud. This service includes the core database-level capabilities of on-premises SQL Server, and is a good option when you need to create a new application in the cloud.

Azure SQL Edge - A SQL engine that is optimized for Internet-of-things (IoT) scenarios that need to work with streaming time-series data.

Compare Azure SQL services

	SQL Server on Azure VMs	Azure SQL Managed Instance	Azure SQL Database
			
Type of cloud service	IaaS	PaaS	PaaS
SQL Server compatibility	Fully compatible with on-premises physical and virtualized installations. Applications and databases can easily be "lift and shift" migrated without change.	Near-100% compatibility with SQL Server. Most on-premises databases can be migrated with minimal code changes by using the Azure Database Migration service	Supports most core database-level capabilities of SQL Server. Some features depended on by an on-premises application may not be available.

#Describe Azure services for open-source databases

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In addition to Azure SQL services, Azure data services are available for other popular relational database systems, including MySQL, MariaDB, and PostgreSQL.

Azure Database for MySQL



Azure Database for MySQL is a PaaS implementation of MySQL in the Azure cloud, based on the MySQL Community Edition.

The Azure Database for MySQL service includes high availability at no additional cost, and scalability as required. You only pay for what you use. Automatic backups are provided, with point-in-time restore.

Azure Database for MariaDB



Azure Database for MariaDB is an implementation of the MariaDB database management system adapted to run in Azure. It's based on the MariaDB Community Edition.

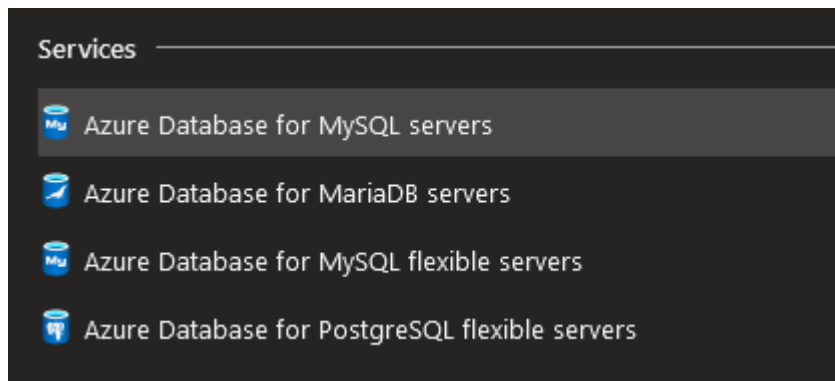
The database is fully managed and controlled by Azure. Once you've provisioned the service and transferred your data, the system requires almost no additional administration.

Azure Database for PostgreSQL

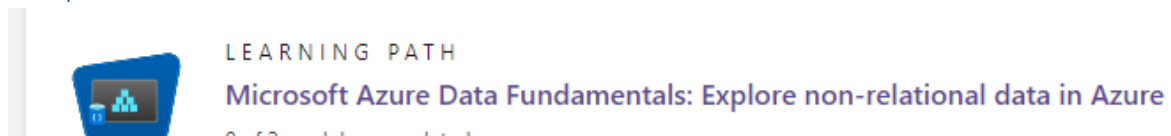


If you prefer PostgreSQL, you can choose Azure Database for PostgreSQL to run a PaaS implementation of PostgreSQL in the Azure Cloud. This service provides the same availability, performance, scaling, security, and administrative benefits as the MySQL service.

#Azure GUI

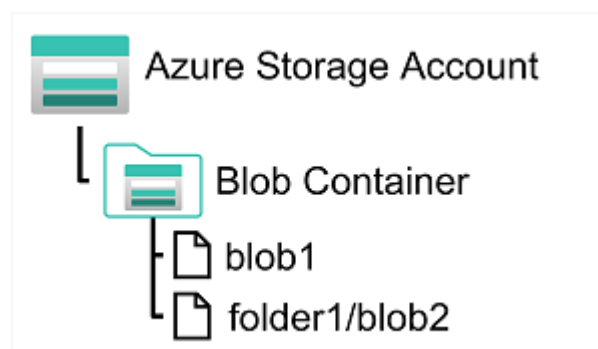


5 Explorer non-relational data



Blob storage

Blob Storage is a service that enables you to store massive amounts of unstructured data as binary large objects, or blobs, in the cloud. Blobs are an efficient way to store data files in a format that is optimized for cloud-based storage, and applications can read and write them by using the Azure blob storage API.



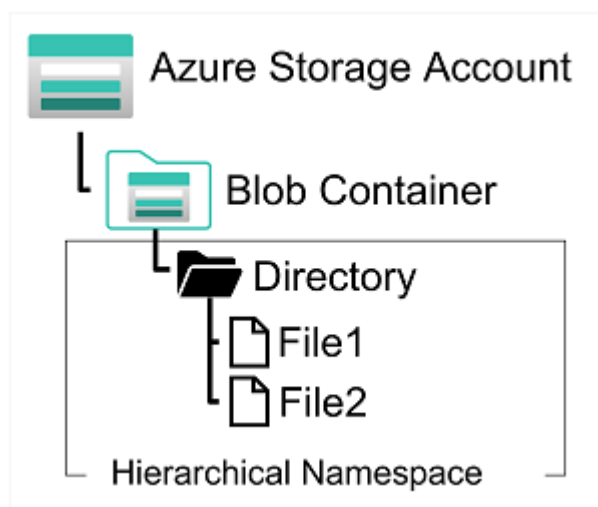
Block blobs, Block blobs are best used to store discrete, large, binary objects that change infrequently.

Page blobs, A page blob is optimized to support random read and write operations; you can fetch and store data for a single page if necessary. Azure uses page blobs to implement virtual disk storage for virtual machines.

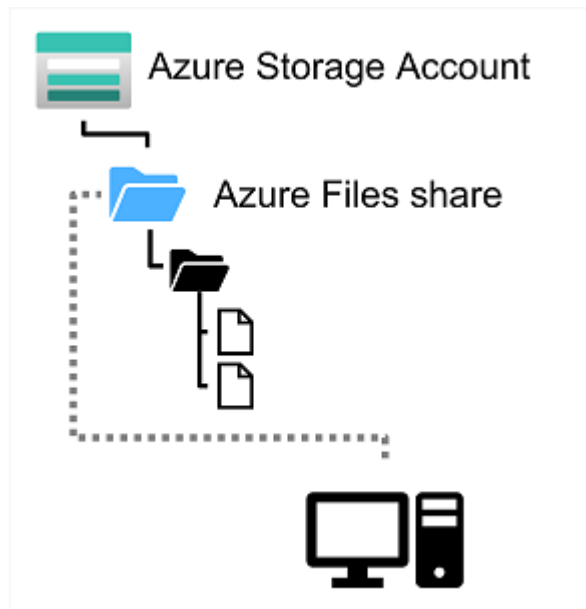
Append blobs, An append blob is a block blob optimized to support append operations. You can only add blocks to the end of an append blob; updating or deleting existing blocks isn't supported.

DataLake Storage Gen2

Azure Data Lake Store (Gen1) is a separate service for hierarchical data storage for analytical data lakes, often used by so-called big data analytical solutions that work with structured, semi-structured, and unstructured data stored in files.

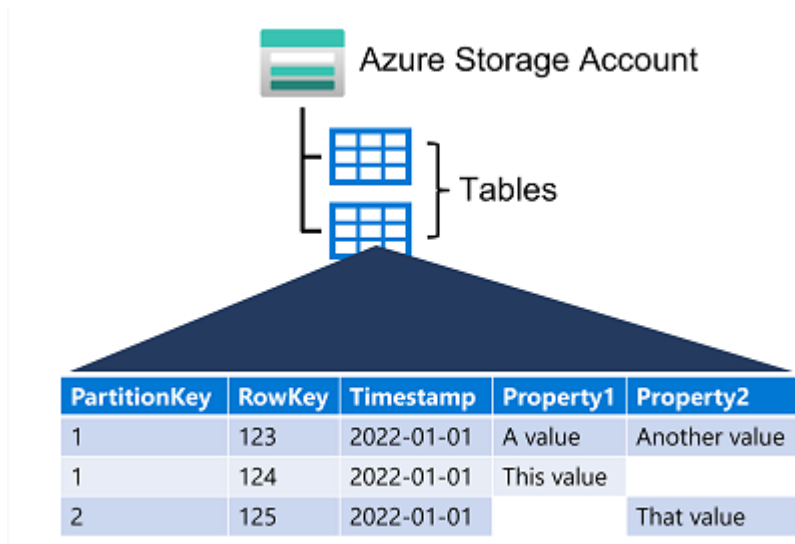


Files



Tables

Azure Table Storage is a NoSQL storage solution that makes use of tables containing key/value data items. Each item is represented by a row that contains columns for the data fields that need to be stored.



An Azure Table enables you to store semi-structured data. All rows in a table must have a unique key (composed of a partition key and a row key), and when you modify data in a table, a timestamp column records the date and time the modification was made; but other than that, the columns in each row can vary.

Partions

An Azure Table enables you to store semi-structured data. All rows in a table must have a unique key (composed of a partition key and a row key), and when you modify data in a table, a timestamp column records the date and time the modification was made; but other than that, the columns in each row can vary.

6 Explorer fundamentals of Cosmos DB

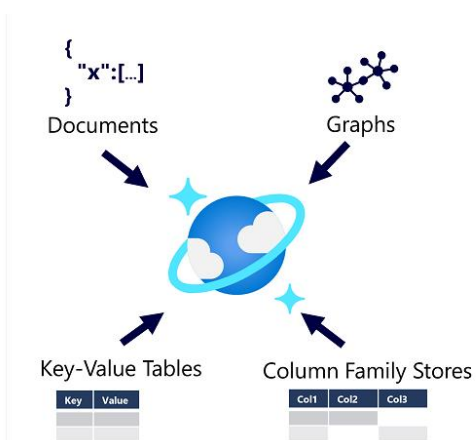


Explore fundamentals of Azure Cosmos DB

31 min remaining • Module • 0 of 6 units completed

★★★★★ 4.8 (3,514)

Azure Cosmos DB is a highly scalable cloud database service for NoSQL data.



Azure Cosmos DB supports multiple application programming interfaces (APIs) that enable developers to use the programming semantics of many common kinds of data store to work with

data in a Cosmos DB database. The internal data structure is abstracted, enabling developers to use Cosmos DB to store and query data using APIs with which they're already familiar.

#When to use Cosmos DB

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- IoT and telematics, These systems typically ingest large amounts of data in frequent bursts of activity.
- Retail and marketing
- Gaming
- Web and mobile applications

#Cosmos DB API

[Identify Azure Cosmos DB APIs - Learn | Microsoft Docs](#)

Azure Cosmos DB supports multiple APIs, enabling developers to easily migrate data from commonly used NoSQL stores and apply their existing programming skills. When you provision a new Cosmos DB instance, you select the API that you want to use.


- Core SQL API (JSON)
- MongoDB API (MQL)
- Table API (Similar to Azure Table)

PartitionKey	RowKey	Name	Email
1	123	Joe Jones	joe@litware.com
1	124	Samir Nadoy	samir@northwind.com

[https://endpoint/Customers\(PartitionKey='1',RowKey='124'\)](https://endpoint/Customers(PartitionKey='1',RowKey='124'))

- Cassandra API (SQL like)
- Gremlin API (Graph structure)

7 Explorer data analytics



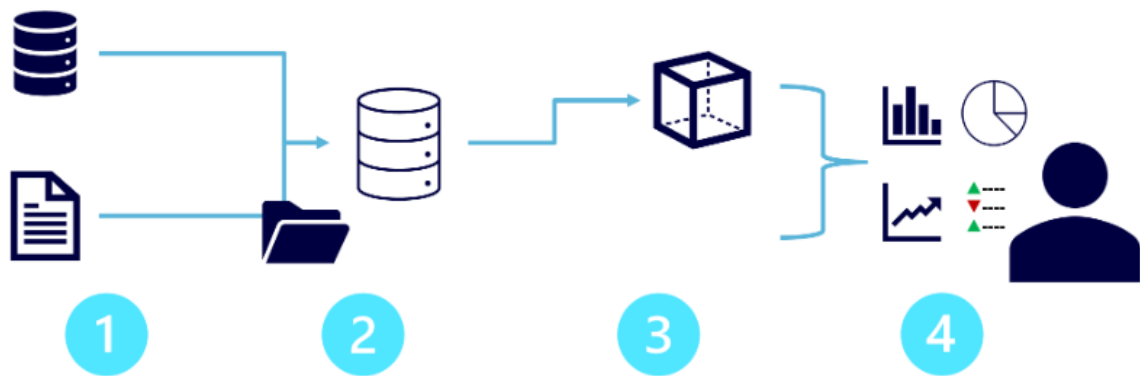
LEARNING PATH

Microsoft Azure Data Fundamentals: Explore data analytics in Azure

0 of 3 modules completed

Explorer modern data warehousing

- 1 Data ingestion and processing, ETL or ELT. Data ingestion includes both batch processing of static data and real-time processing of streaming data.
- 2 Analytical data store, relational data warehouse, file-system based data lakes, and hybrid.
- 3 Analytical data model, 1 or more data models that pre-aggregate the data to make it easier to produce reports, dashboards and interactive solutions.
- 4 Data visualization.

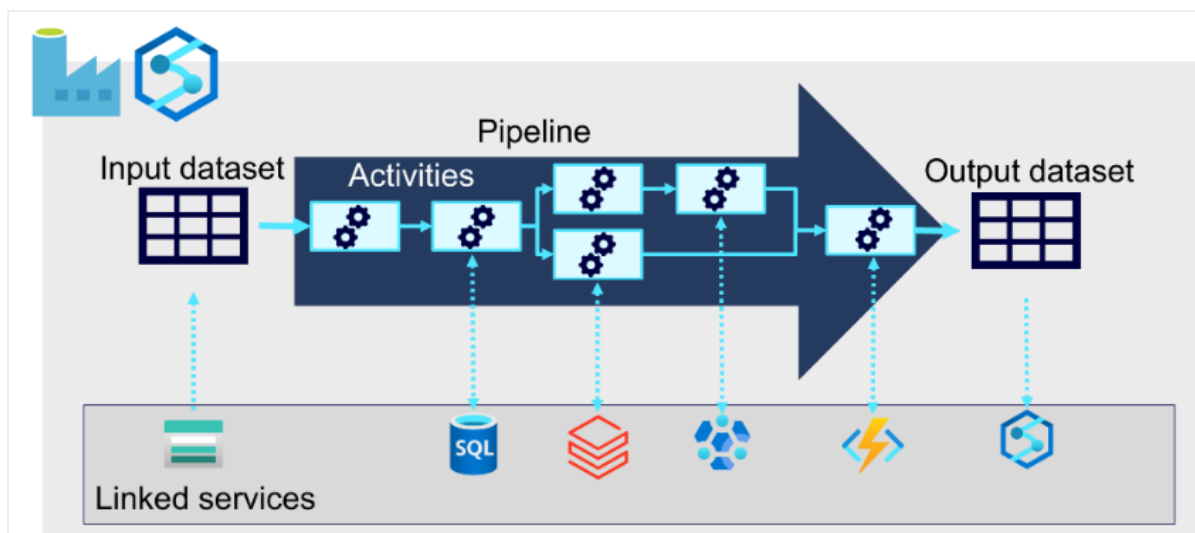


#Explorer data ingestion pipelines

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Large scale:

- Pipelines and ETL
- Pipelines with Azure data factory or use same engine in Azure synapse analytics if you want to manage all of the components of your d w solution in a unified workspace.
- In either case, pipelines consist of one or more activities that operate on data. An input dataset provides the source data, and activities can be defined as a data flow that incrementally manipulates the data until an output dataset is produced. Pipelines use linked services to load and process data – enabling you to use the right technology for each step of the workflow.



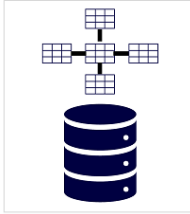
#Explorer analytical data store

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There are two common types of analytical data store.

Data warehouse

A data warehouse is a relational database in which the data is stored in a schema that is optimized for data analytics rather than transactional workloads. Commonly, the data from a transactional store is denormalized into a schema in which numeric values are stored in central fact tables,



Data lake

A data lake is a file store, usually on a distributed file system for high performance data access. Technologies like Spark or Hadoop are often used to process queries on the stored files and return data for reporting and analytics. These systems often apply a schema-on-read approach to define tabular schemas on semi-structured data files at the point where the data is read for analysis, without applying constraints when it's stored.

Data lakes



Hybrid

[Azure services for analytical stores](#)

Three main



Azure Synapse Analytics is a unified, end-to-end solution for large scale data analytics. It brings together multiple technologies and capabilities, enabling you to combine the data integrity and reliability of a scalable, high-performance SQL Server based relational data warehouse with the flexibility of a data lake and open-source Apache Spark. It also includes native support for log and telemetry analytics with Azure Synapse Data Explorer pools, as well as built in data pipelines for data ingestion and transformation. All Azure Synapse Analytics services can be managed through a single, interactive user interface called Azure Synapse Studio, which includes the ability to create interactive notebooks in which Spark code and markdown content can be combined. Synapse Analytics is a great choice when you want to create a single, unified analytics solution on Azure.



Azure Databricks is an Azure implementation of the popular Databricks platform. Databricks is a comprehensive data analytics solution built on Apache Spark, and offers native SQL capabilities as well as workload-optimized Spark clusters for data analytics and data science. Databricks provides an interactive user interface through which the system can be managed and data can be explored in interactive notebooks. Due to its common use on multiple cloud platforms, you might want to consider using Azure Databricks as your analytical store if you want to use existing expertise with the platform or if you need to operate in a multi-cloud environment or support a cloud-portable solution.



Azure HDInsight is an Azure service that supports multiple open-source data analytics cluster types. Although not as user-friendly as Azure Synapse Analytics and Azure Databricks, it can be a suitable option if your analytics solution relies on multiple open-source frameworks or if you need to migrate an existing on-premises Hadoop-based solution to the cloud.

#Tutorial Explore Azure Synapse Analytics Pricy

[Exercise: Explore Azure Synapse Analytics - Learn | Microsoft Docs](#)

Services



Azure Synapse Analytics



No Azure Synapse Analytics to display

Synapse Analytics is a fully-managed service to build modern data warehouses for enterprises. Synapse Analytics brings together SQL, Apache Spark, Orchestration, and Ingestion into a single workspace, dramatically reducing the time to build an analytics solution.

[Create Synapse workspace](#)

Pricy

Pre-Purchase Plans

[Data Integration](#)[Data Warehousing](#)[Big Data Analytics](#)[Log and Telemetry Analytics](#)[Dedicated SQL pool](#)

You can get up to 28% savings over pay-as-you-go prices when you pre-purchase Azure Synapse Analytics Commit Units (SCUs), to be used on any publicly Azure Synapse except storage over the subsequent 12 months. Your Azure Synapse usage will draw from your pre-purchased SCUs at the individual product are exhausted, or until the end of the 12-month period.

The purchase tiers and discounts for pre-purchase plan Synapse Commit Units are shown below:

Tier	Synapse Commit Units (SCUs)	Discount %	Price
1	5,000	6%	kr40,724.090

8 Explorer fundamental of real-time analytics



Explore fundamentals of real-time analytics

1 t 22 min nienstår • Module • 1 av 11 enheter fullført

#Understand batch and stream processing

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Batch processing, in which multiple data records are collected and stored before being processed together in a single operation.

- New data collected and stored, and whole group is processed together as a batch
- Based on schedule, 1 h
- Trigger when data has arrived
- Parking lot, collect cars in lot and then count them in a single operation.

Stream processing, in which a source of data is constantly monitored and processed in real time as new data events occur.

- Processed when it arrives
- No waiting, processed as individual units
- Parking lot, counting cars in realtime as they pass.

Understand differences between batch and streaming data

#Explore common elements of stream processing architecture

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General architecture

1. An event generates some data
2. The generated data is captured in a streaming source for processing (folder or database or queue)
3. The event data is processed (query time-based or windows)
4. The result of streaming process operation are written to an output or sink (file, database, dashboard or another queue)

#Realtime analytics in Azure

[Explore common elements of stream processing architecture - Learn | Microsoft Docs](#)

- **Azure Stream Analytics:** A platform-as-a-service (PaaS) solution that you can use to define *streaming jobs* that ingest data from a streaming source, apply a perpetual query, and write the results to an output.
- **Spark Structured Streaming:** An open-source library that enables you to develop complex streaming solutions on Apache Spark based services, including **Azure Synapse Analytics**, **Azure Databricks**, and **Azure HDInsight**.
- **Azure Data Explorer:** A high-performance database and analytics service that is optimized for ingesting and querying batch or streaming data with a time-series element, and which can be used as a standalone Azure service or as an **Azure Synapse Data Explorer** runtime in an Azure Synapse Analytics workspace.

Sources for stream processing

- **Azure Event Hubs:** A data ingestion service that you can use to manage queues of event data, ensuring that each event is processed in order, exactly once.
- **Azure IoT Hub:** A data ingestion service that is similar to Azure Event Hubs, but which is optimized for managing event data from *Internet-of-things* (IoT) devices.
- **Azure Data Lake Store Gen 2:** A highly scalable storage service that is often used in *batch processing* scenarios, but which can also be used as a source of streaming data.
- **Apache Kafka:** An open-source data ingestion solution that is commonly used together with Apache Spark. You can use Azure HDInsight to create a Kafka cluster.

Sinks for stream processing

- **Azure Event Hubs:** Used to queue the processed data for further downstream processing.
- **Azure Data Lake Store Gen 2 or Azure blob storage:** Used to persist the processed results as a file.
- **Azure SQL Database or Azure Synapse Analytics, or Azure Databricks:** Used to persist the processed results in a database table for querying and analysis.
- **Microsoft Power BI:** Used to generate real time data visualizations in reports and dashboards.

#Explore Azure Stream Analytics SQL syntax

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Azure Stream Analytics is a service for complex event processing and analysis of streaming data. Stream Analytics is used to:

- Ingest data from an input, such as an Azure event hub, Azure IoT Hub, or Azure Storage blob container.
- Process the data by using a query to select, project, and aggregate data values.
- Write the results to an output, such as Azure Data Lake Gen 2, Azure SQL Database, Azure Synapse Analytics, Azure Functions, Azure event hub, Microsoft Power BI, or others.

Once started, a Stream Analytics query will run perpetually, processing new data as it arrives in the input and storing results in the output.

Azure Stream Analytics is a great technology choice when you need to continually capture data from a streaming source, filter or aggregate it, and send the results to a data store or downstream process for analysis and reporting.

#Explore Apache Spark on Microsoft Azure

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Apache Spark is a distributed processing framework for large scale data analytics.

#Explore Azure Data Explorer KQL, Kusto syntax

[Explore Azure Data Explorer - Learn | Microsoft Docs](#)

Azure Data Explorer is a standalone Azure service for efficiently analyzing data. You can use the service as the output for analyzing large volumes of diverse data from data sources such as websites, applications, IoT devices, and more. For example, by outputting Azure Stream Analytics logs to Azure Data Explorer, you can complement Stream Analytics low latency alerts handling with Data Explorer's deep investigation capabilities.

9 Explore fundamentals of data visualization

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Explore fundamentals of data visualization

38 min • Module • 7 Units

#Describe Power BI tools and workflow

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A typical workflow for creating a data visualization solution starts with Power BI Desktop, application in which you can import data from a wide range of data sources, combine and organize the data from these sources in an analytics data model, and create reports that contain interactive visualizations of the data.

publish them to the Power BI service; a cloud service in which reports can be published and interacted with by business users.

Users can consume reports, dashboards, and apps in the Power BI service through a web browser, or on mobile devices by using the Power BI phone app.

#Analytical modeling in Microsoft Power BI

[Describe core concepts of data modeling - Learn | Microsoft Docs](#)

Power BI to define an analytical model from tables of data, which can be imported from one or more data source.

Describe considerations for data visualization

- Tables, text

- Charts, graphs
- Etc

#Tutorial Visualize data with Power BI

[Exercise – Visualize data with Power BI - Learn | Microsoft Docs](#)

- Install Power BI
- Import data
 - web
- Explorer data model
- Create report