Microsoft

Serverless Analytics

Using Synapse Distributed Query Processor

CE, CSA, MCS & Architects - Global Data & AI Team Meeting

Devin Jaiswal – Data SQL Ninja Team

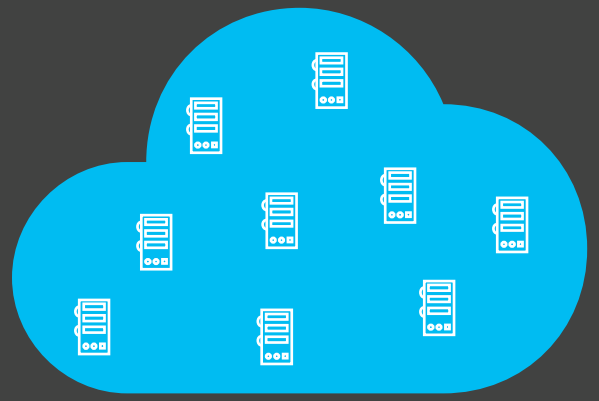
Abraham Samuel – Global Black Belt Team

Microsoft

February 25th, 2021

Today's customer, before using Azure resource, first, they need to size the Azure resources, customize it to there needs, and then use it.

Serverless is the one step closer, where they just bring the data, and start using it.



Serverless, the next gen platform

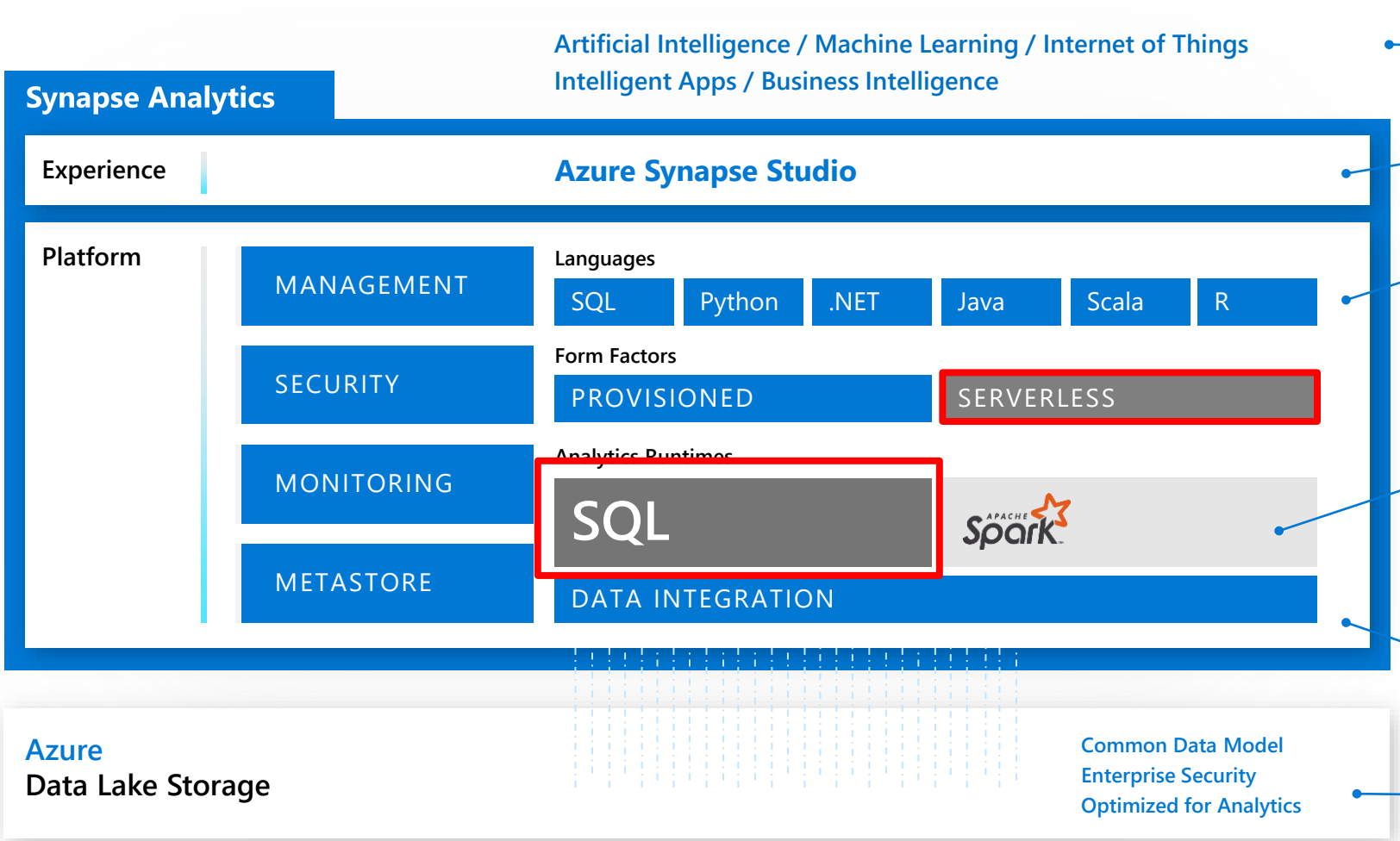
The "evolution" of database platforms

Objectives

- Synapse DQP Technical deep dive
- Best practices
- Demo

Azure Synapse Analytics

Integrated data platform for BI, AI and continuous intelligence



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 provisioned and serverless on-demand

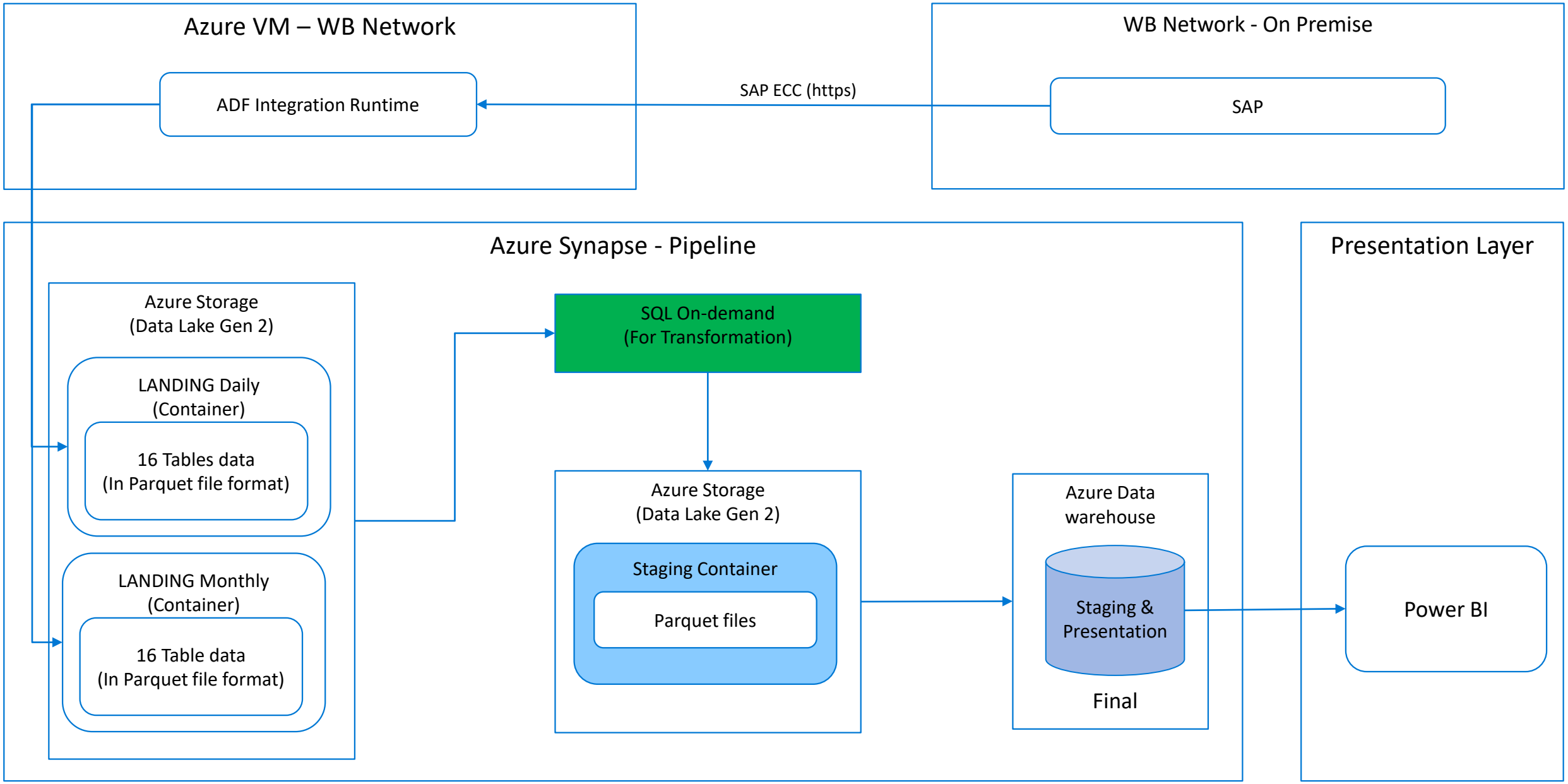
SQL Analytics offering T-SQL for batch, streaming and interactive processing

Spark 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

LIS To Azure Synapse – Data flow



Synapse SQL on-demand scenarios

Discovery and exploration	What's in this file? How many rows are there? What's the max value? **SQL On-demand reduces data lake exploration to the right-click!**
Data transformation	How to transform the raw data? **Use the full power of T-SQL to transform the data in the data lake**

SQL Serverless – Querying on storage Demo

Microsoft Azure | Synapse Analytics ▸ prlangadws2

Search resources

Publish all 2 | Validate all | Refresh | Discard all

Data

Filter resources by name

- Storage accounts
  - prlangaddemosa (Primary)
    - filesystem
    - holidaydatacontainer
    - isdweatherdatacontainer
    - nyctlc
    - prlangaddemosa
    - tmpcontainer
    - wwimporters
- Databases
  - prlangadSQLDW (SQL pool)
  - default (SQL on-demand)
  - default (Spark)
- Datasets

HolidayDataPi... | Load Data to S... | Pipeline 1 | Data flow 1 | SQL script 1 * | Copy Open Da... | nyctlc

Upload | Download | New Folder | Select All | Rename | Manage Access | Properties | Delete | Refresh

nyctlc > yellow > puYear=2015 > puMonth=3

New SQL script and open in new tab

LAST MODIFIED

part-00133-[illegible]6543-aea5b543-5e83-4a7d-8d31-69f72c50b05d-15253-1.c000.snappy.parquet 10/25/2019, 2:20:23 PM

- New SQL script
- New notebook
- Copy ABFSS path
- Manage Access...
- Rename...
- Download
- Delete
- Properties...

Microsoft Azure | Synapse Analytics ▸ prlangadws2

Search resources

prlangad@microsoft.com

Publish all 3 | Validate all | Refresh | Discard all

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HolidayDataPi... | Load Data to S... | Pipeline 1 | Data flow 1 | SQL script 1 * | Copy Open Da... | nyctlc | SQL script 2

Run | Publish | Query plan | Connect to: SQL Analytics on-demand | Use database: master

```
SELECT
    TOP 100 *
FROM
    OPENROWSET(
        BULK 'https://prlangaddemosa.dfs.core.windows.net/nyctlc/yellow/puYear=2015/puMonth=3/part-00133-tid-210938564719836543-aea5b543-5e83-4
        FORMAT='PARQUET'
    ) AS nyc;
```

Results | Messages

View: Table | Chart | Export results

Search

VENDORID	TPEPPICKUPDATETIME	TPEPDROPOFFDATET...	PASSENGERCOUNT	TRIPDISTANCE	PULOCATIONID	DOLOCATIONID	STARTLON	STARTLAT	ENDI
2	2015-02-28T23:5...	2015-03-01T00:0...	6	1.63	NULL	NULL	-74.000846862793	40.7306938171387	-73.
1	2015-03-28T19:2...	2015-03-28T19:2...	1	2.2	NULL	NULL	-73.977653503418	40.7631607055664	-73.
2	2015-02-28T23:5...	2015-03-01T00:1...	5	3.23	NULL	NULL	-73.96012878417...	40.7621574401855	-73.
1	2015-03-28T19:2...	2015-03-28T19:3...	1	2.1	NULL	NULL	-73.98143005371...	40.7815055847168	-74.
2	2015-02-28T23:5...	2015-03-01T00:1...	1	3.52	NULL	NULL	-73.98373413085...	40.7497062683105	-74.

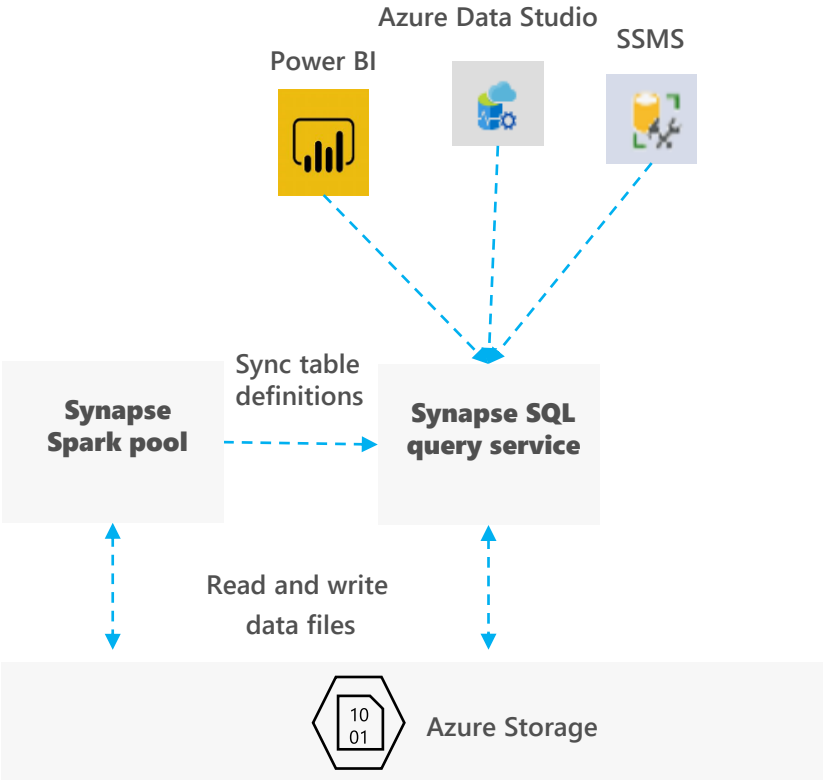
00:01:00 Query executed successfully.

Synapse serverless SQL pool

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

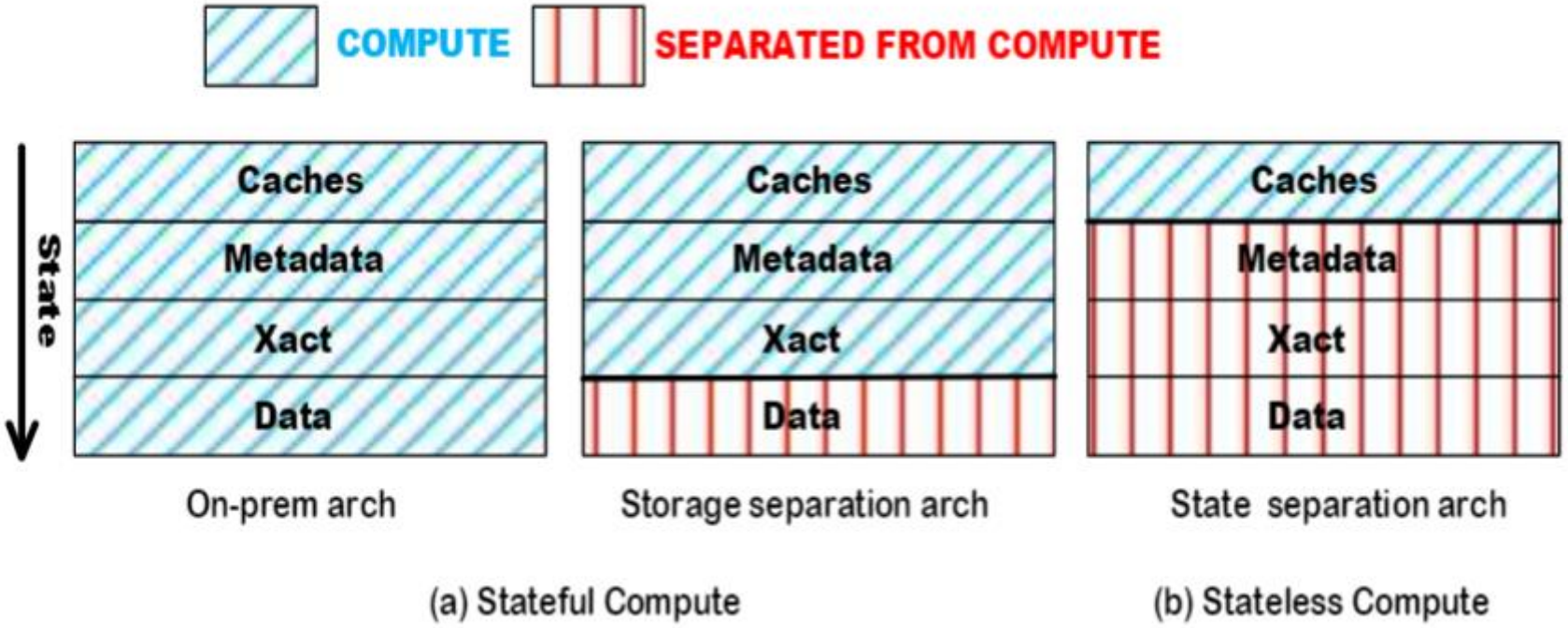
The Serverless Pool uses separation of Compute and State:

- **Stateless, resilient compute**
- **A logical database storage model, rather than physical**
- **Seamless scalability**



The Dedicated Pool uses separation of Compute and Storage

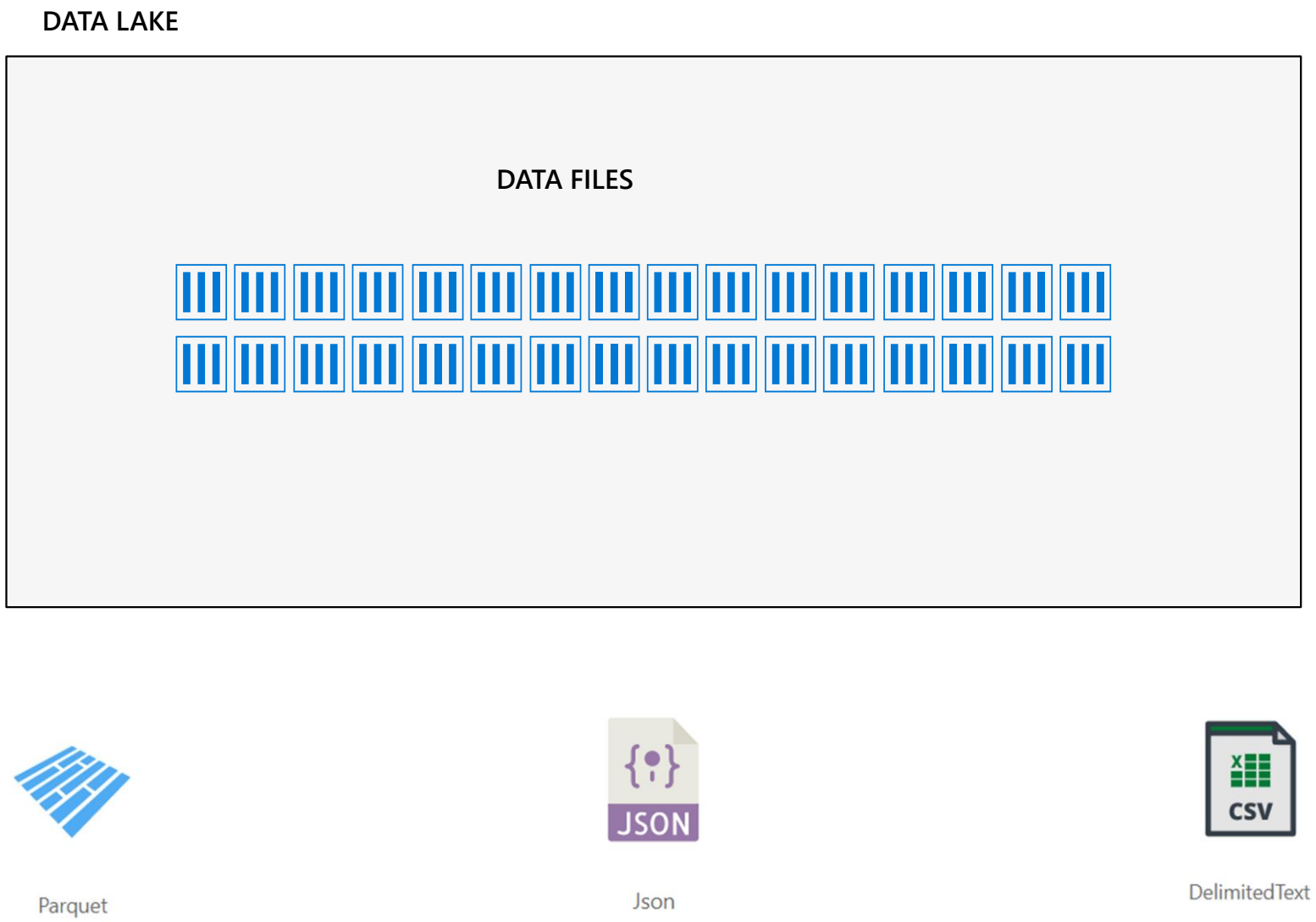
Separating Compute and State



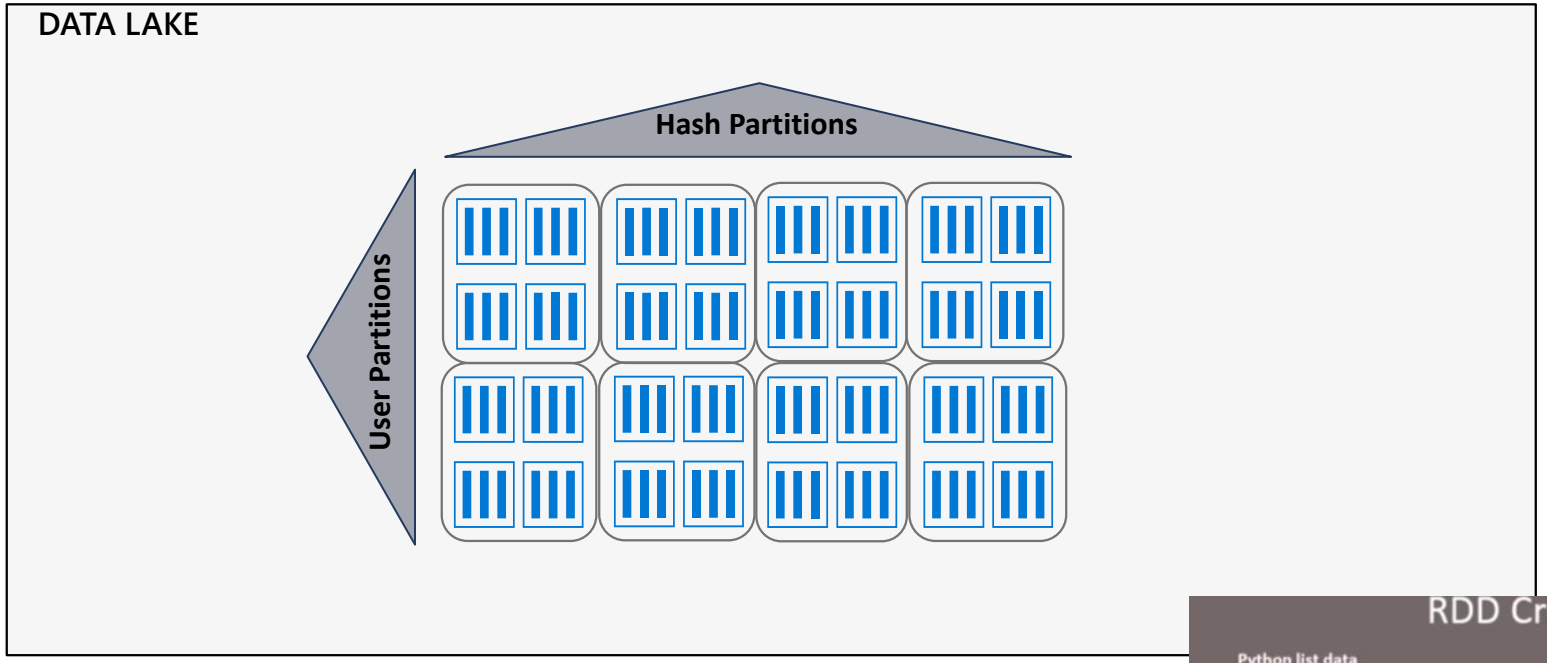
Evolution of data warehouse architectures over the years, illustrating how state has been coupled with compute.

Data to Data Cells

A collection (e.g., table) of data objects (e.g.,
rows) in serverless pool can be logically abstracted as a collection of cells



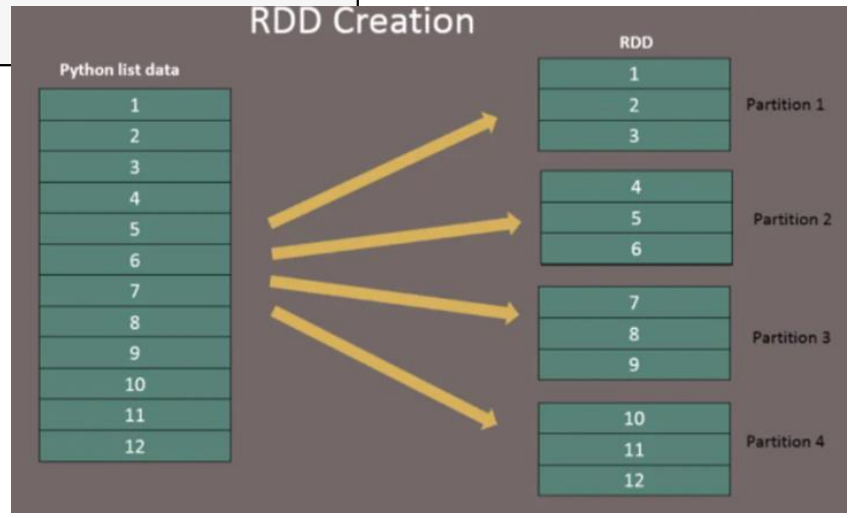
Distribute the data



Dataset must be uniformly distributed across a large number of cells

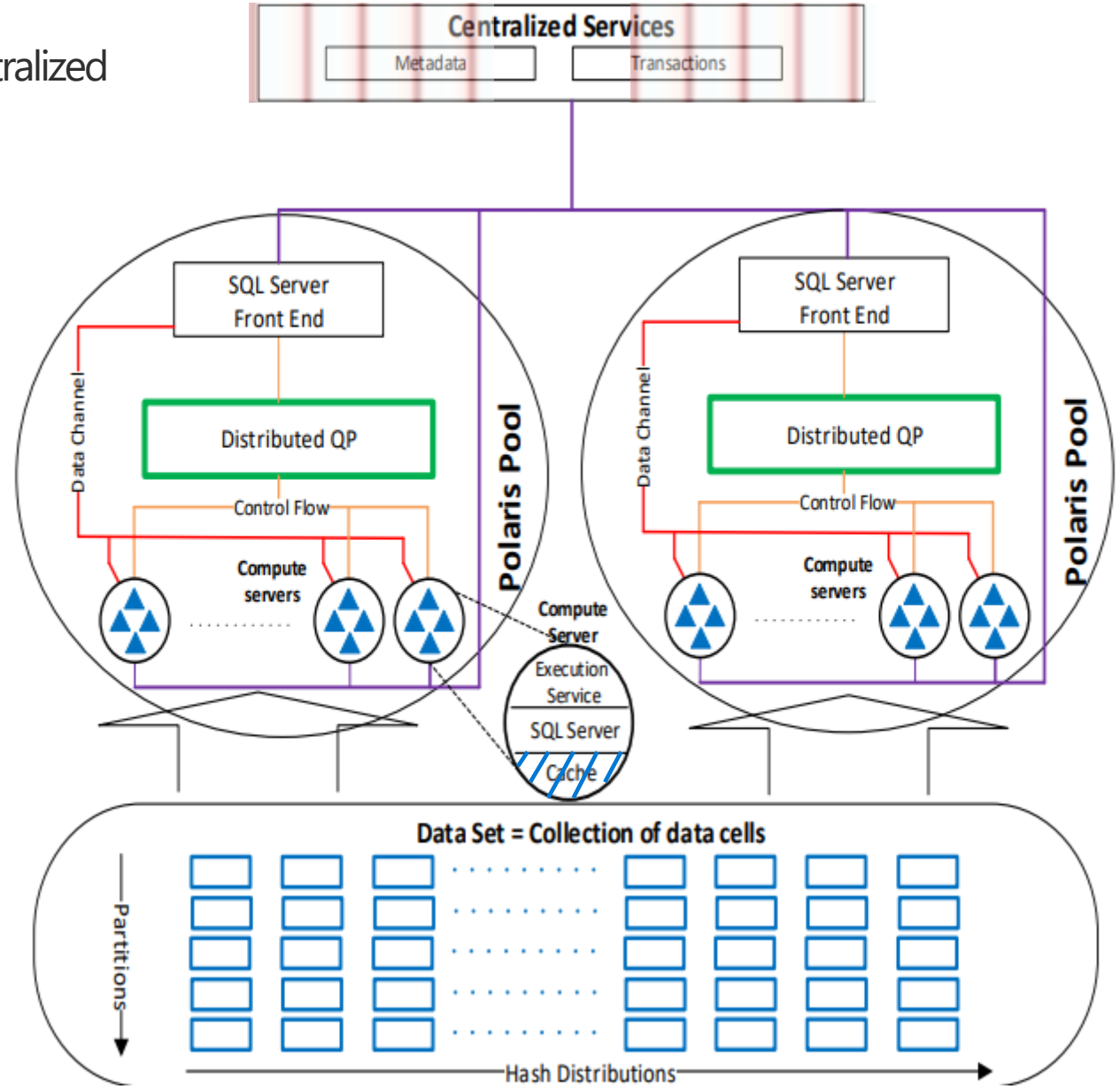
We achieve that using Hash Partition, The hash-distribution h is used to map cells to compute nodes.

Similar concept as Spark RDD



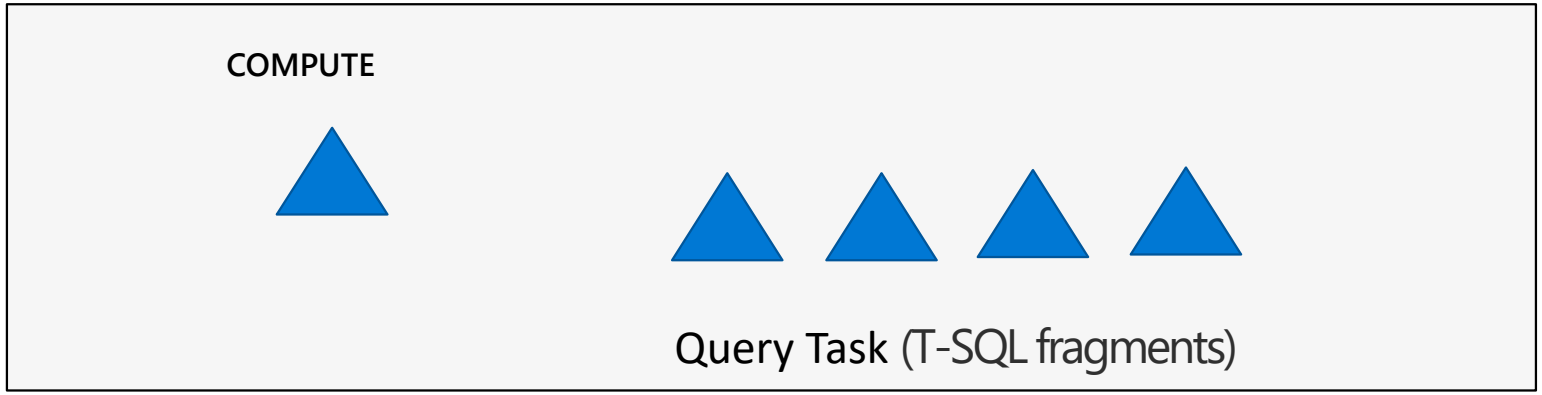
The metadata and transactional log state is off-loaded to centralized services.

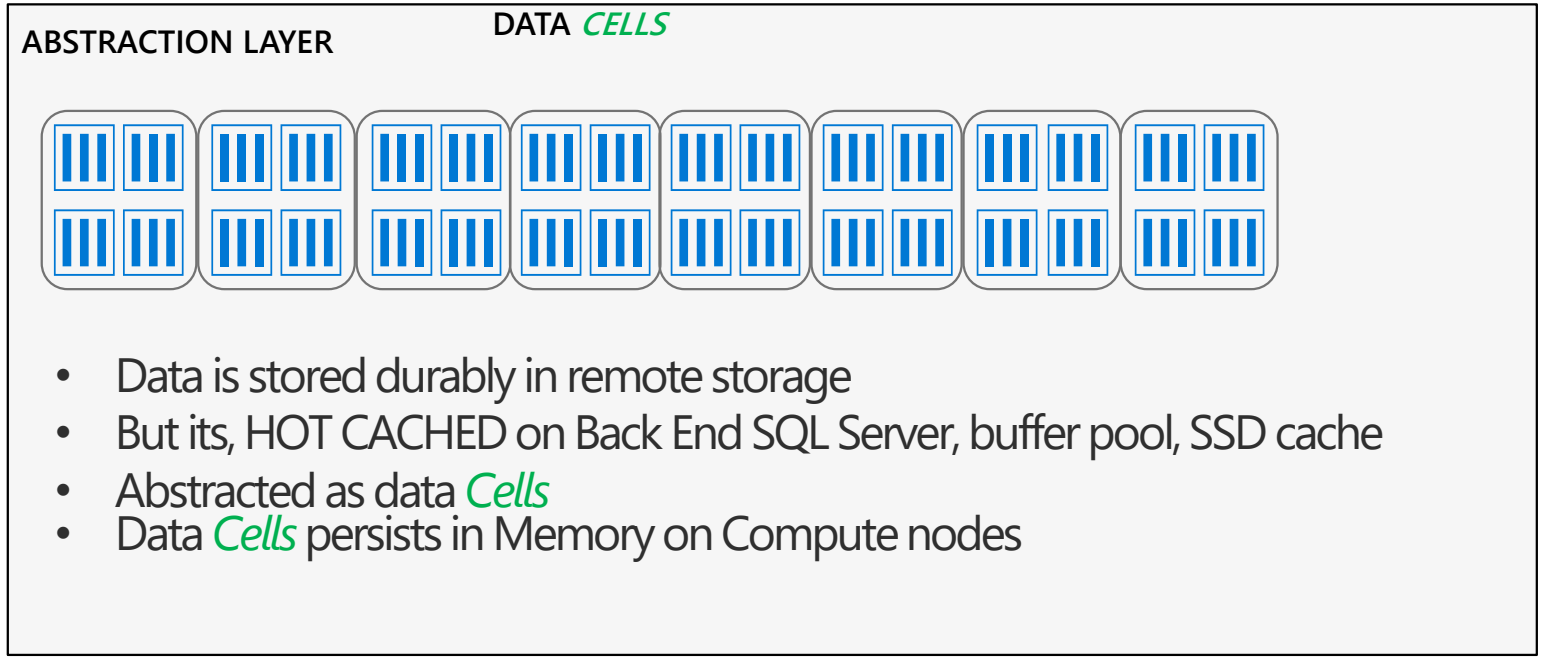
The SQL Server Front End is the service responsible for authentication, and metadata (bind metadata to data cells)



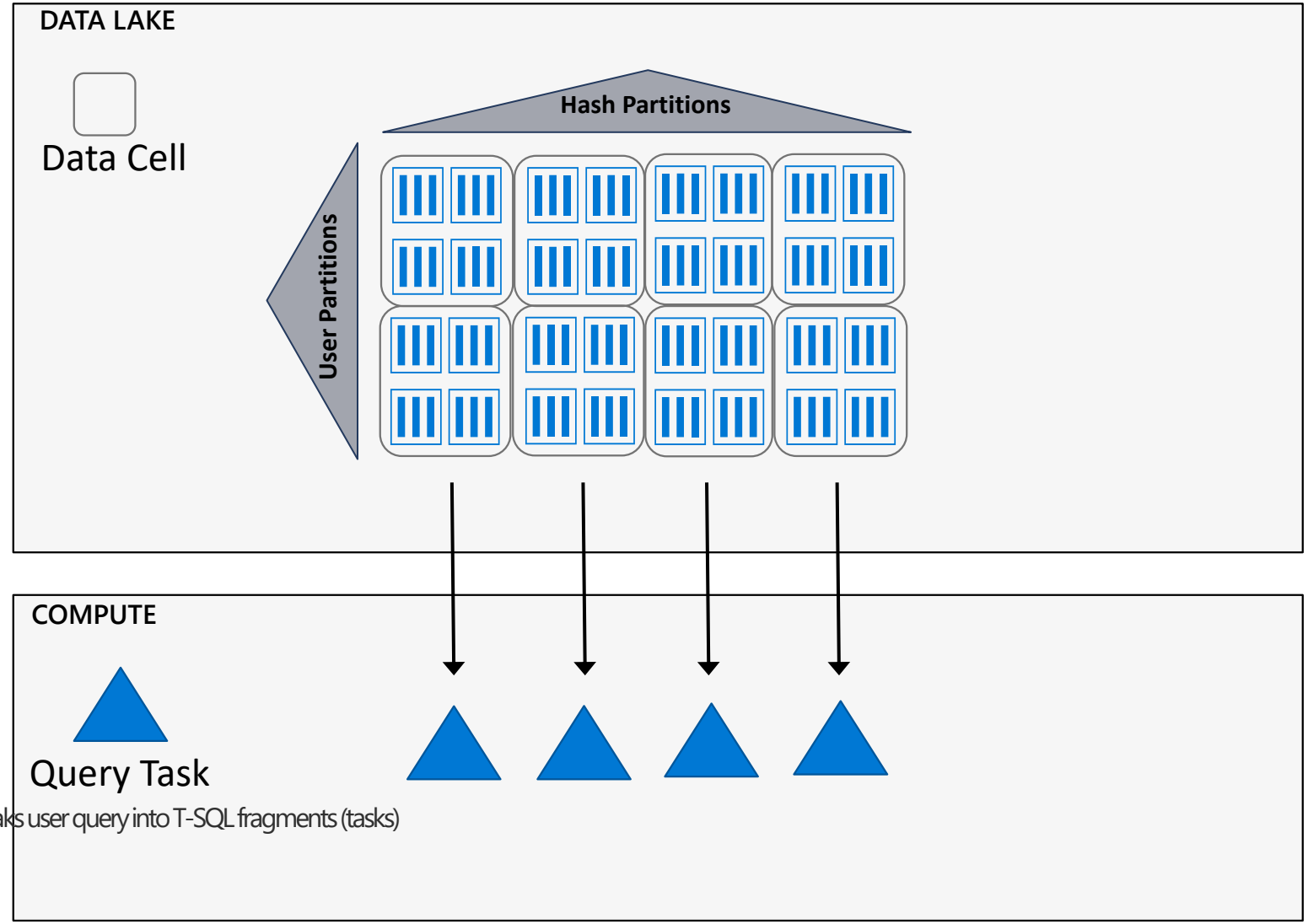
Data is stored durably in remote storage, and HOT CACHED on Compute Server. Abstracted as data cells.

Data Cells and Tasks



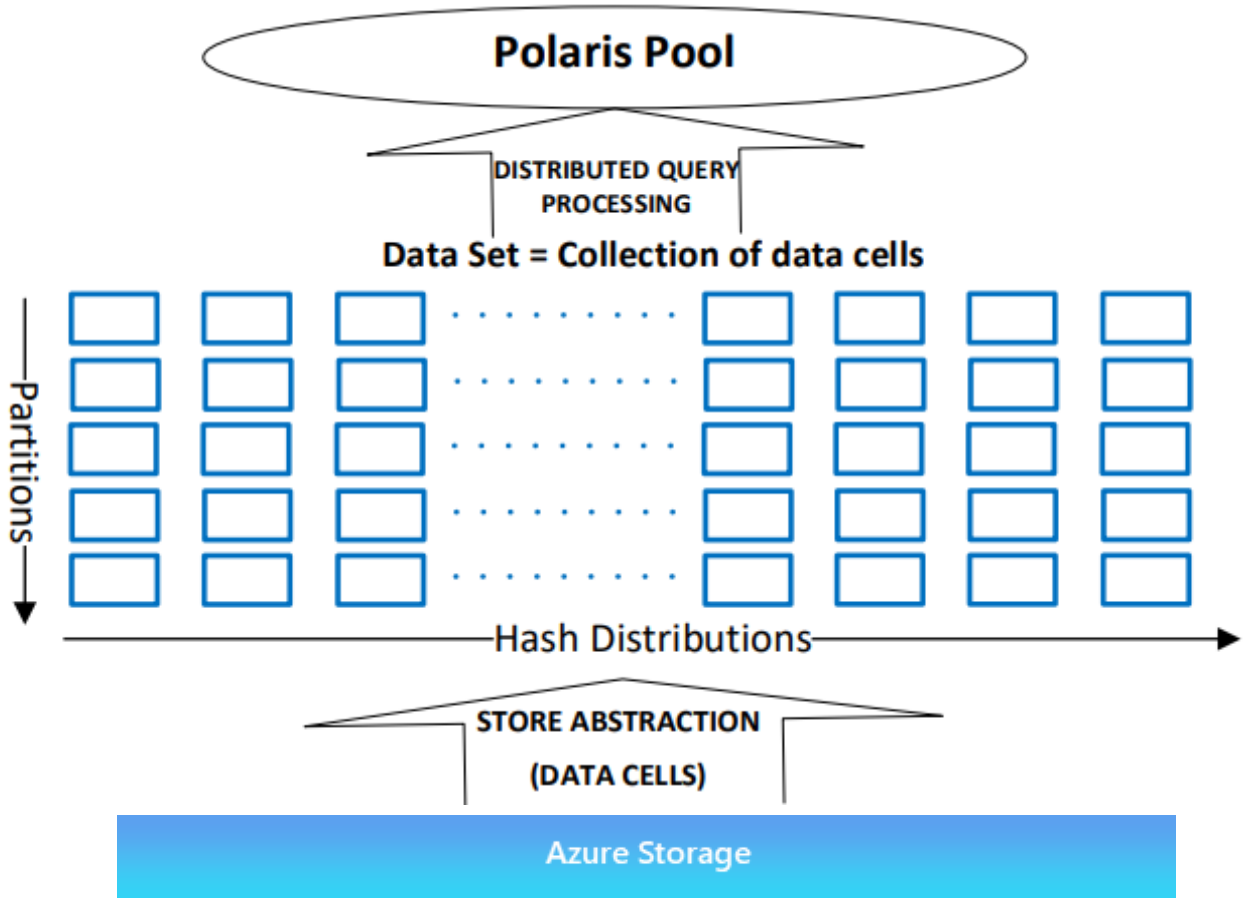


Task are mapped to cell



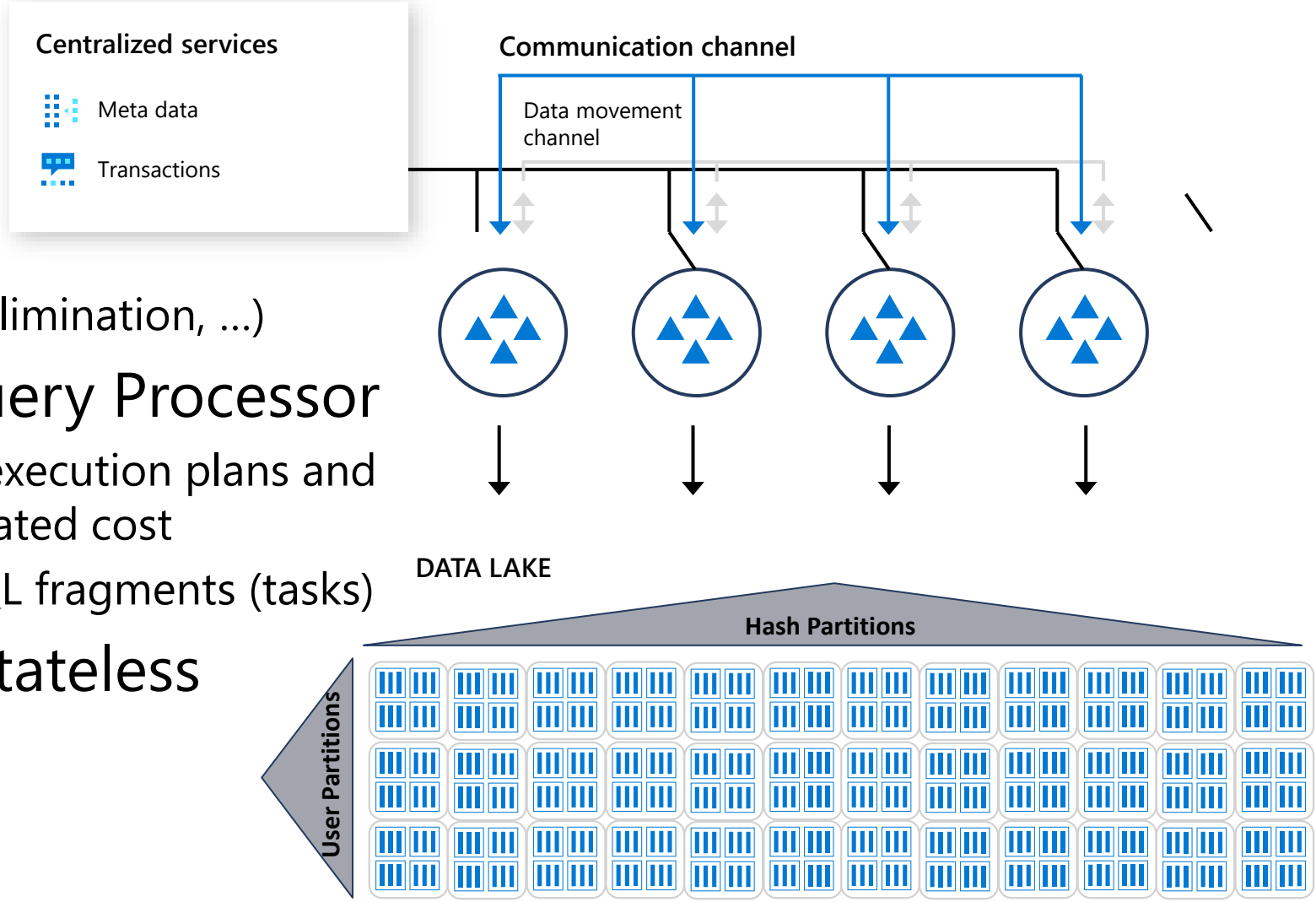
DQP Breaks user query into T-SQL fragments (tasks)

Abstraction



Distributed query execution flow

- SQL Frontend
  - Metadata
  - Security
  - Query simplification
    (filter pushdown, partition elimination, …)
- DQP – Distributed Query Processor
  - Explores viable distributed execution plans and picks one with lowest estimated cost
  - Breaks user query into T-SQL fragments (tasks)
- SQL Backend – fully stateless
  - Executes tasks
  - Propagate results to parent



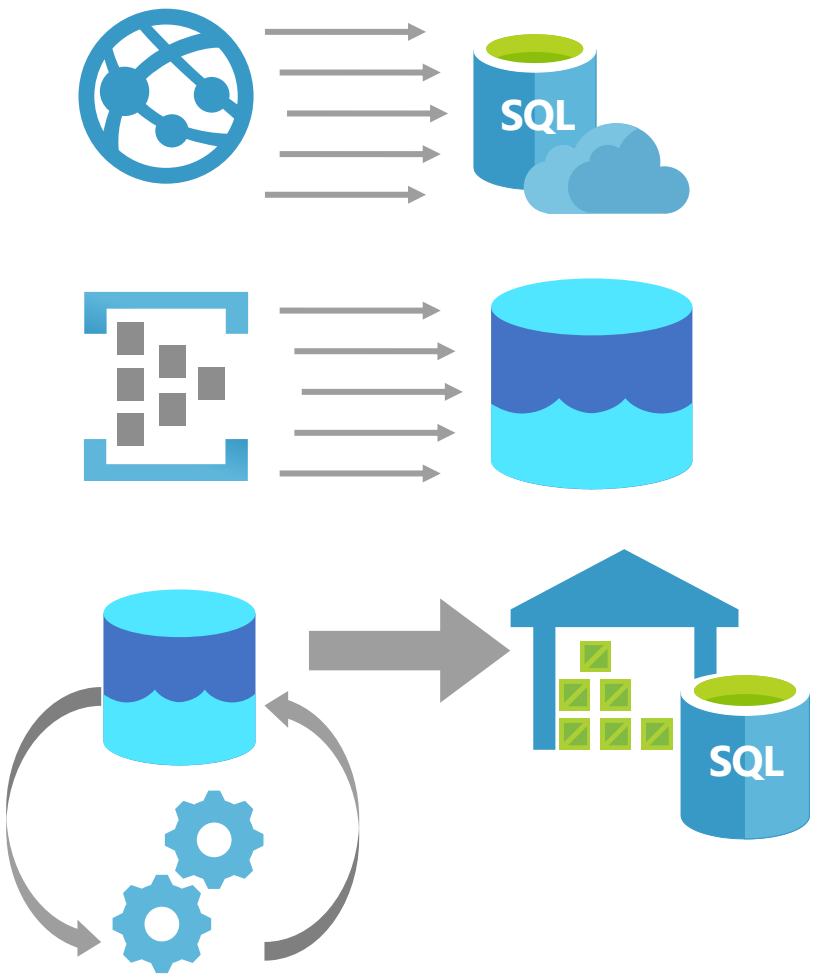
What workloads are NOT suitable?

Operational workloads (OLTP)

- High frequency reads and writes.
- Large numbers of singleton selects.
- High volumes of single row inserts.
- Critical SLA Reporting and Queries.
- Not recommended for sub-second performance.

Data Preparations

- Row by row processing needs.
- Incompatible formats (XML).



What Workloads are Suitable?

Store large volumes of data.

Consolidate disparate data into a single location.

Shape, model, transform and aggregate data.

Batch/Micro-batch loads.

Perform query analysis across large datasets.

Ad-hoc reporting across large data volumes (relaxed SLA's).

All using simple SQL constructs.

Observations

- External tables (CETAS)
  - Statistics Matter!
  - Serverless SQL pool relies on statistics to generate optimal query execution plans.
  - Parquet files - automatically created
  - CSV files - you should create statistics manually for columns
  - Where? Columns - particularly used in DISTINCT, JOIN, WHERE, ORDER BY and GROUP BY
  - sys.sp_create_openrowset_statistics [@stmt =] N'statement_text’
  - [Create and update statistics using Azure Synapse SQL resources - Azure Synapse Analytics | Microsoft Docs]

Observations

- External tables (CETAS)
  - Data Types Matter!
  - Recommend using the right data types for the CREATE EXTERNAL TABLE at all times
  - Don’t use varchar(8000) for all columns ☺. If the max length for a column is 25 use varchar(25).
  - If the data is numeric/decimal use int, bigint, decimal, float, etc. Don’t use varchar type.
    - Synapse SQL Data Types - CREATE TABLE (Azure Synapse Analytics) - SQL Server | Microsoft Docs
  - Correct collations also matter in terms of performance. Avoid unexpected conversions.
    - Details: Always use UTF-8 collations to read UTF-8 text in serverless SQL pool - Microsoft Tech Community

Observations

- Guidance : Best practices for serverless SQL pool - Azure Synapse Analytics | Microsoft Docs
- External tables (CETAS)
  - CETAS is a parallel operation that creates external table metadata and exports the SELECT query results to a set of files in your storage account.
  - As CETAS generates Parquet files, statistics will be automatically created when the first query targets this external table, resulting in improved performance for subsequent queries targeting table generated with CETAS.

Observations

- Execution Plans – DAGS
- DMV's - Coming soon

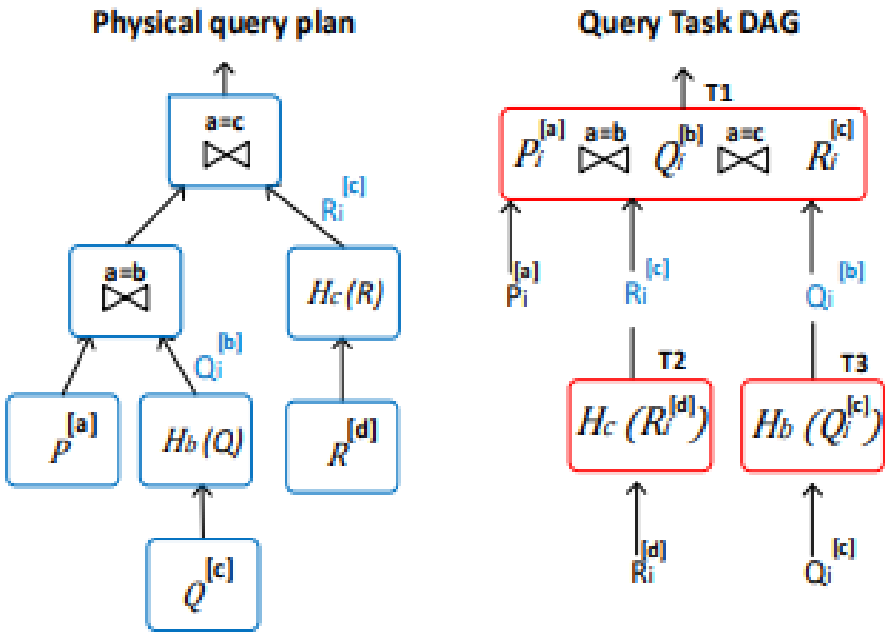


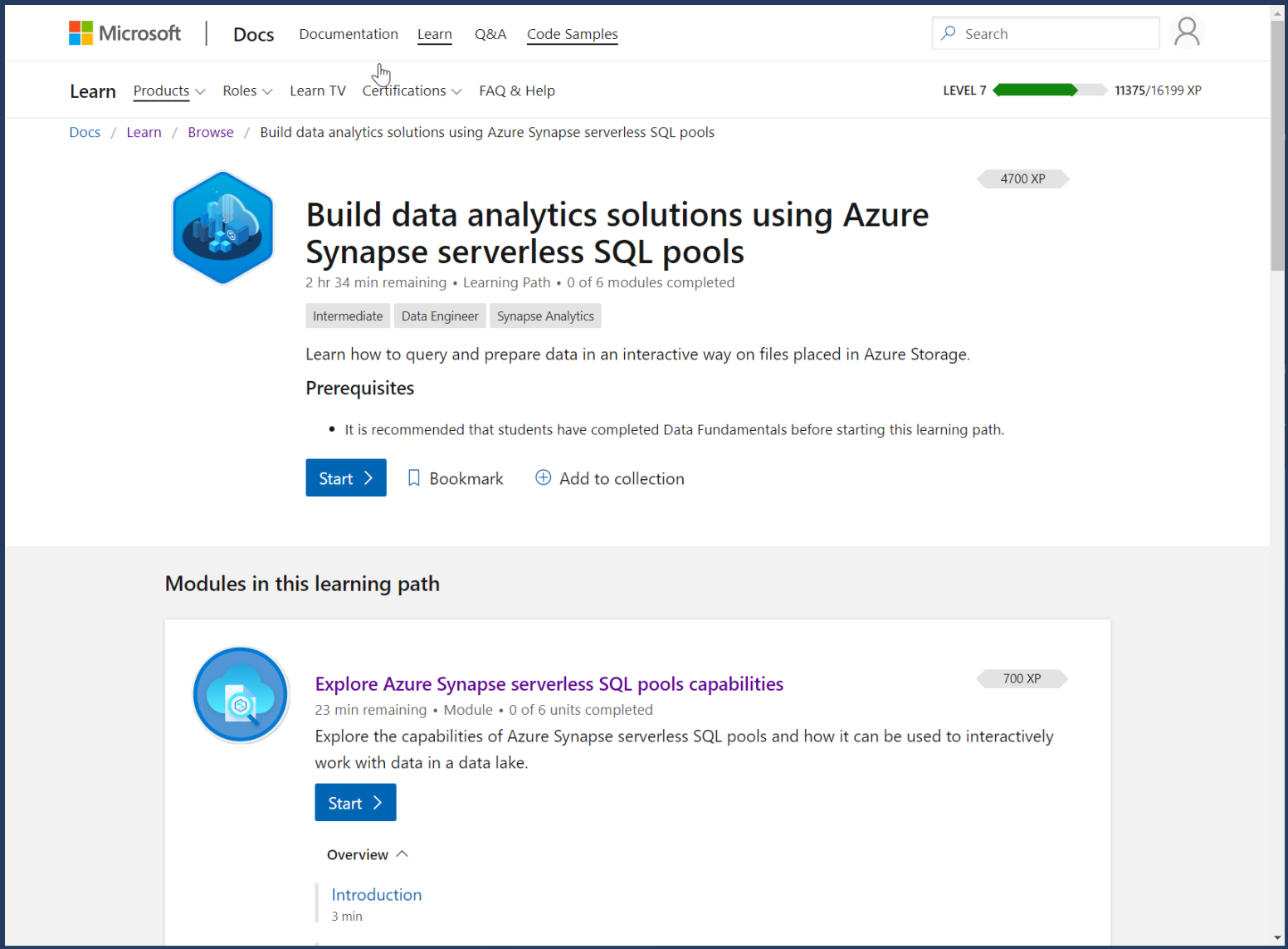
Figure 6. The Query Task DAG

Demo: Run interactive queries using Azure Synapse serverless SQL pools

/learn alert

Complete interactive learning exercises, watch videos, and practice and apply your new skills.

aka.ms/mslearnasaserverless



https://www.vldb.org/pvldb/vol13/p3204-saborit.pdf

Azure Synapse serverless SQL Pools

Synapse Serverless has two Analytics Runtimes

- SQL engine – Per TB
- Spark engine – Per Hour