Microsoft

Microsoft Azure Virtual Training Day: Delivering the modern data warehouse

Microsoft

Delivering a modern data warehouse

Nicholas Moore
Cloud Solutions Architect

Agenda

- Why Modern Data Warehousing?
- Building the Modern Datawarehouse
- Advanced Analytics Patterns
- The evolution of Cloud Scale Analytics

Why modern data warehousing?

Digital transformation

91% of business leaders see Digital Transformation as a way of sparking innovation and **finding efficiencies**

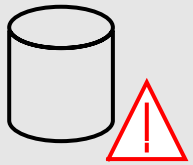
68% say Digital Transformation is **increasing profits**

85% say they must offer digital services or **become irrelevant**

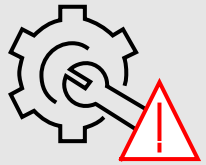
64% say they have less than 4 years to complete a Digital Transformation or they may **go out of business**

Common challenges with on-premises solutions

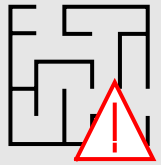
Data Silos



Performance Constraints



Solution Complexity



Escalating Costs

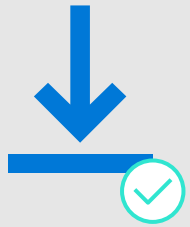
Derive real value from your data in the cloud

One hub for all data

Unlimited data scale

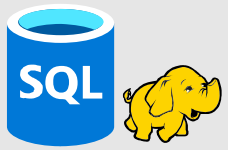
Common Platform

Lower TCO



Common customer use cases

Modern data warehouse

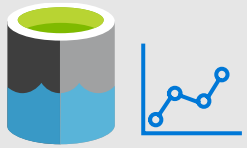


"Integrate all our data—including Big Data—with our data warehouse for analytics and reporting"

Advanced analytics

"Predict next best offer and customer churn"

Real-time analytics

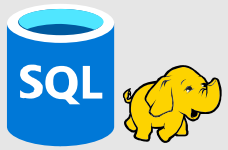


"Derive insights from our devices and data streams in real-time"

Building the modern data warehouse

Modern data warehouse patterns

Modern data warehouse



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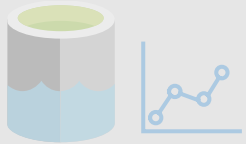
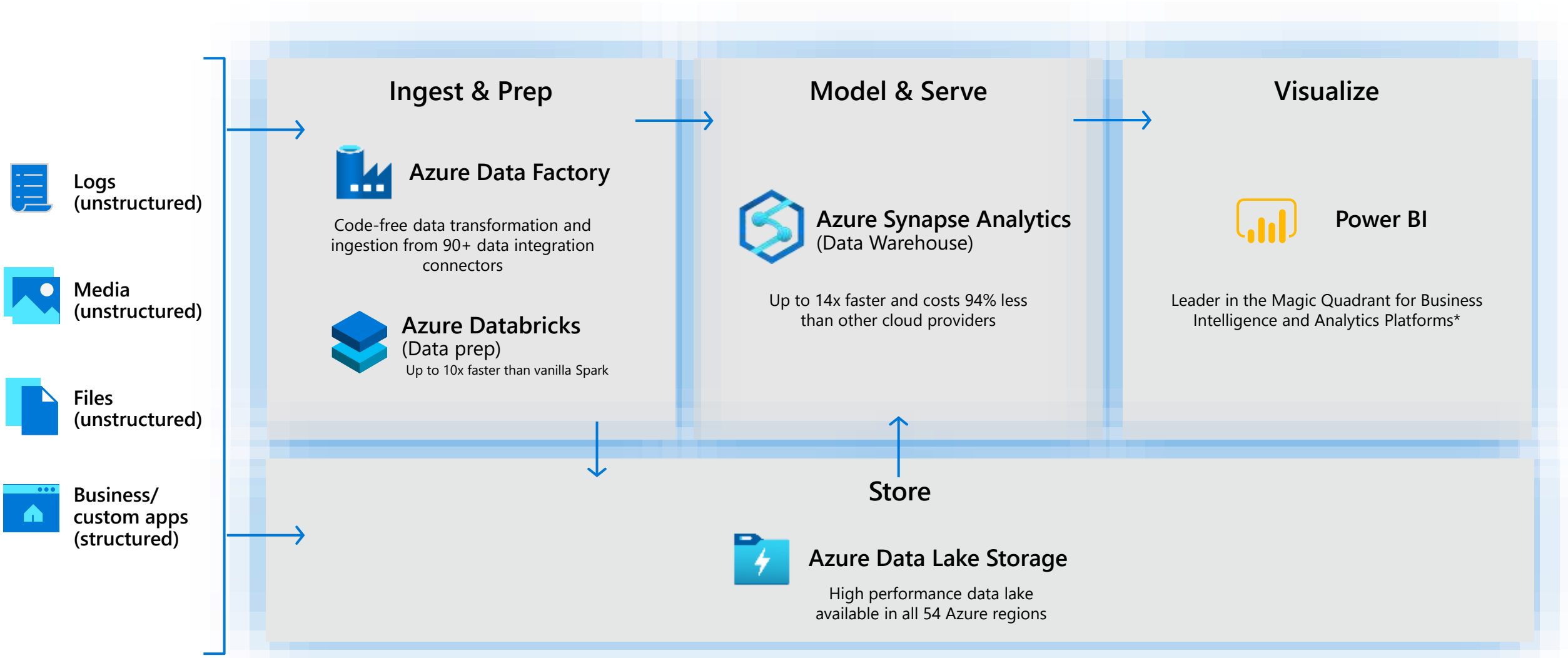
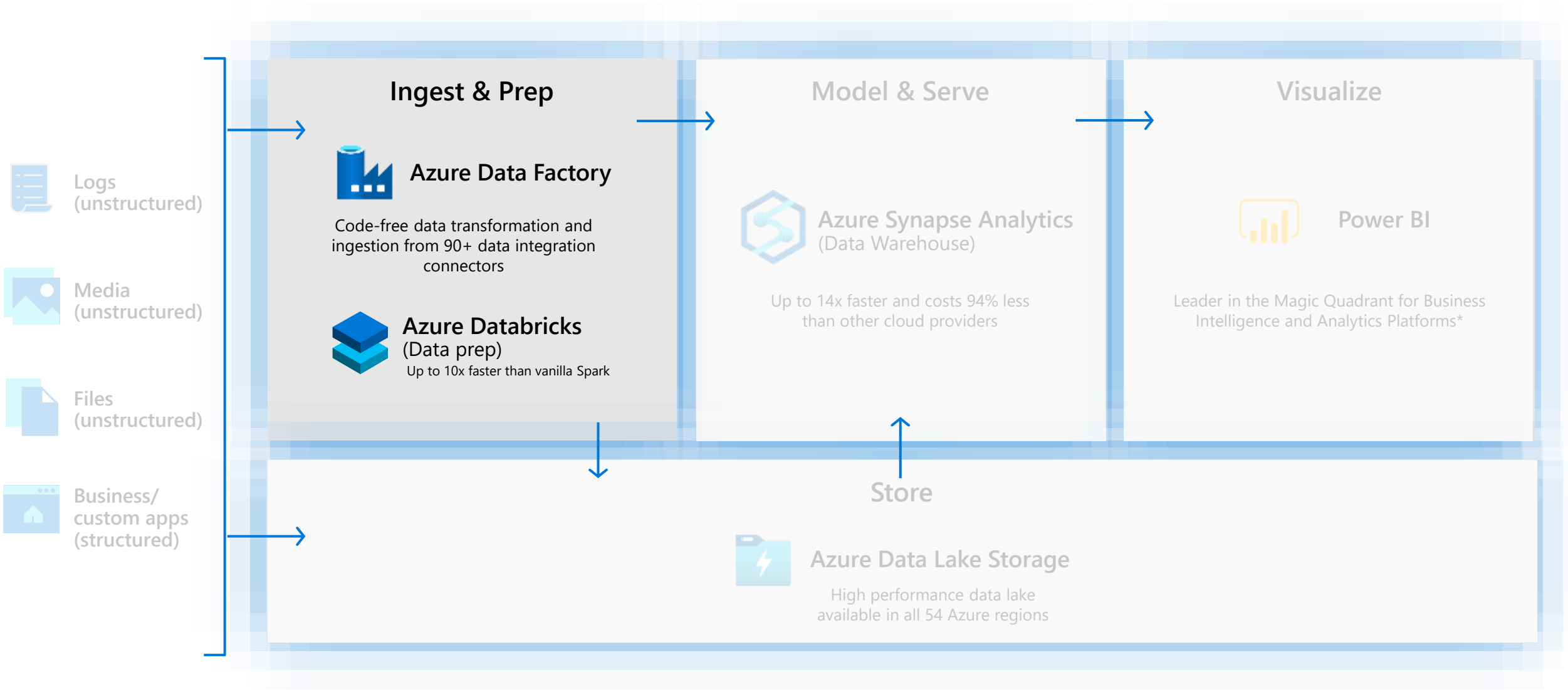


"Derive insights from our devices and data streams in real-time"

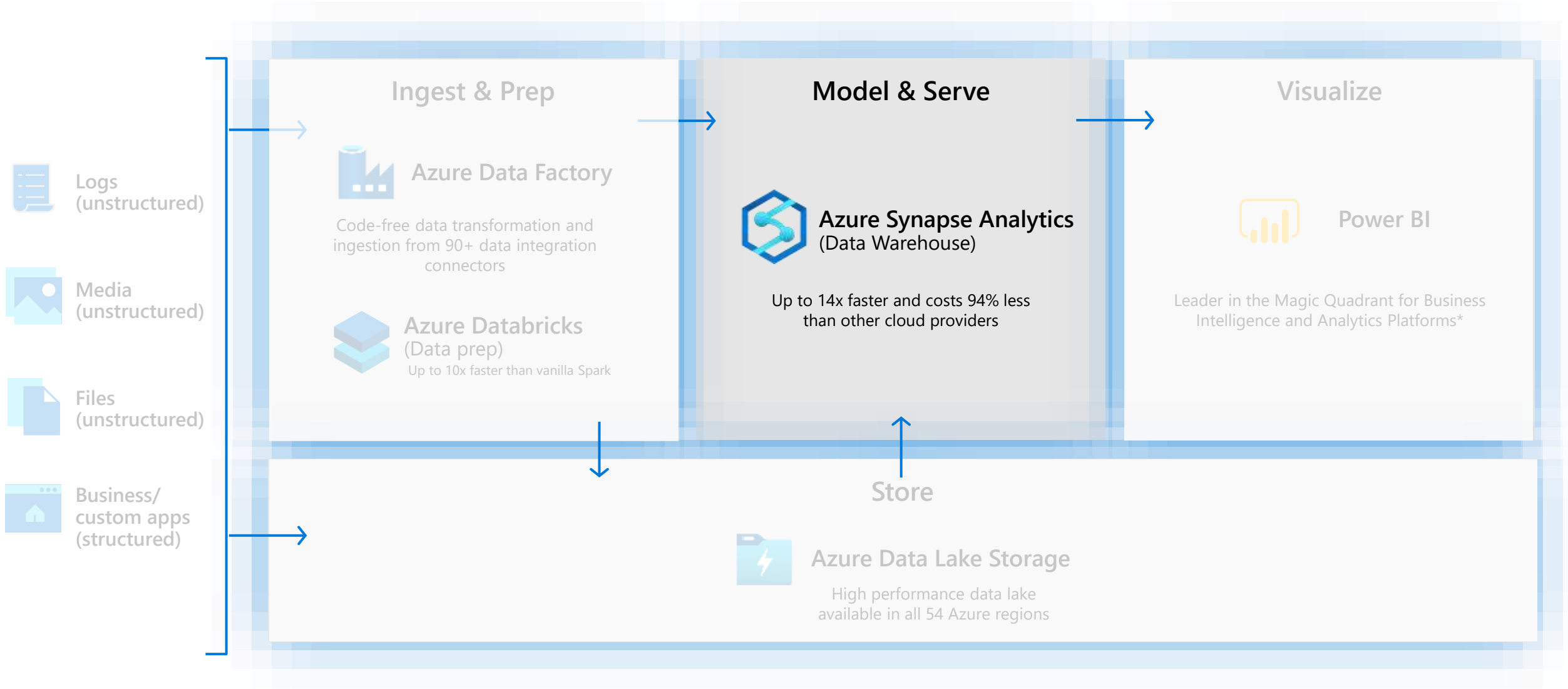
Modern data warehousing patterns



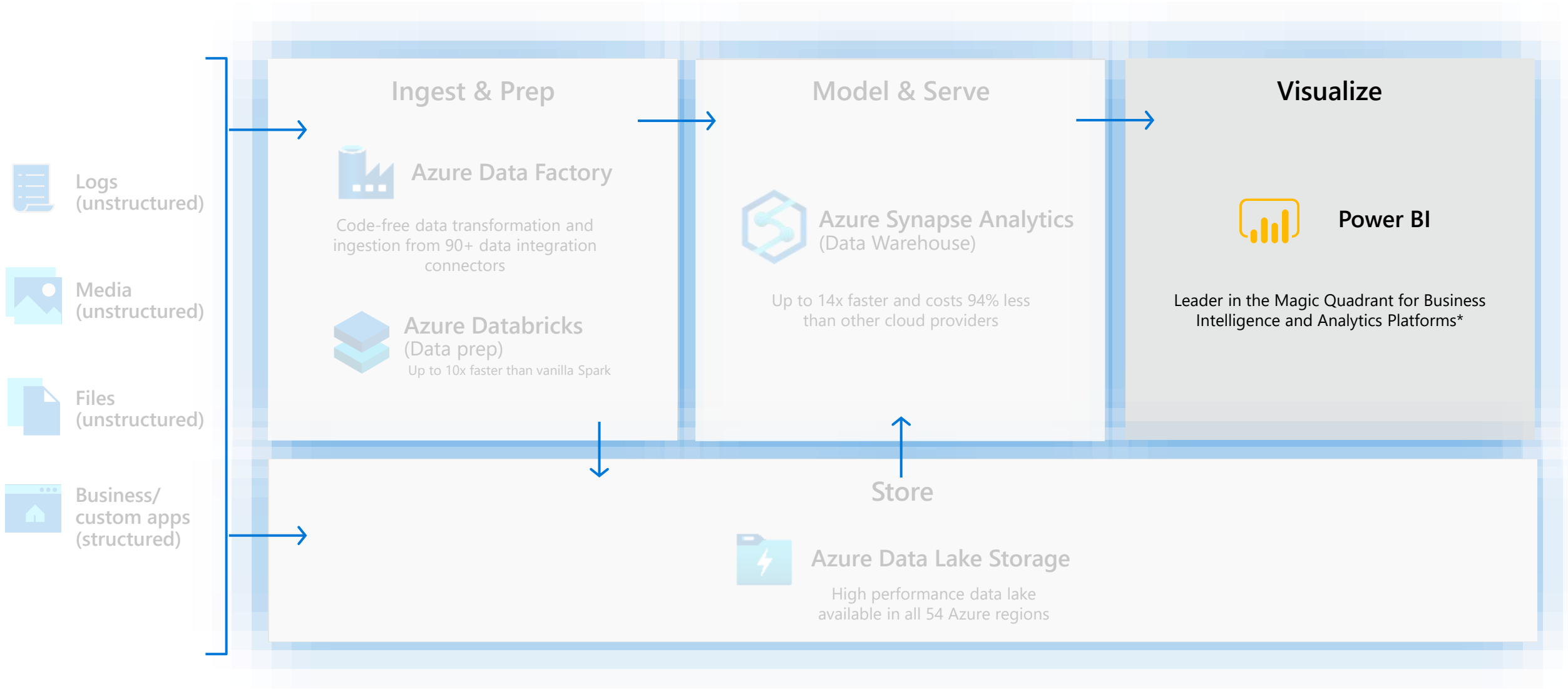
Ingest and Prep



Model and Serve



Visualize

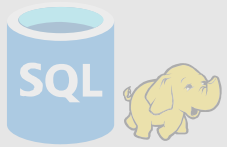

Logs (unstructured)
Media (unstructured)
Files (unstructured)
Business/ custom apps (structured)
Ingest & Prep
Azure Data Factory
Code-free data transformation and ingestion from 90+ data integration connectors
Azure Databricks
(Data prep)
Up to 10x faster than vanilla Spark
Model & Serve
Azure Synapse Analytics
(Data Warehouse)
Up to 14x faster and costs 94% less than other cloud providers
Visualize
Power BI
Leader in the Magic Quadrant for Business Intelligence and Analytics Platforms*
Store
Azure Data Lake Storage
High performance data lake available in all 54 Azure regions

Advanced Analytics patterns

The evolving world of Analytics

Advanced Analytics patterns

Modern data warehouse

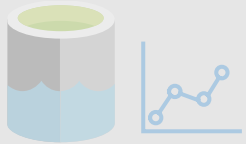


"Integrate all our data—including Big Data—with our data warehouse for analytics and reporting"

Advanced analytics

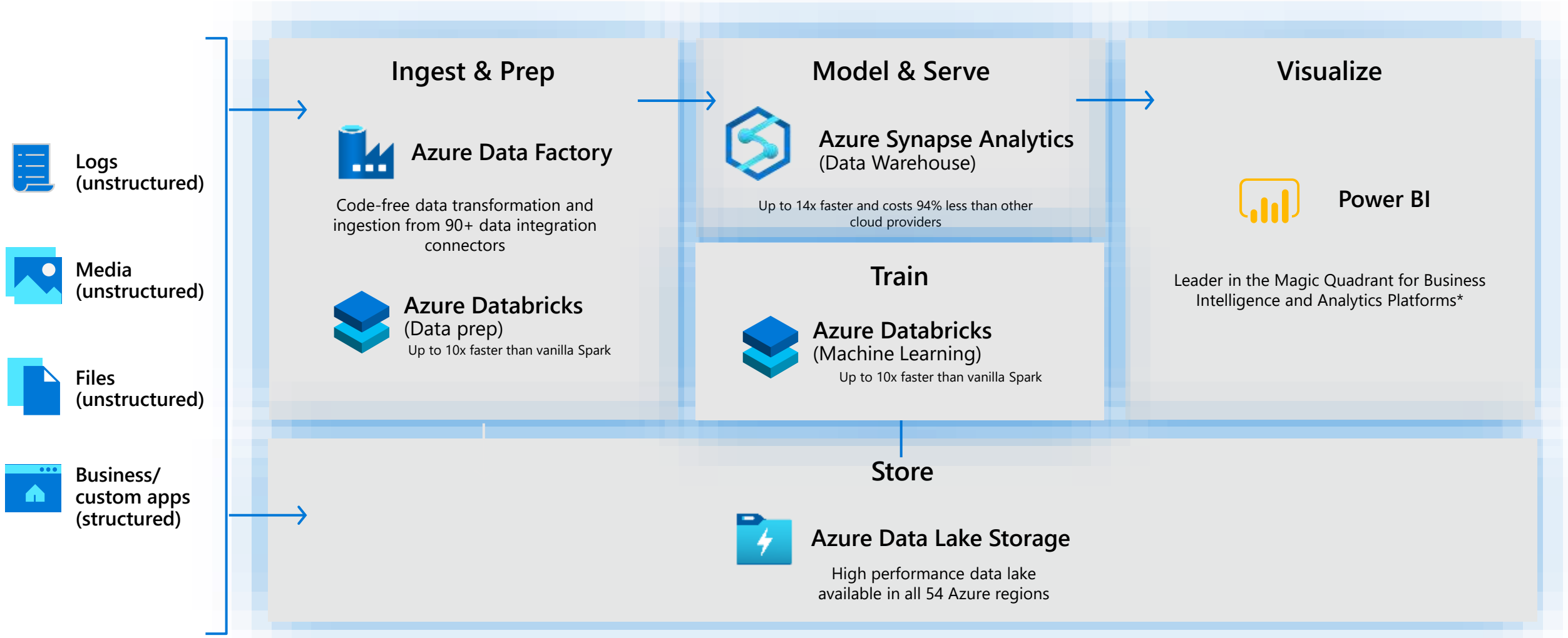
"Predict next best offer and customer churn"

Real-time analytics



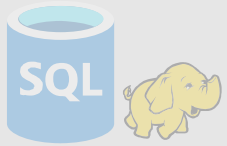
"Derive insights from our devices and data streams in real-time"

Advanced Analytics patterns



Real-time analytics patterns

Modern data warehouse



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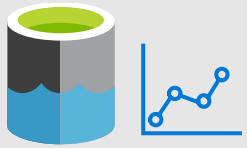

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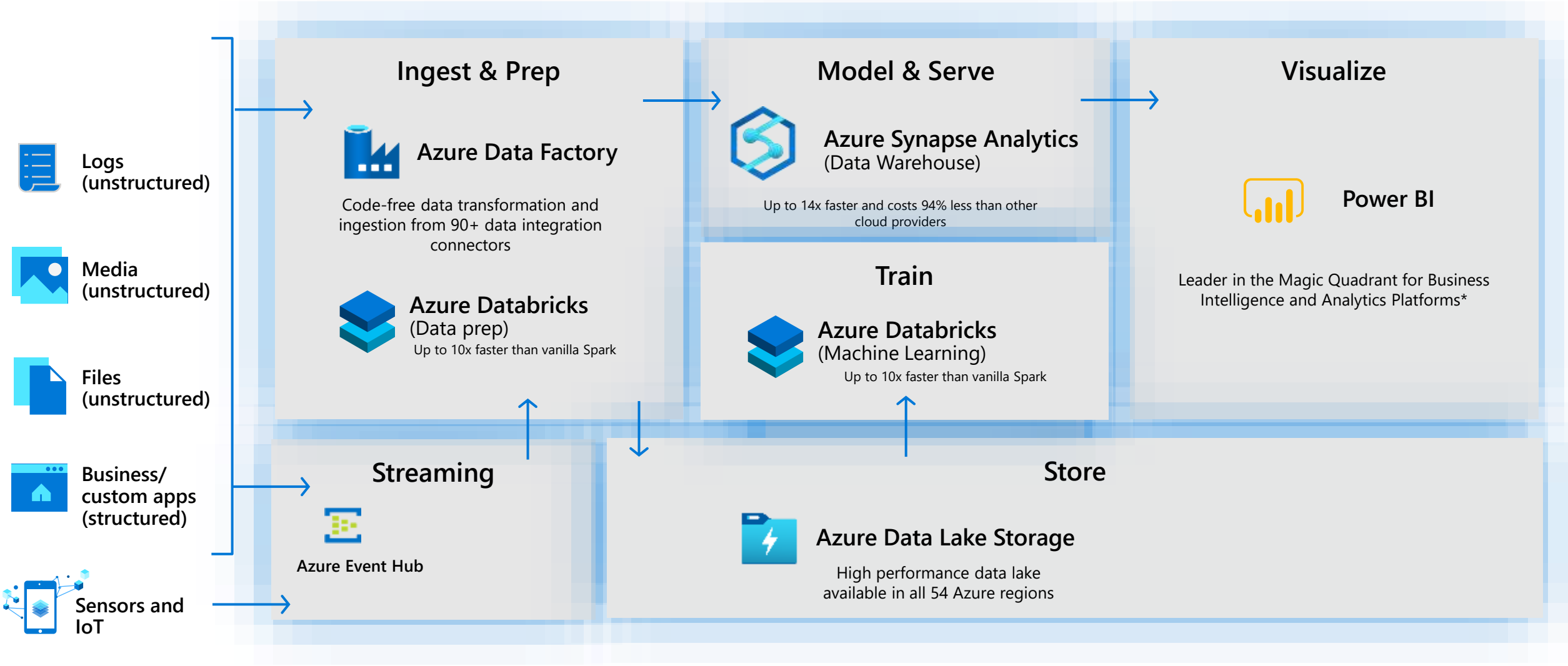
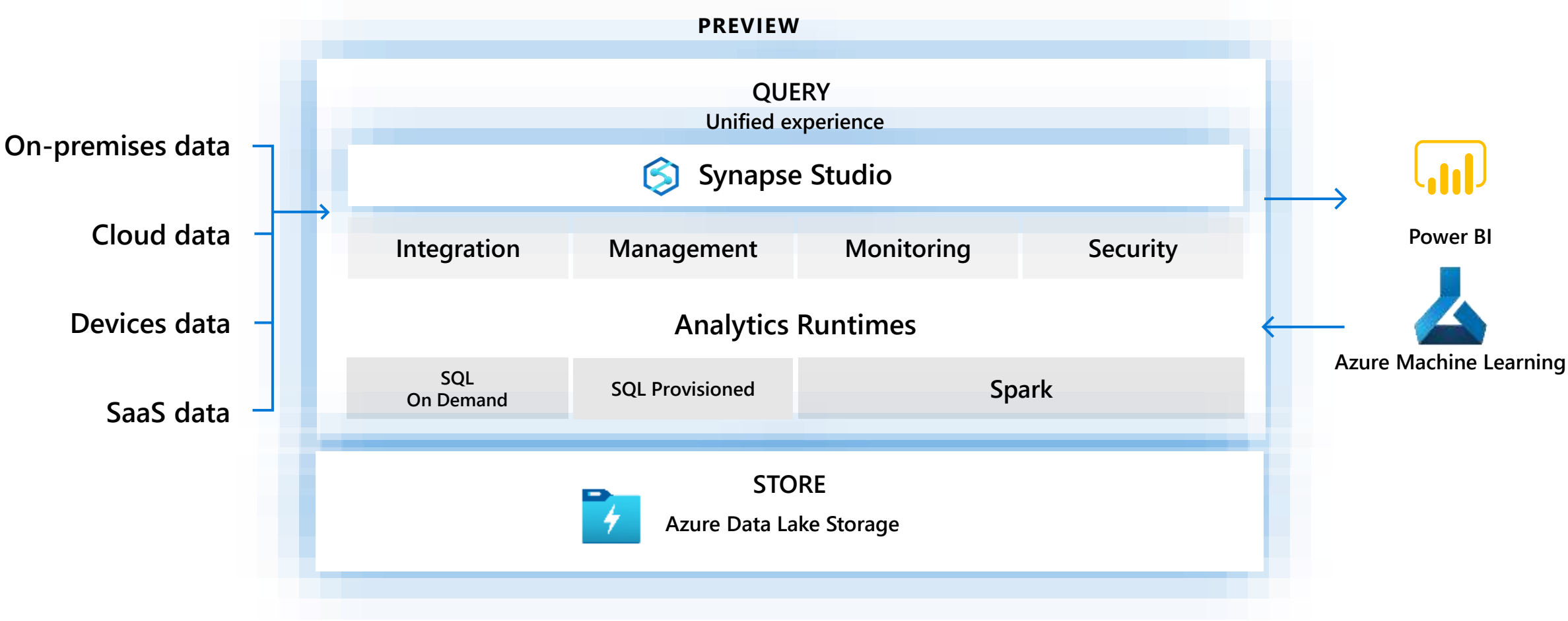


Demo:
Modern Data Warehousing and Cloud Scale Analytics

The evolution of Cloud Scale Analytics

Azure Synapse Analytics

Limitless data warehouse with unmatched time to insights



Azure Synapse Analytics

Limitless scale

Powerful insights

Unified experience

Unmatched security

Microsoft

Ingesting data for analytics workloads

Nicholas Moore
Cloud Solutions Architect

Agenda

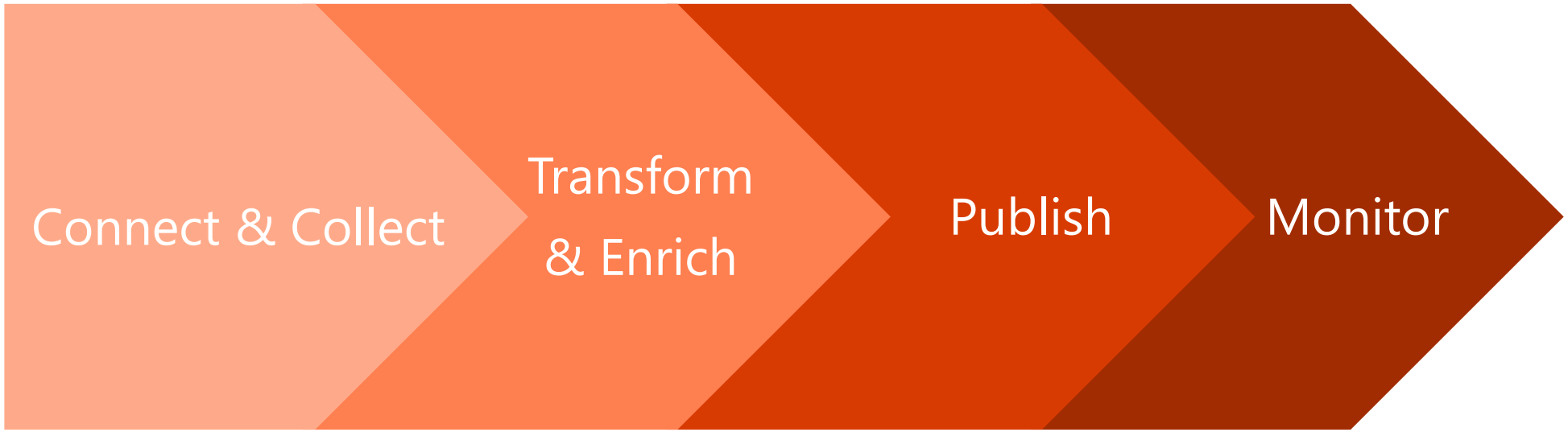
- What is Azure Data Factory?
- Ingesting data
- Monitoring

What is Azure Data Factory?

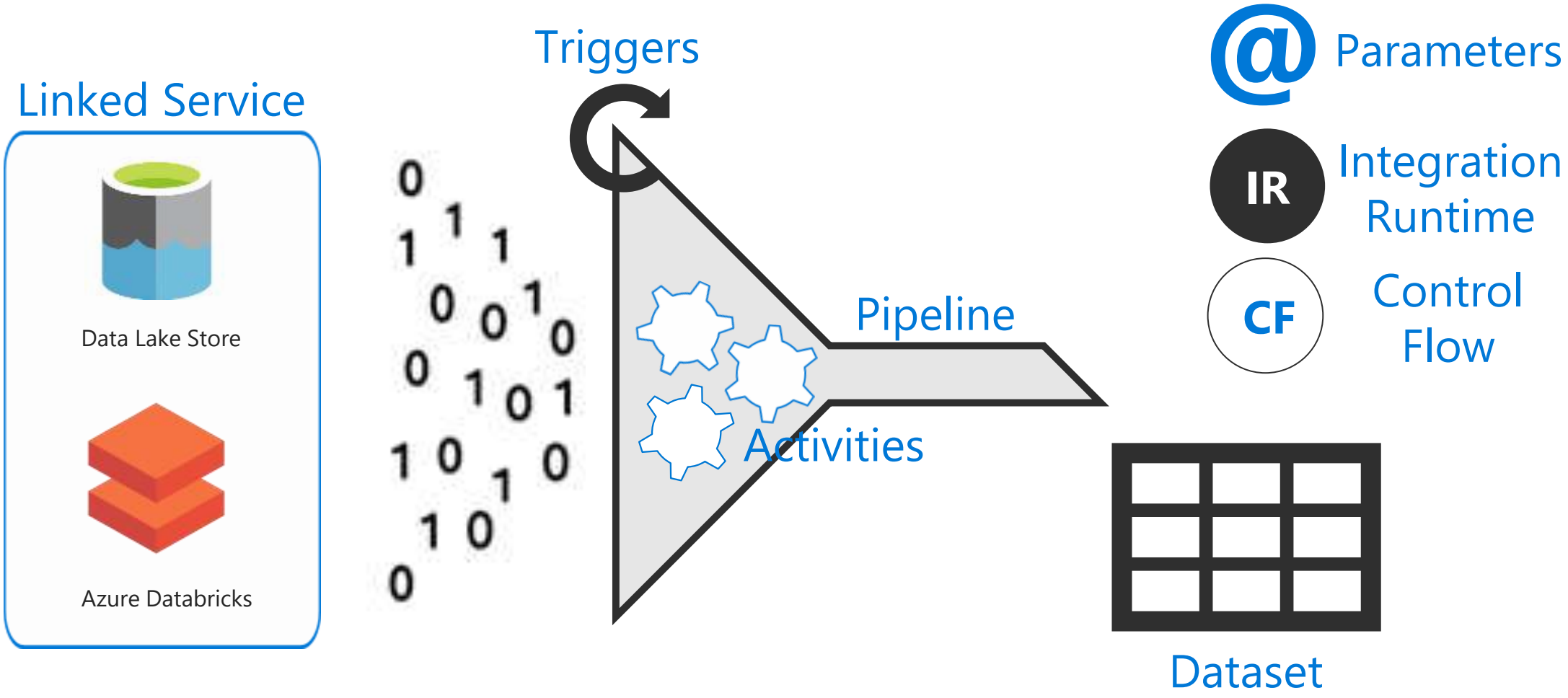
Azure Data Factory

A cloud-based data integration service that allows you to orchestrate and automate data movement and data transformation.

Azure Data Factory process



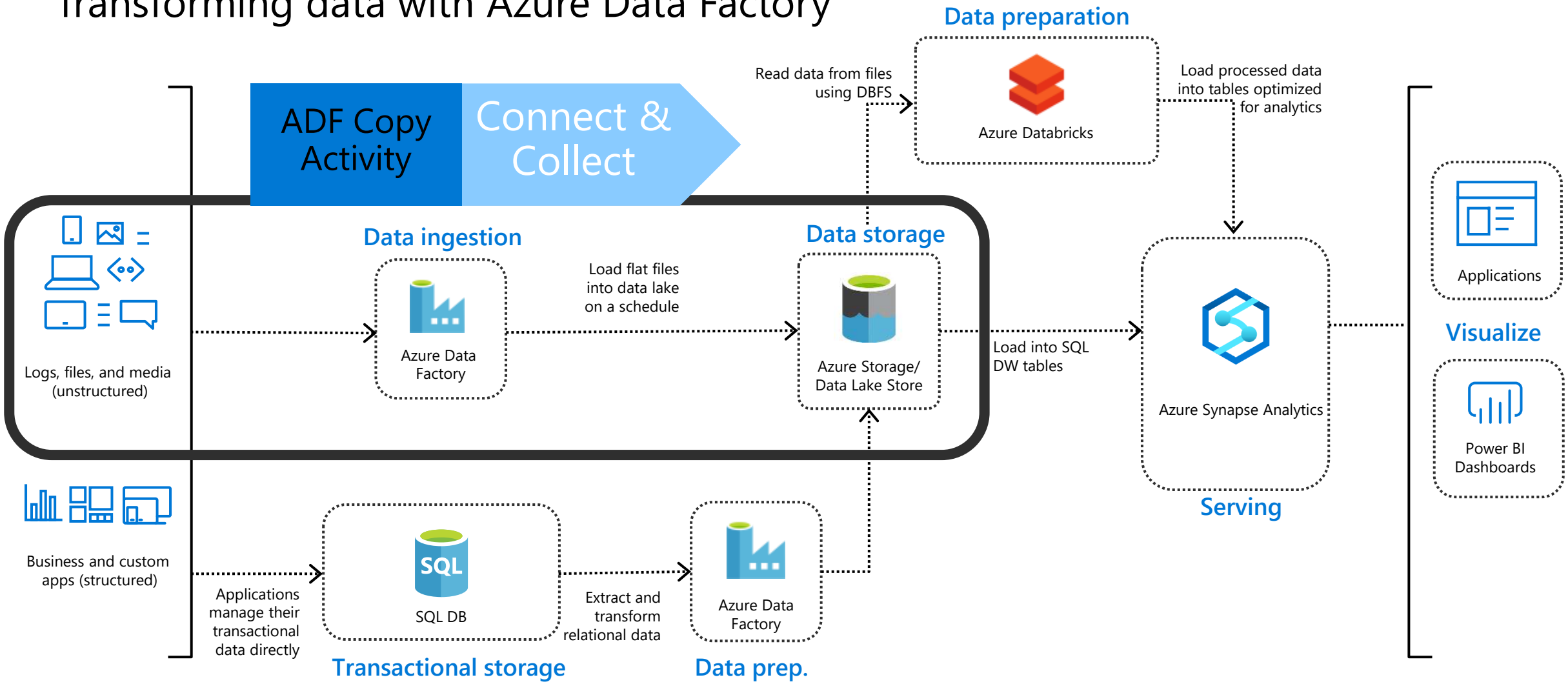
Azure Data Factory Components



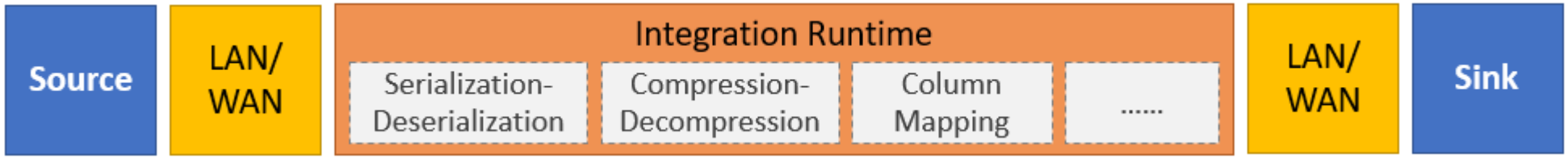
Ingesting data

Data transformation in Azure

Transforming data with Azure Data Factory

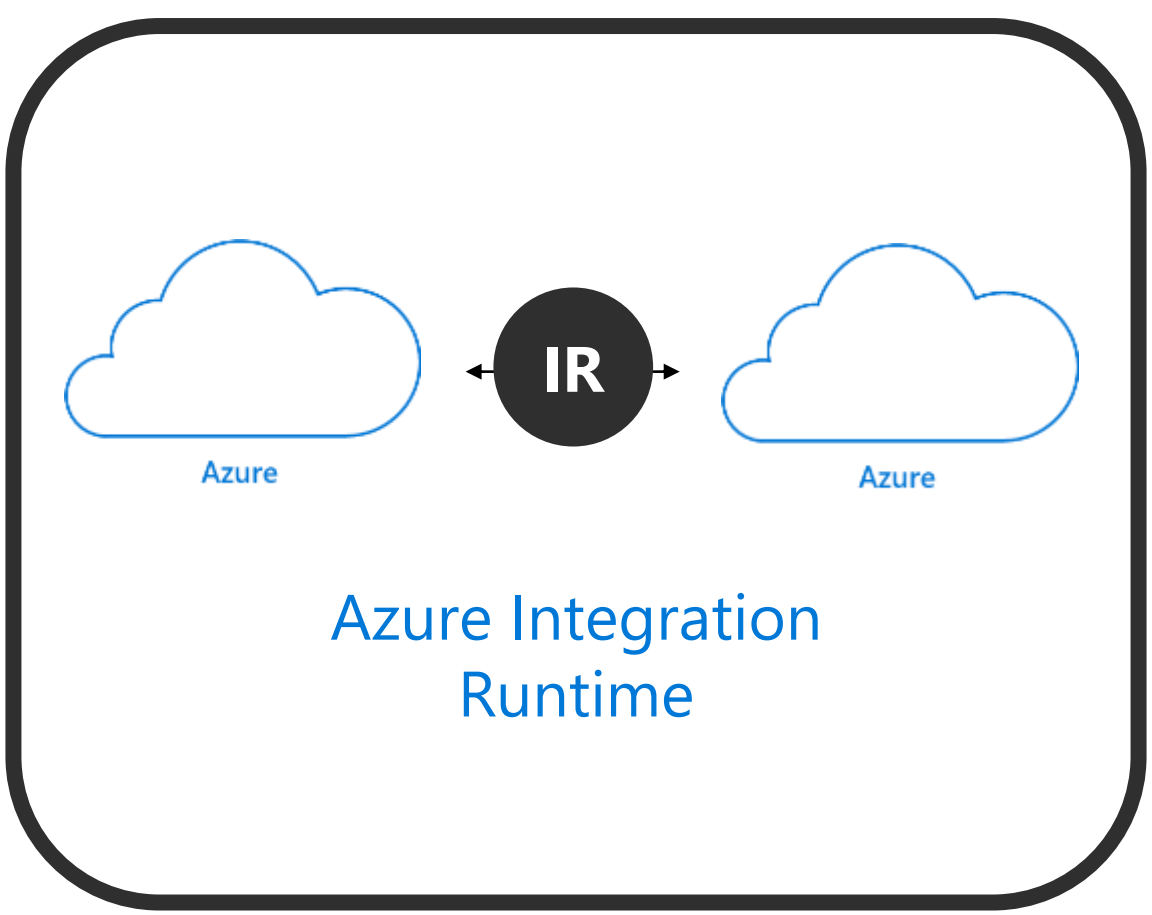


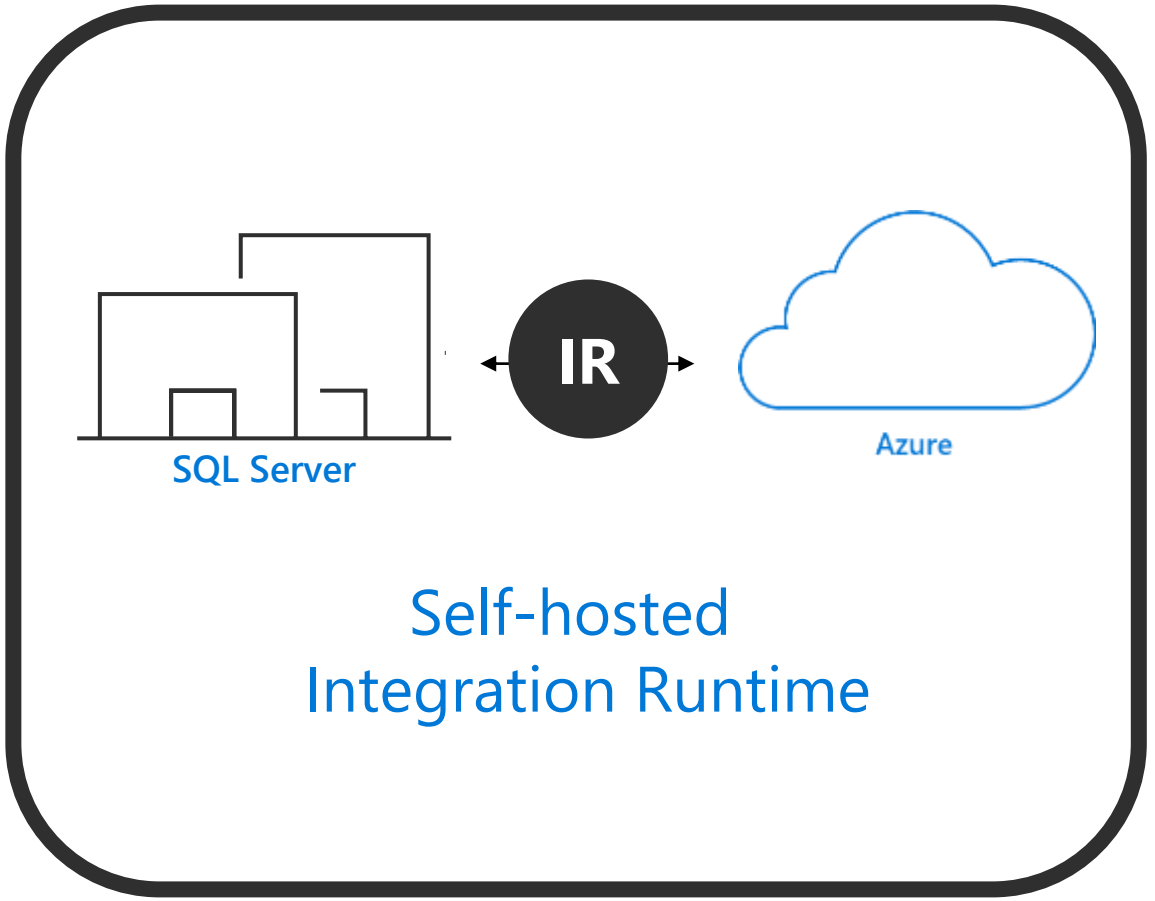
Copy Activity process



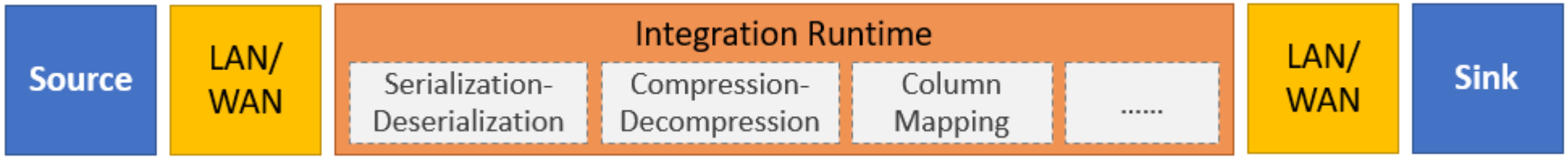
- Reads data from a source data store.
- Performs serialization/deserialization, compression/decompression, column mapping, and so on. It performs these operations based on the configuration of the input dataset, output dataset, and Copy activity.
- Writes data to the sink/destination data store

Integration Runtime





Copy files with the Copy Activity



Supported file formats:

- Text
- JSON
- Avro
- ORC
- Parquet

Copy activity can compress and decompress files with The following codecs:

- Gzip
- Deflate
- Bzip2
- ZipDeflate

Microsoft

Transforming and enriching data

Nicholas Moore
Cloud Solutions Architect

What is Azure Data Factory?

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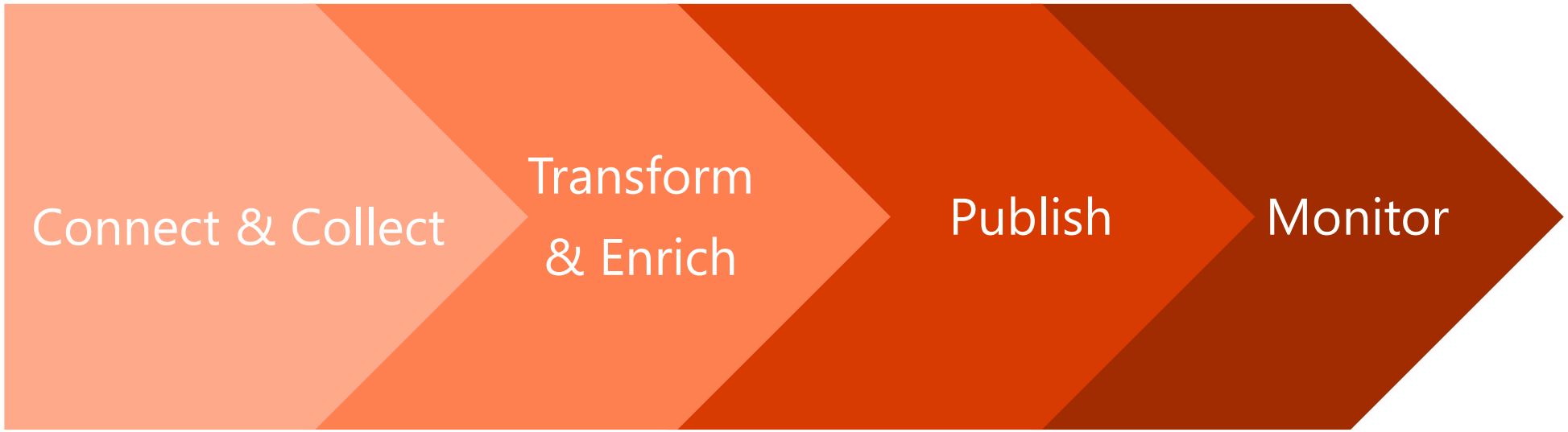
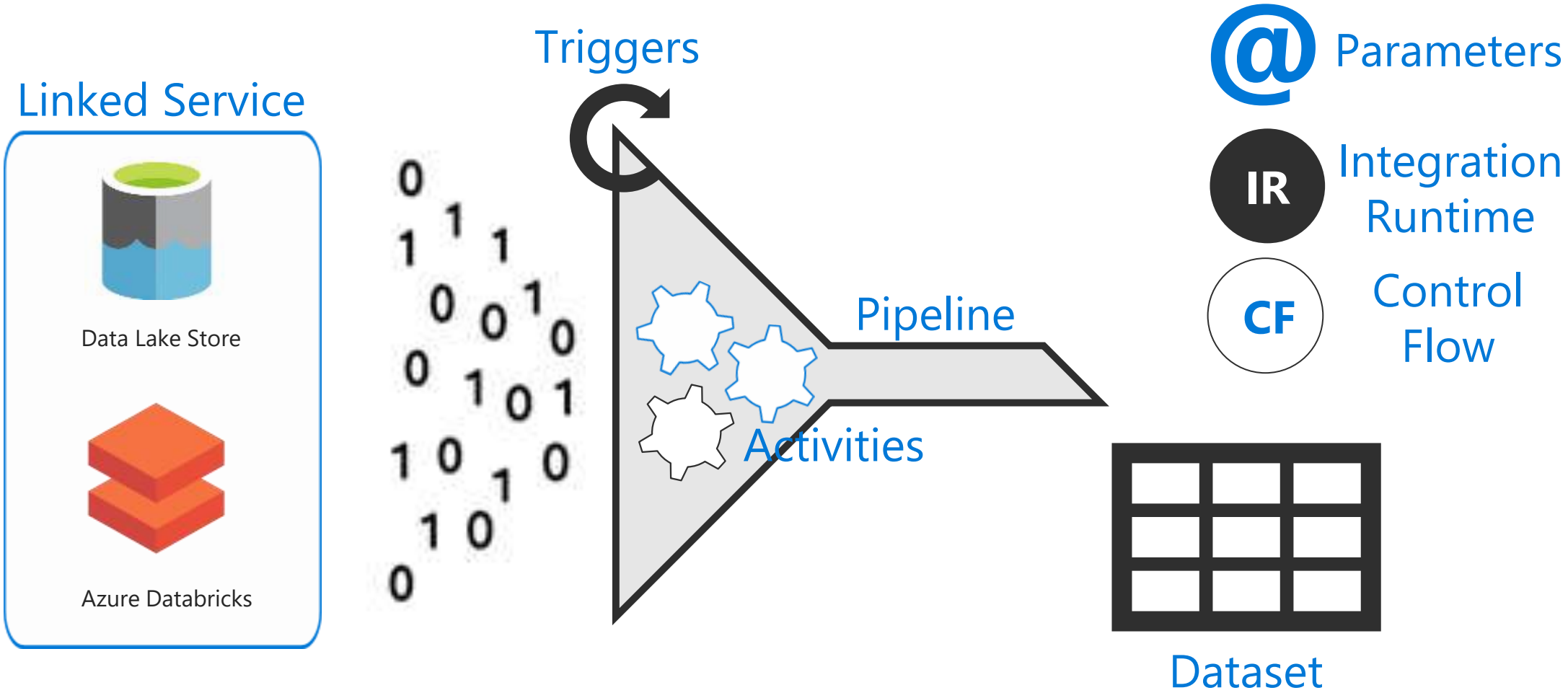
A cloud-based data integration service that allows you to orchestrate and automate data movement and data transformation.

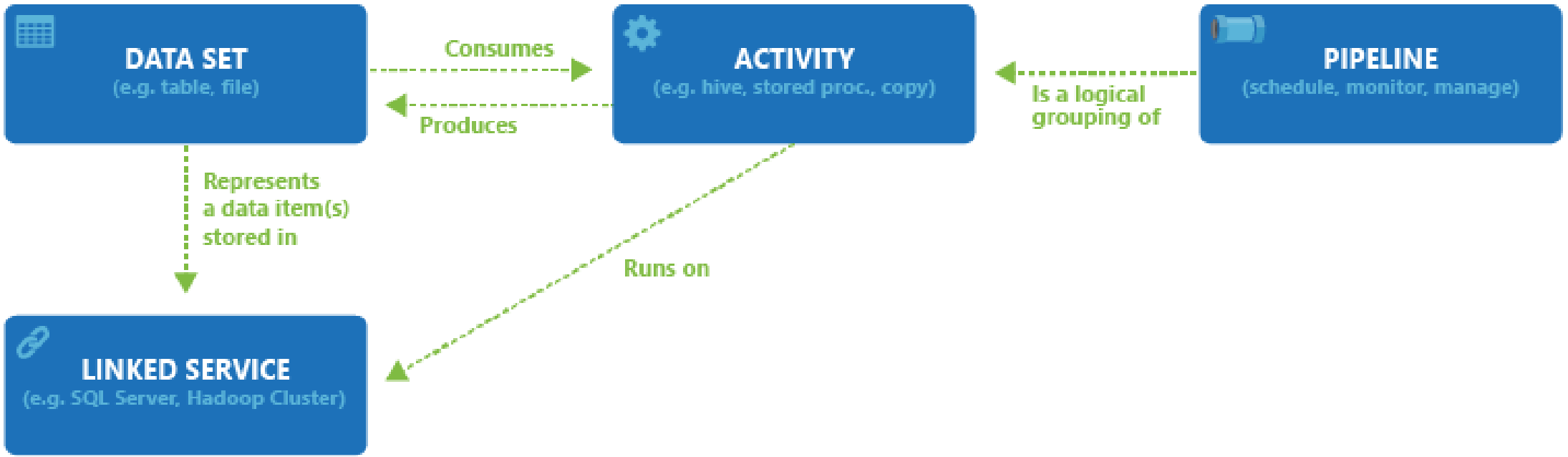
Azure Data Factory process



Azure Data Factory Components



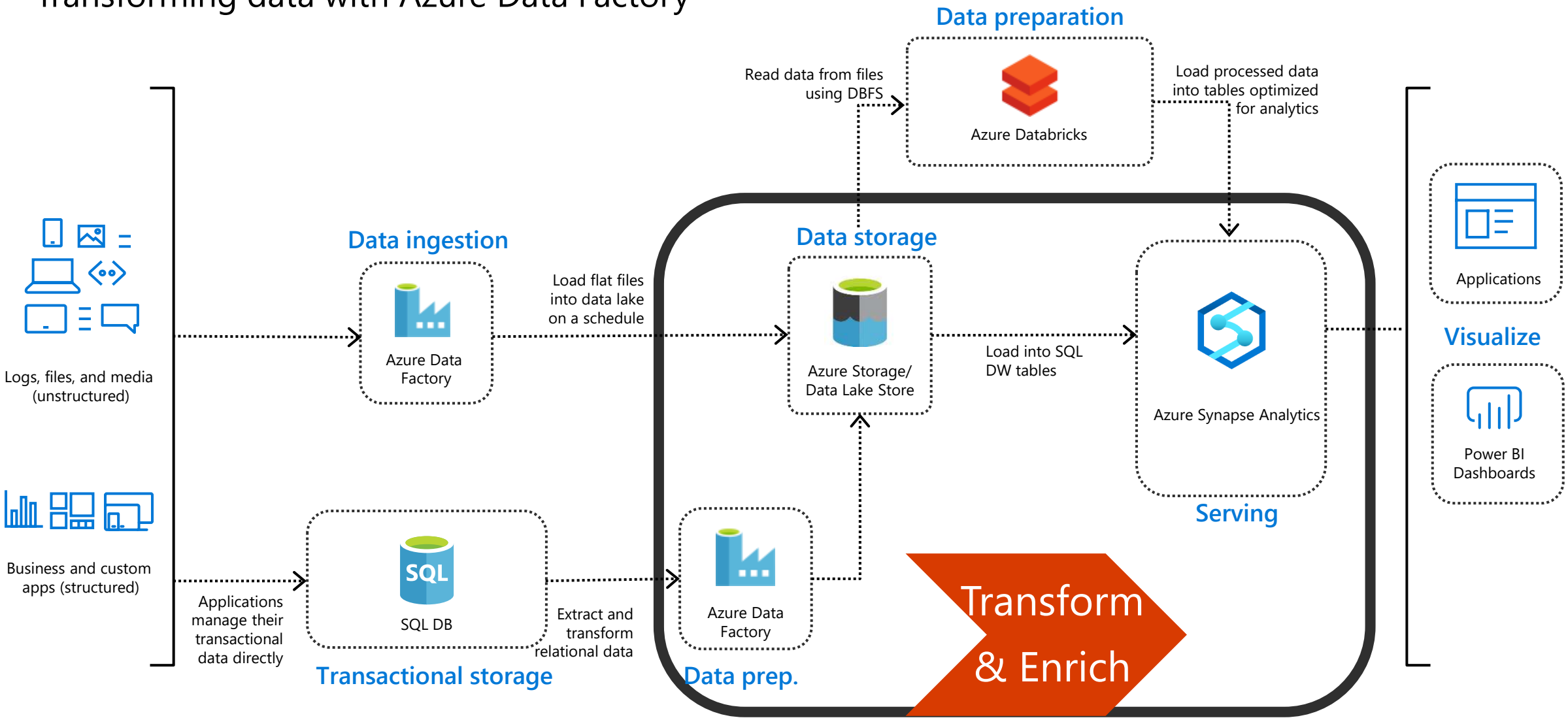
Component dependencies



Transforming data with the ADF Mapping Data Flow

Data transformation in Azure

Transforming data with Azure Data Factory

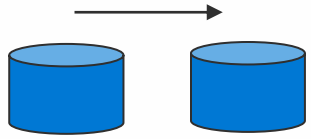


Methods for transforming in Azure Data Factory

Compute resources

SSIS Packages

Mapping Data Flow



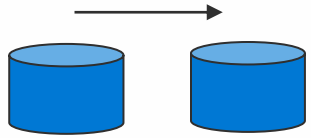
Methods for transforming data in Azure Data Factory

Code free data transformation at scale

Compute resources

SSIS Packages

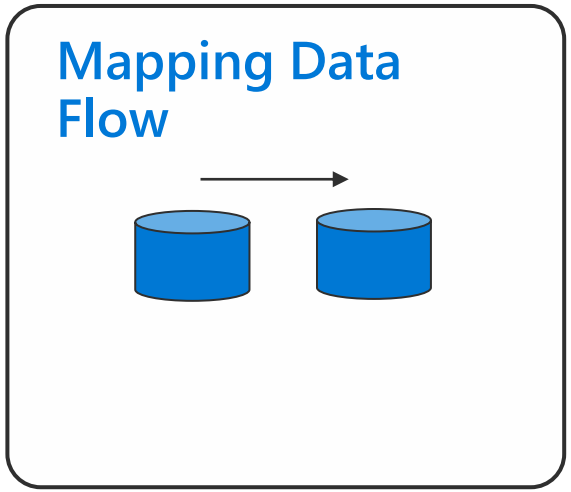
Mapping Data Flow



Benefits of Mapping Data Flow

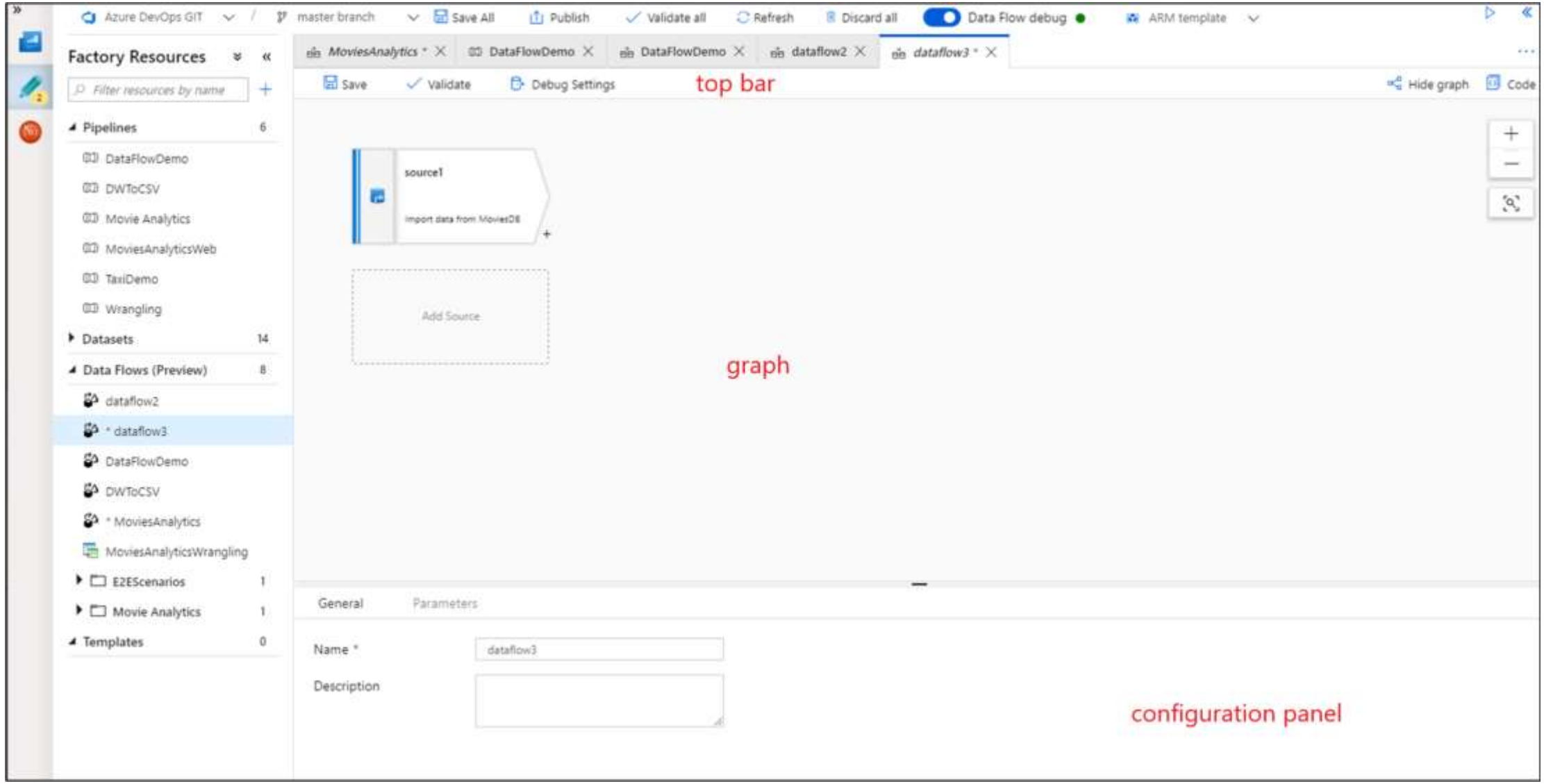
Code free data transformation at scale

- Perform data cleansing, transformation, aggregations, etc.
- Enables you to build resilient data flows in a code free environment
- Enable you to focus on building business logic and data transformation
- Underlying infrastructure is provisioned automatically with cloud scale via Spark execution



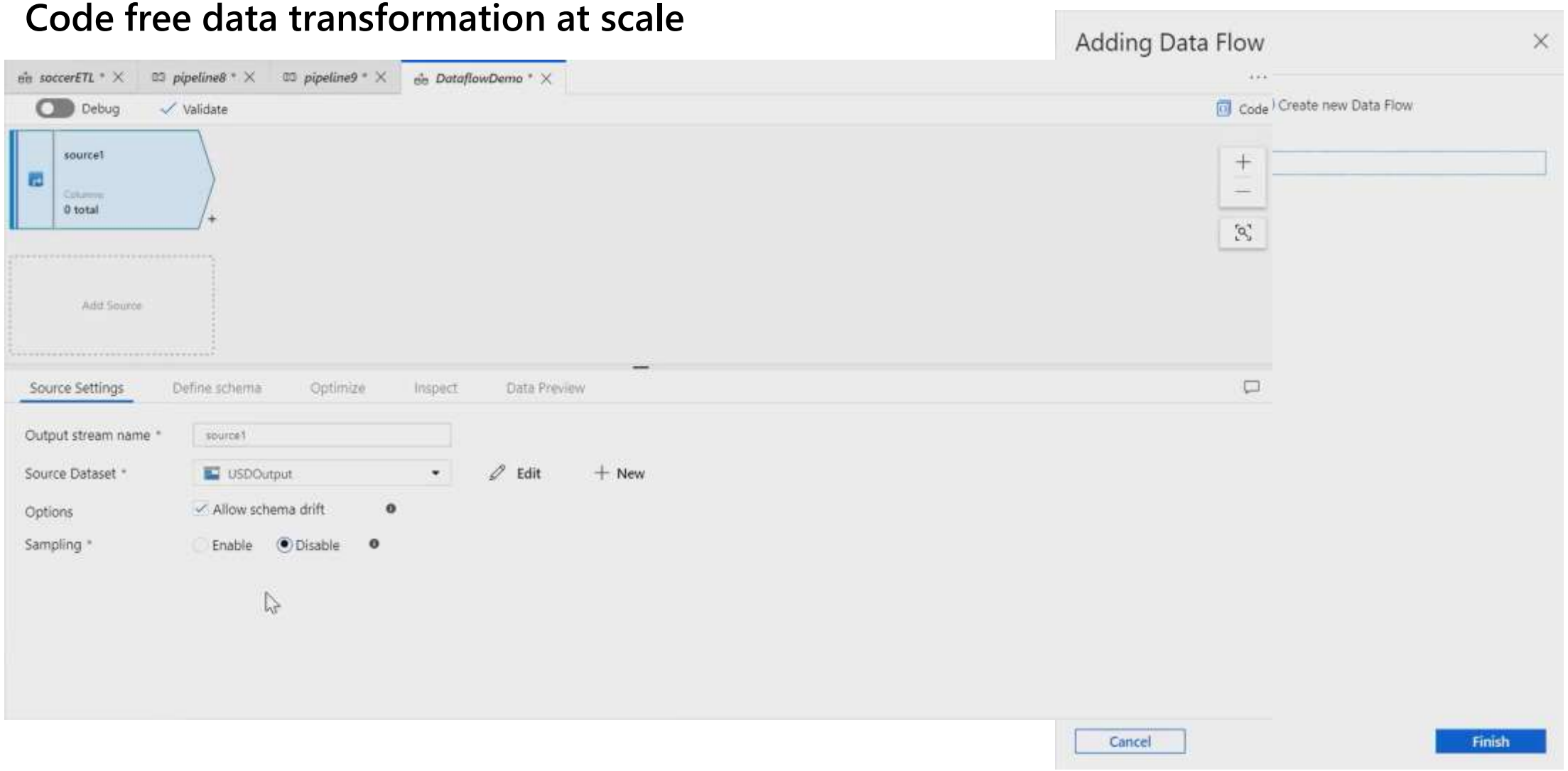
Using the Mapping Data Flow

Code free data transformation at scale

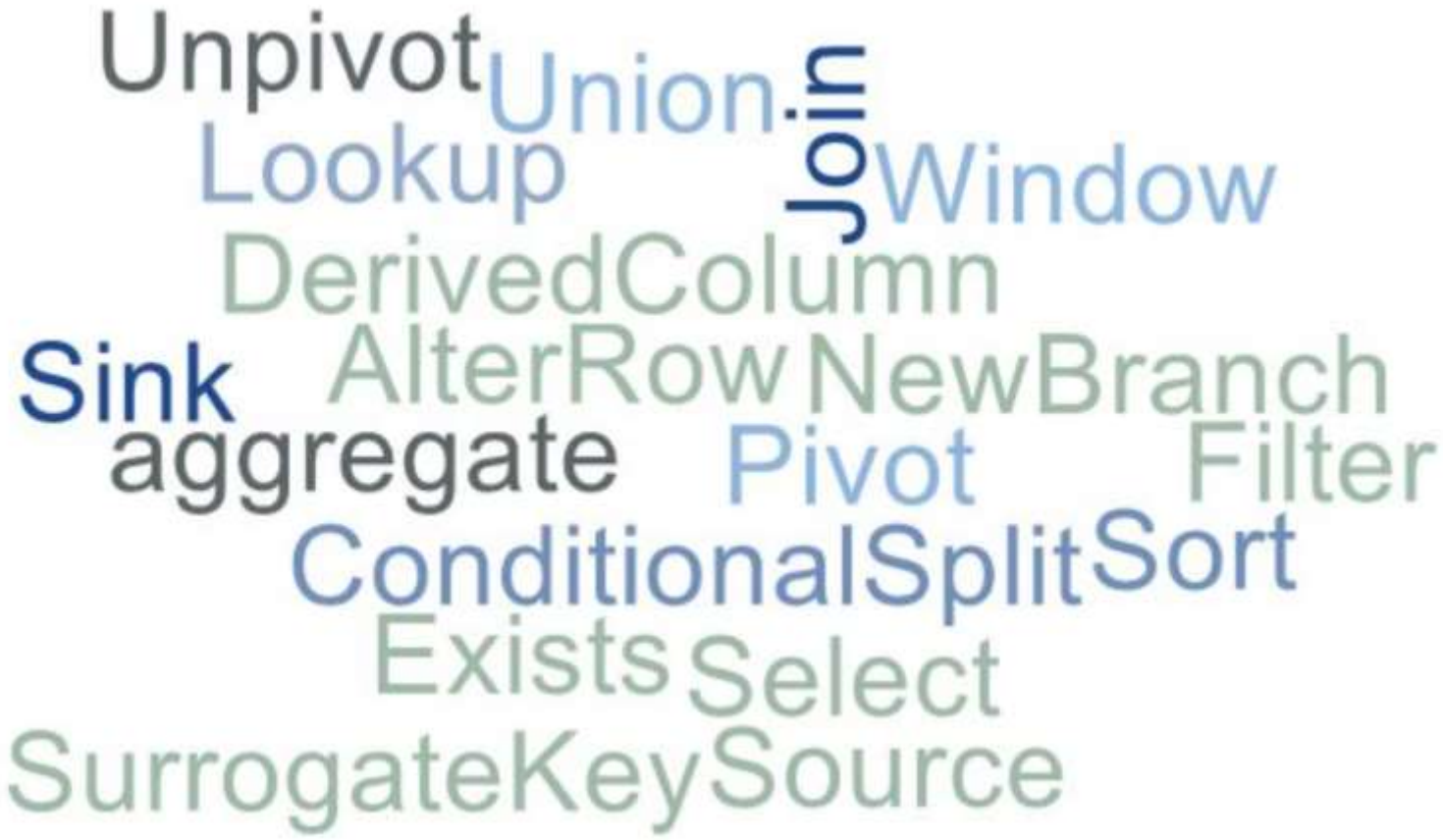


Starting the Mapping Data Flow

Code free data transformation at scale



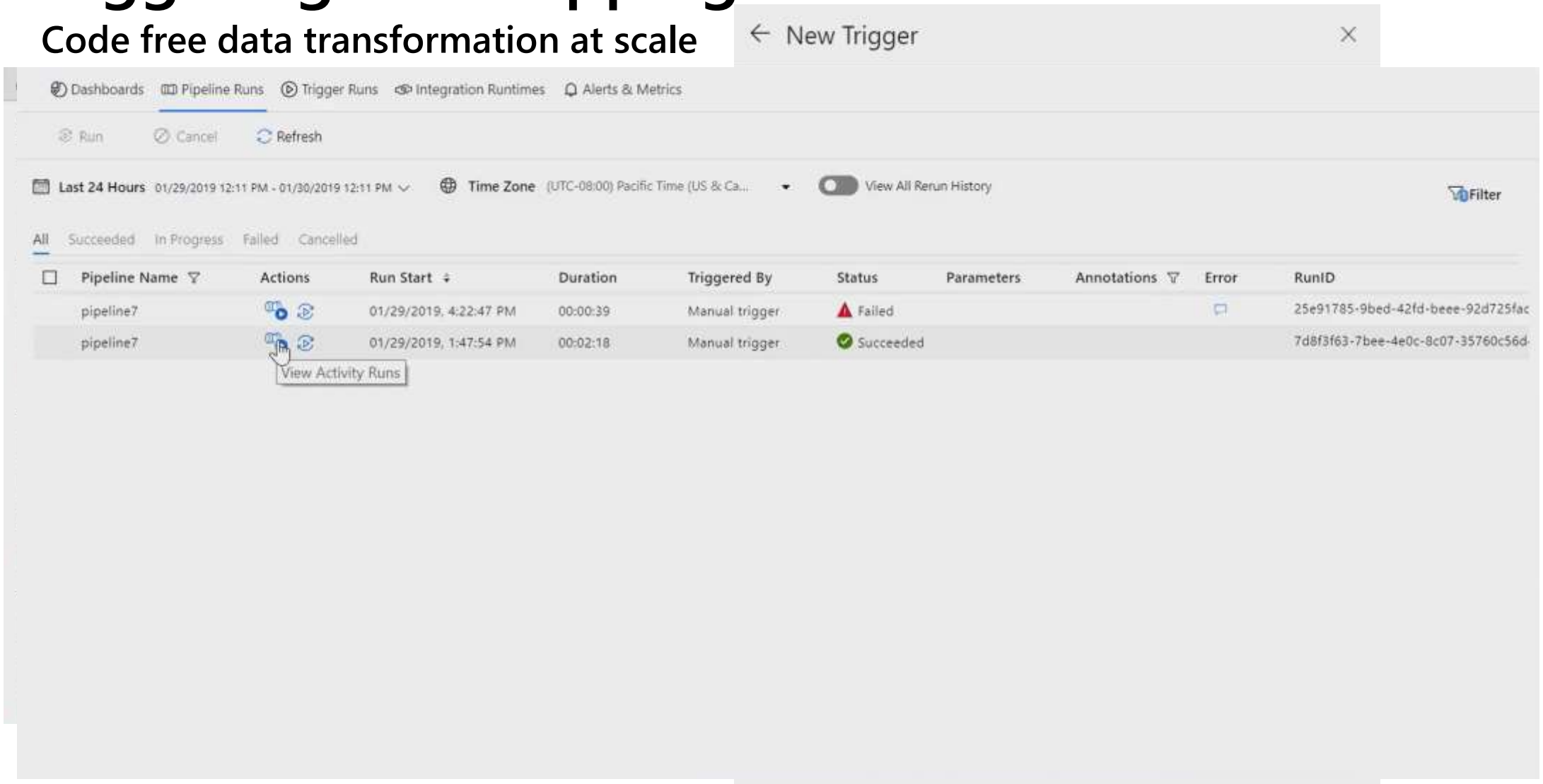
Transformation options in the Mapping Data Flow



Triggering and monitoring

Triggering the Mapping Data Flow

Code free data transformation at scale



Demo:
Transforming your data in Azure Data Factory

In Summary:

Transforming Data with Azure Data Factory

- Azure Data Factory (ADF) is a cloud-based data integration service that allows you to orchestrate and automate data movement and data transformation.
- Transforming data can be performed in ADF by orchestrating a compute resource, calling an SSIS package or using the Mapping Data Flow feature
- The Mapping Data Flow feature enables code free data transformation at scale
- Enable you to focus on building business logic and data transformation
- It is added to an ADF Pipeline, and can be scheduled or triggered
- You can monitor the Mapping Data Flow both visually and programmatically

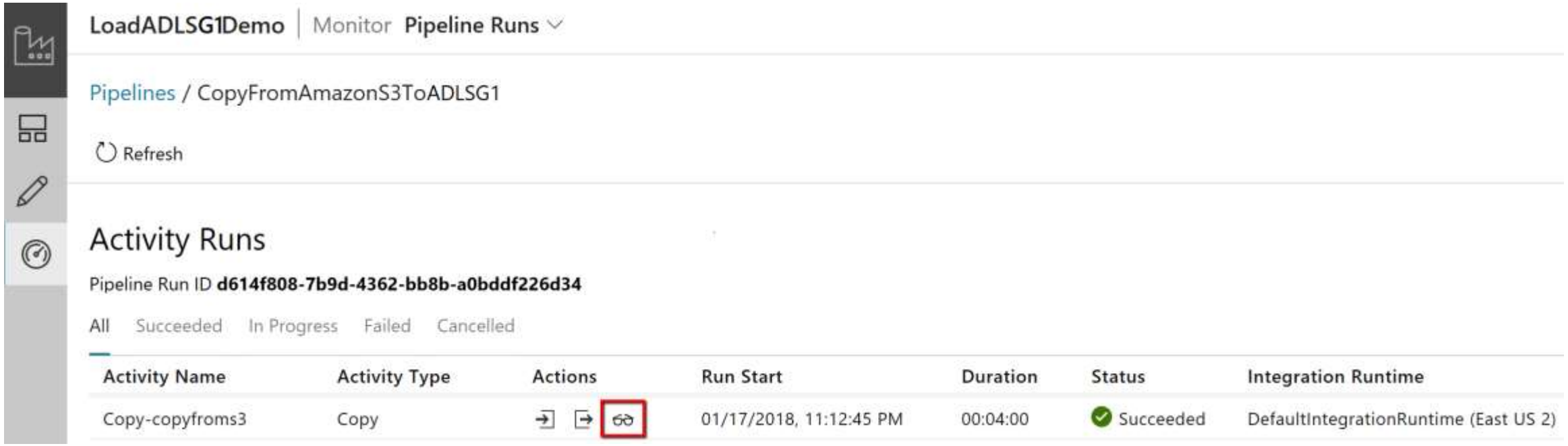
Demo:
Ingesting data with Azure Data Factory

Monitoring data ingestion

Monitoring

Activity runs

Pipeline runs



In Summary:

Ingesting Data with Azure Data Factory

- Azure Data Factory (ADF) is a cloud-based data integration service that allows you to orchestrate and automate data movement and data transformation.
- Ingesting data can be performed by the ADF Copy Activity
- The ADF Copy Activity can be used to connect and collect data for ingestion, and to publish data to BI tools and applications.
- Different Integration Runtimes are required for different ingestion scenarios
- File copy are very efficient using the ADF Copy Activity
- You can monitor the performance of the ADF Copy Activity both visually and programmatically

Microsoft

Data Loading Best Practices

Luis Silva
Cloud Solution Architect, Data Platform

Agenda

- What is Azure Synapse Analytics
- Using Polybase to Load Data in a data warehouse
- Data Loading best practices

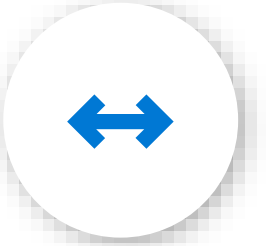
What is Azure Synapse Analytics?

Azure Synapse Analytics

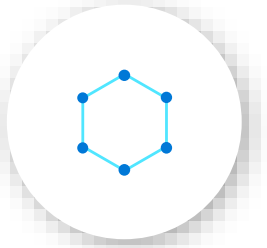
A **limitless** analytics service with **unmatched time to insight**, that delivers insights from all your data, **across data warehouses and big data** analytics systems, **with blazing speed**

Azure Synapse Analytics

PaaS

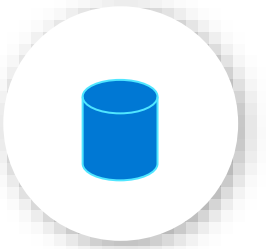


Elastic Scale



Big Data

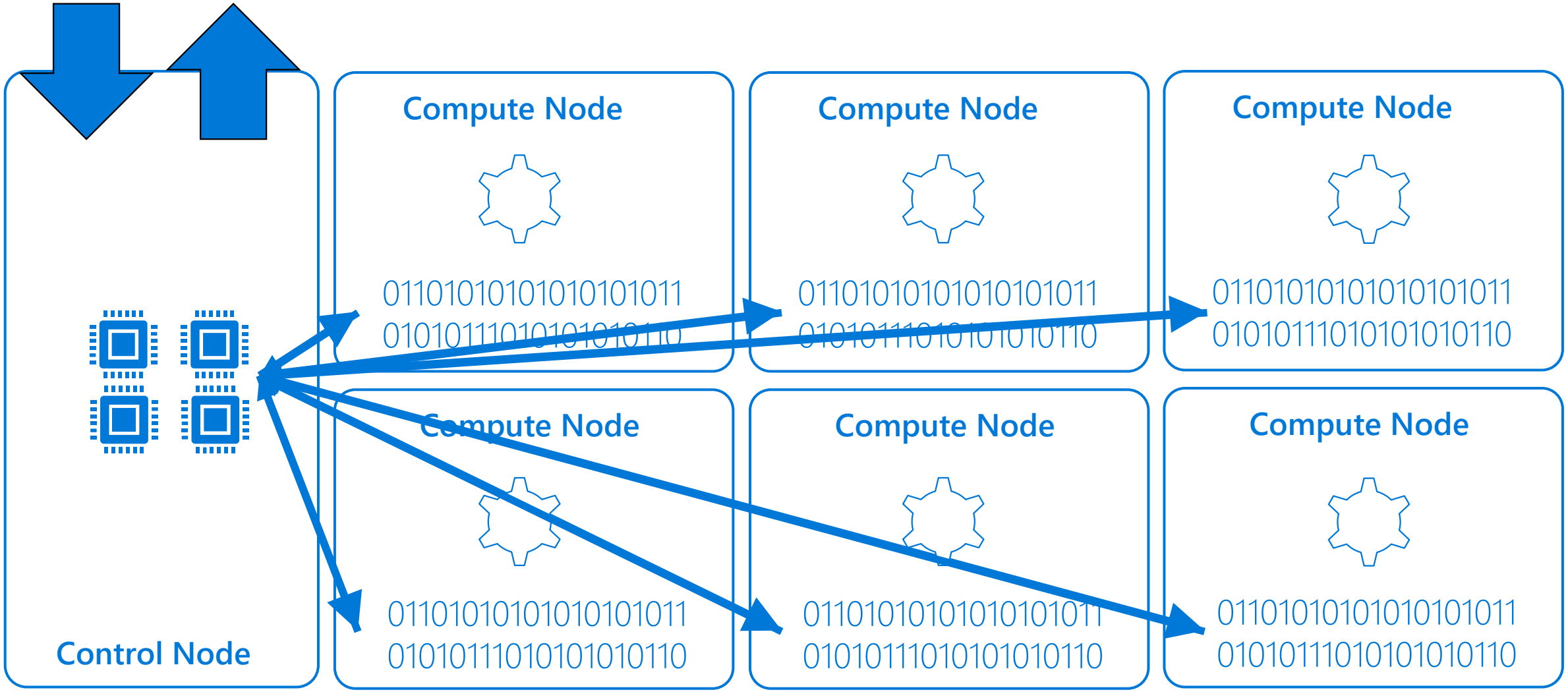
Pause/Resume



Separate Storage/Compute

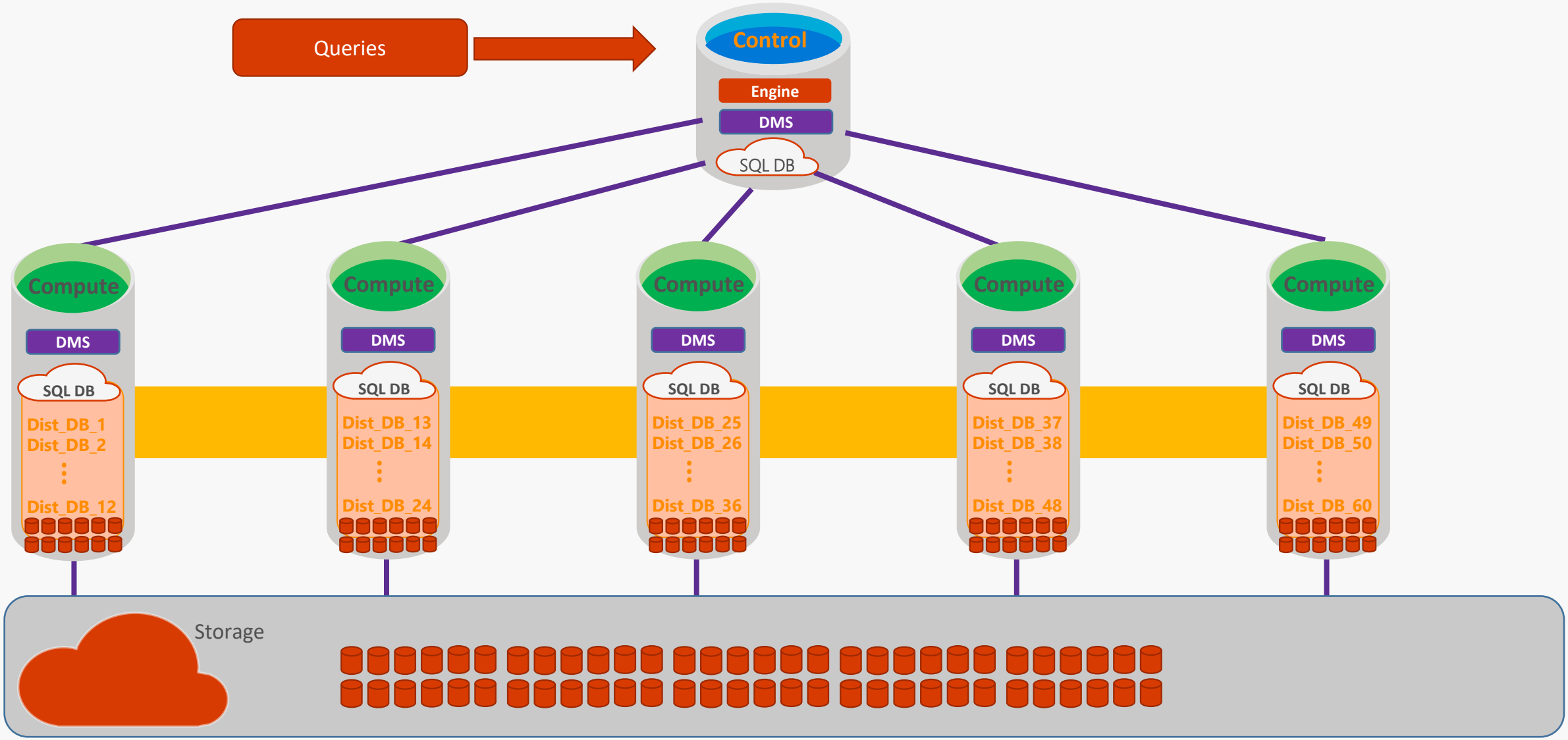
Workload Management

Data Warehouse Architecture



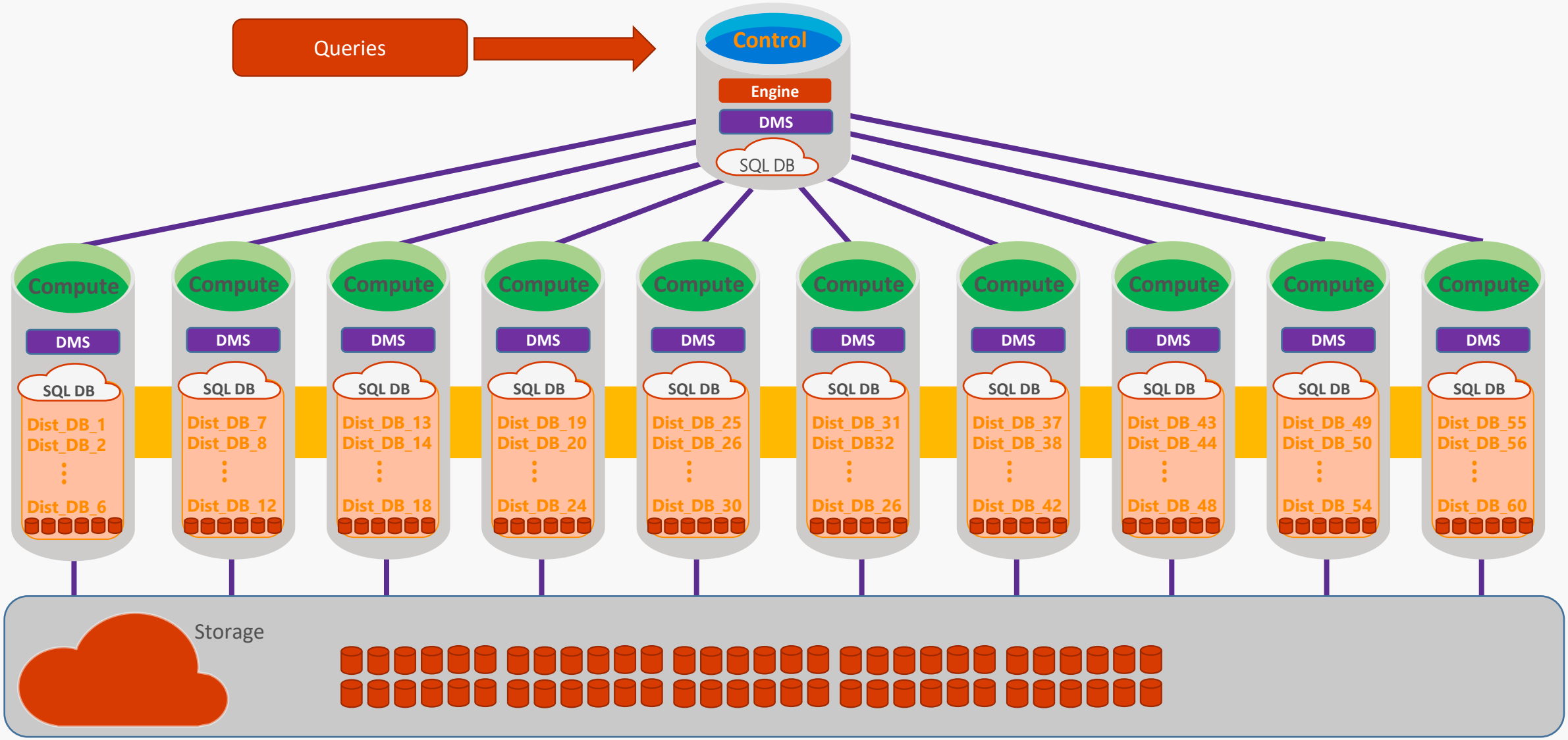
SQL Pool Scaling

DW2500c (5 compute nodes)

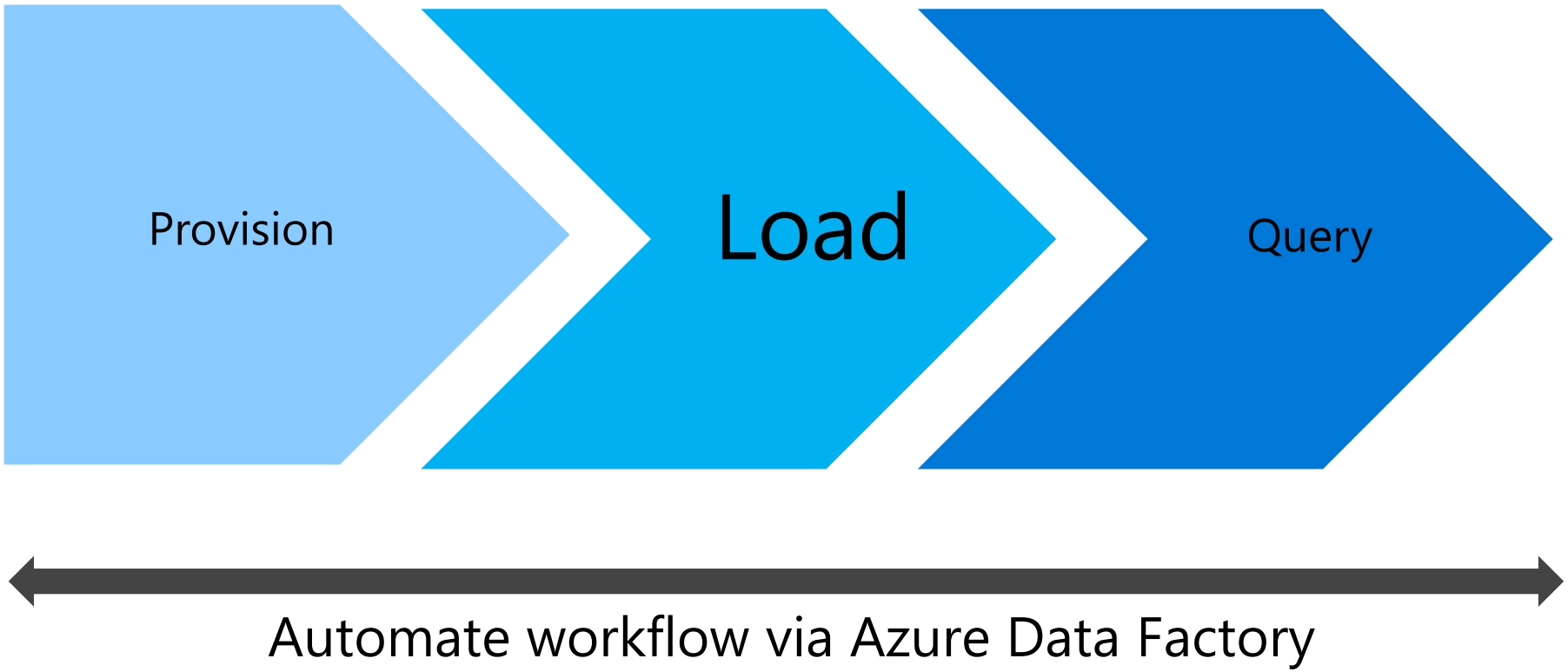


SQL Pool Scaling

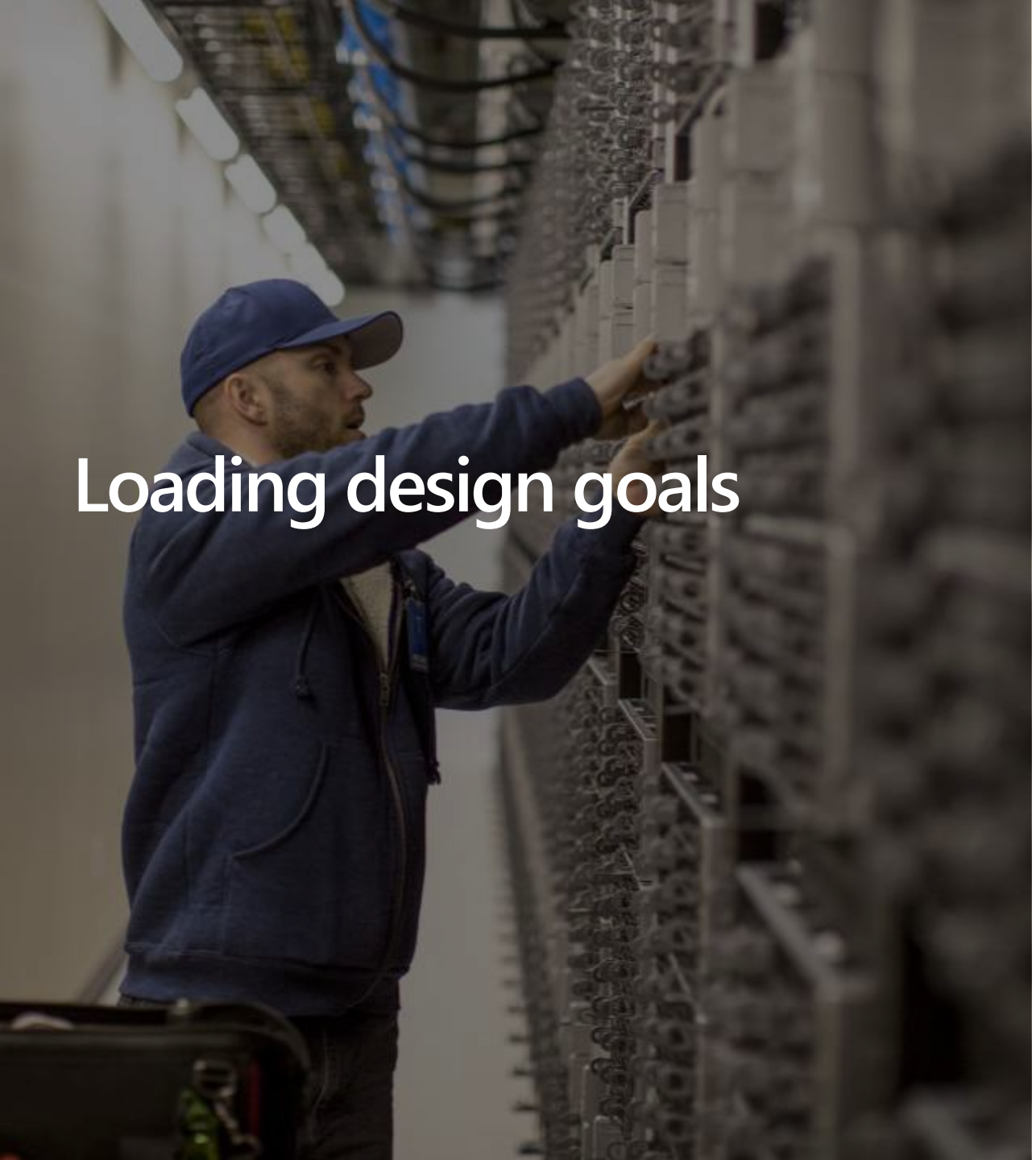
DW5000c (10 compute nodes)



Data Warehouse Processes



Loading design goals

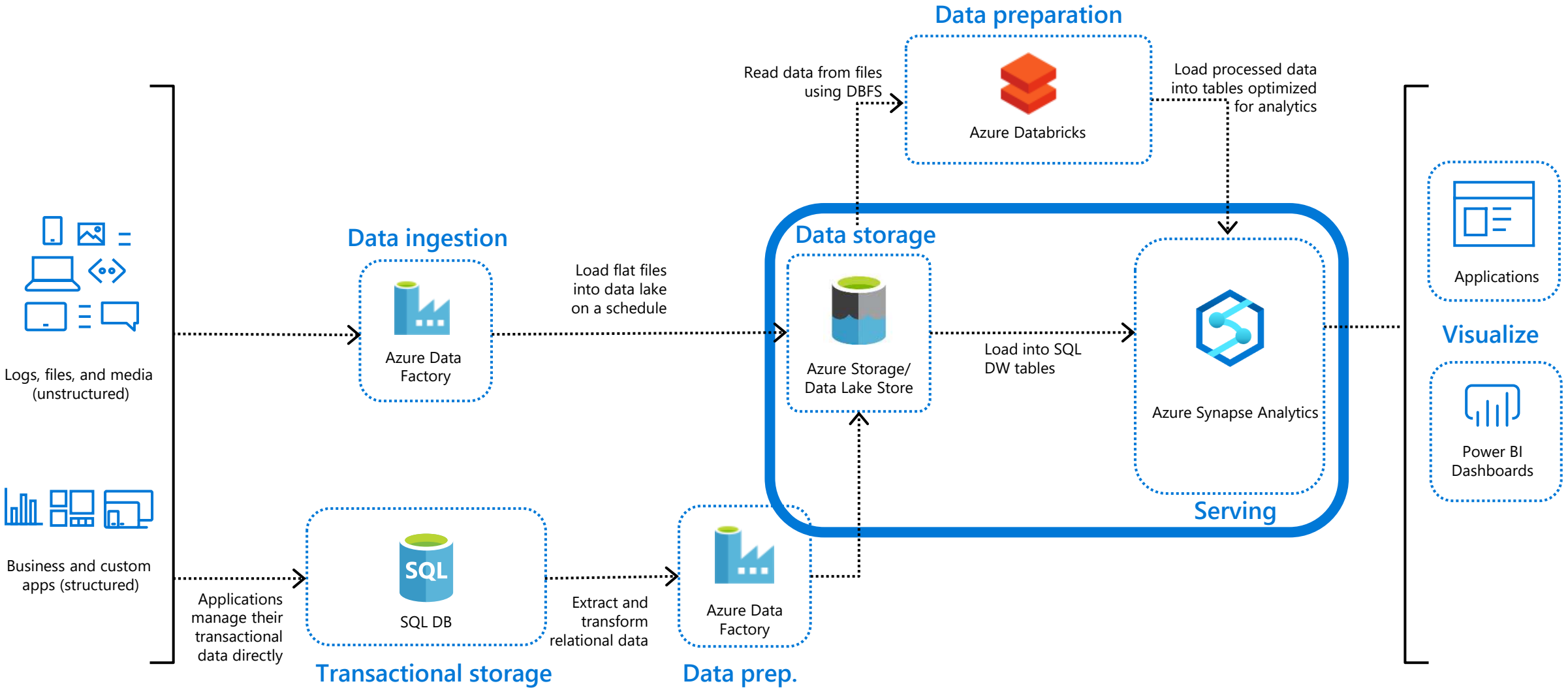


Loading design goals

- Load data efficiently
- Load Data non-obtrusively, respecting concurrent queries and loads
- Reduce table fragmentation as much as possible
- Provide system recovery capabilities in the event of data load failure with minimal impact on concurrent queries
- Multiple methods of loading

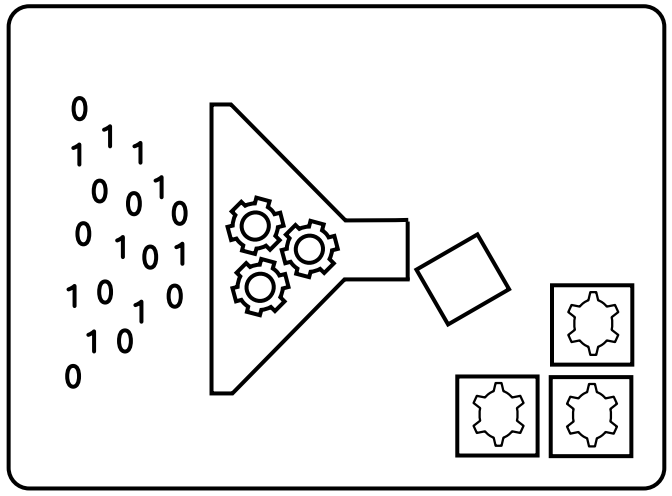
Data warehousing loading in Azure

Loading data into a data warehouse in Azure Synapse Analytics



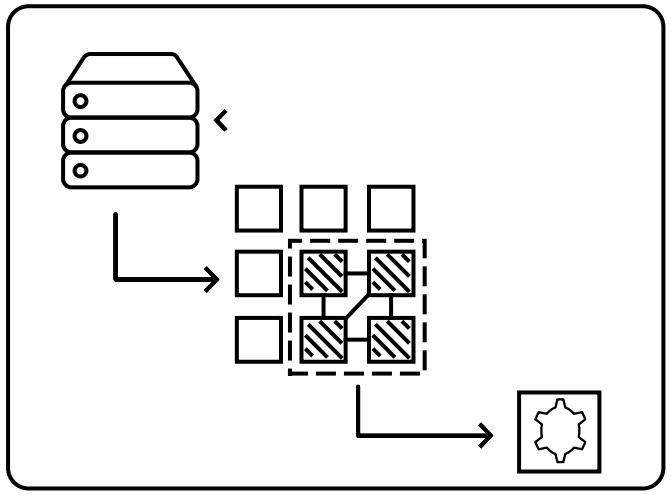
Loading Methods

BCP



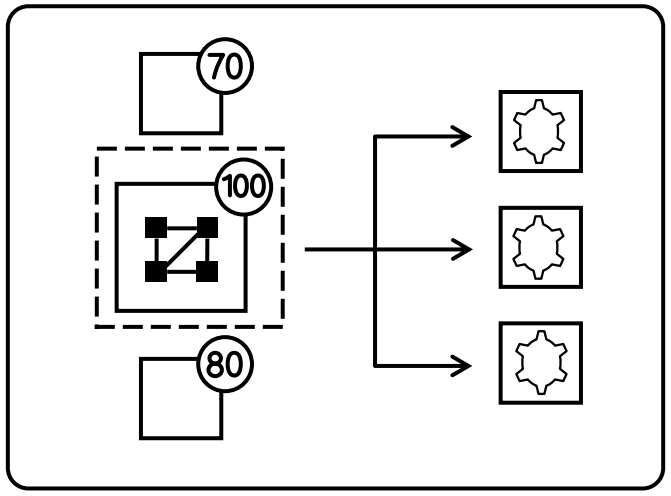
File based

SSIS



Heterogenous

PolyBase



File based

PolyBase benefits

Best practices for loading large amount of data

Leverages MPP architecture

PolyBase is designed to leverage the MPP (Massively Parallel Processing) architecture of Azure Synapse Analytics and will therefore load and export data magnitudes faster than any other tool.

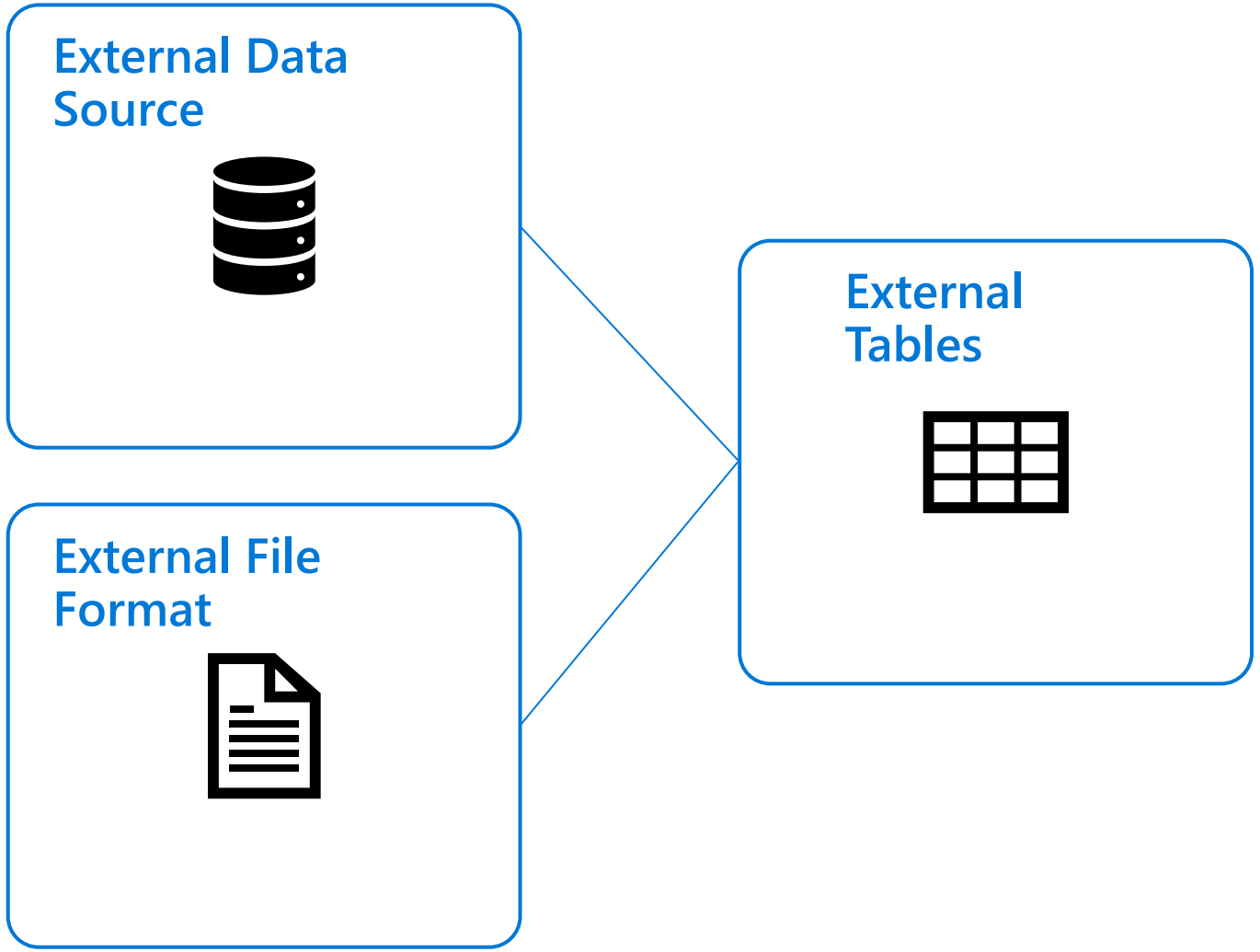
Azure Data Factory support

Azure Data Factory also supports PolyBase loads and can achieve similar performance to running PolyBase manually

Variety of file formats

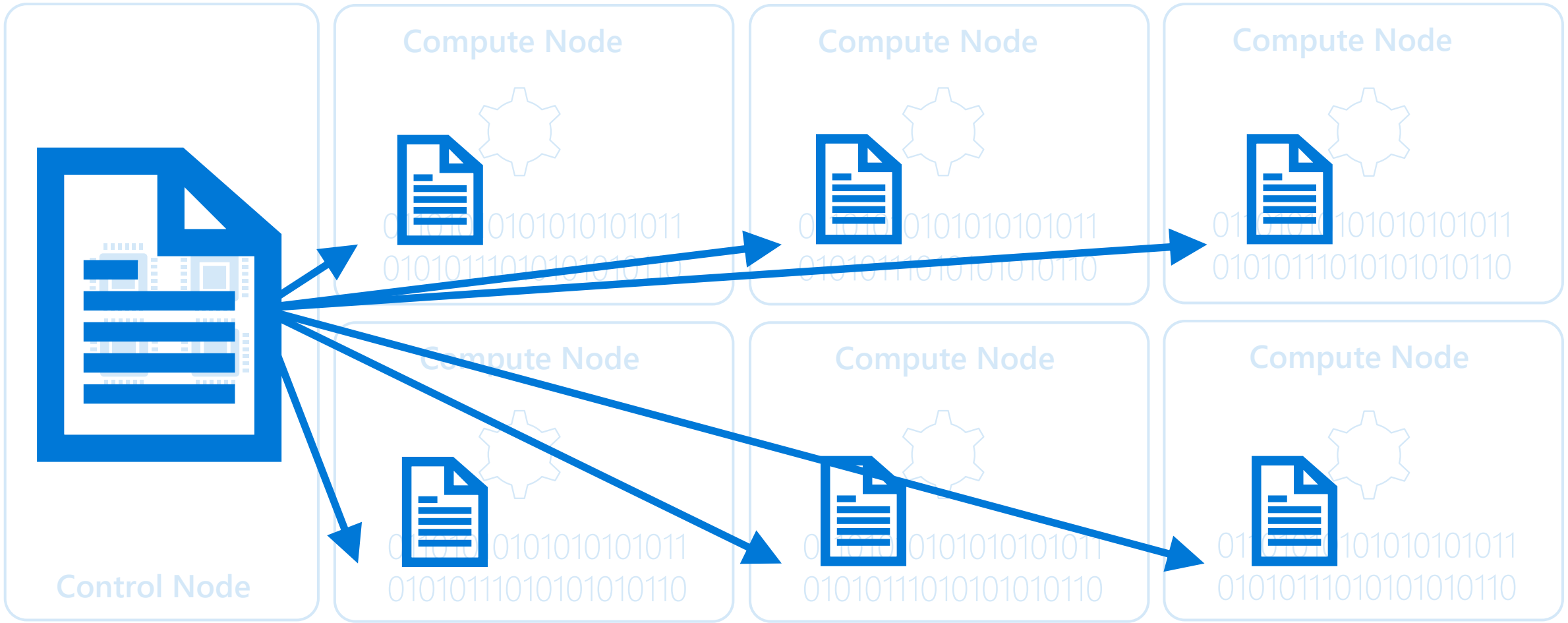
PolyBase supports a variety of file formats including RC, ORC and Gzip files.

Components of PolyBase

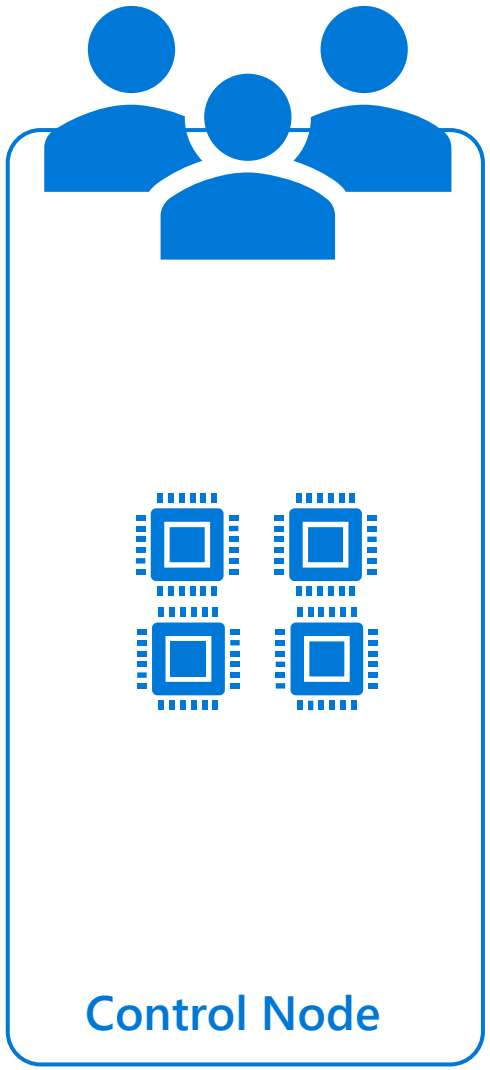


Loading best practices

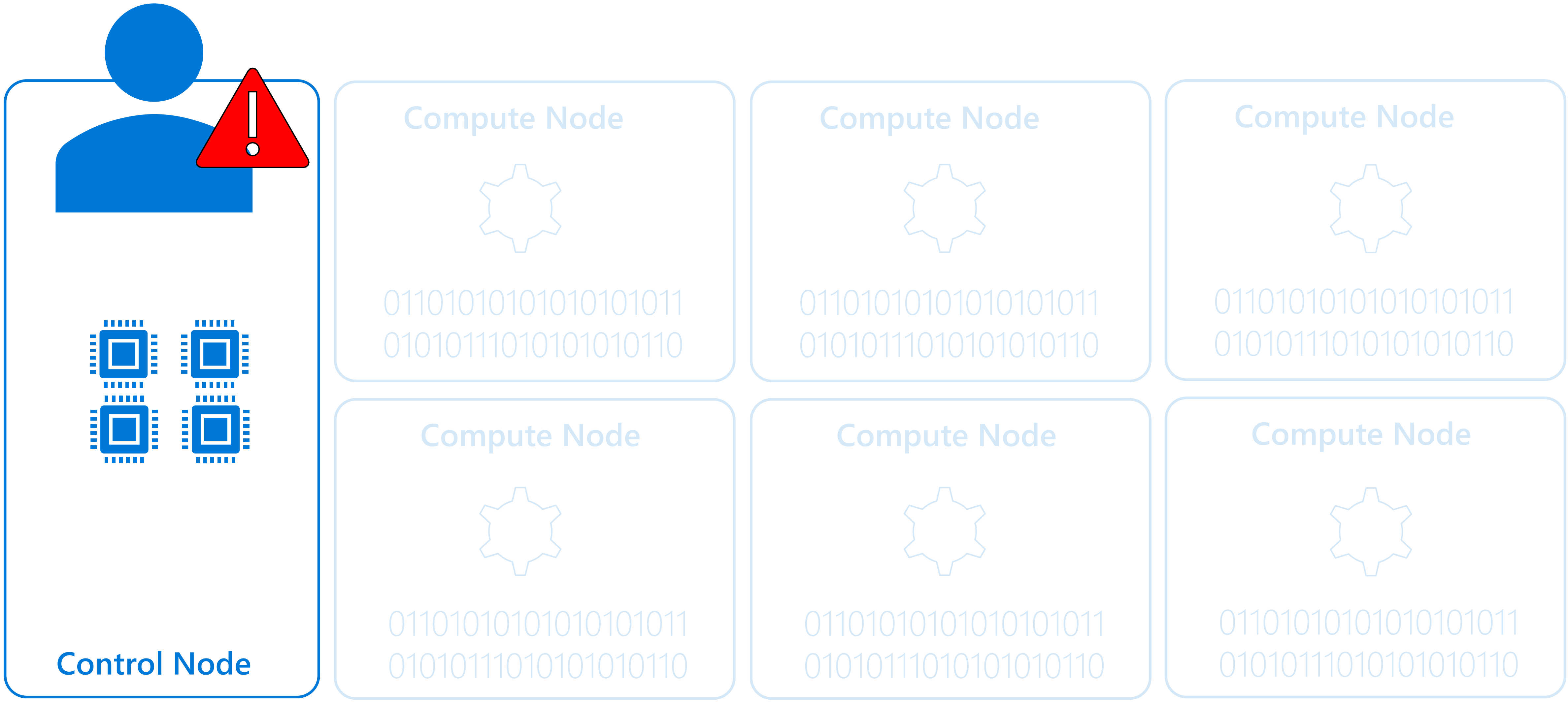
Manage your files



Reduce concurrent access



Create a dedicated load user account



Manage singleton updates

Control Node

Compute Node

01101010101010101011
01010111010101010110

Compute Node

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Compute Node

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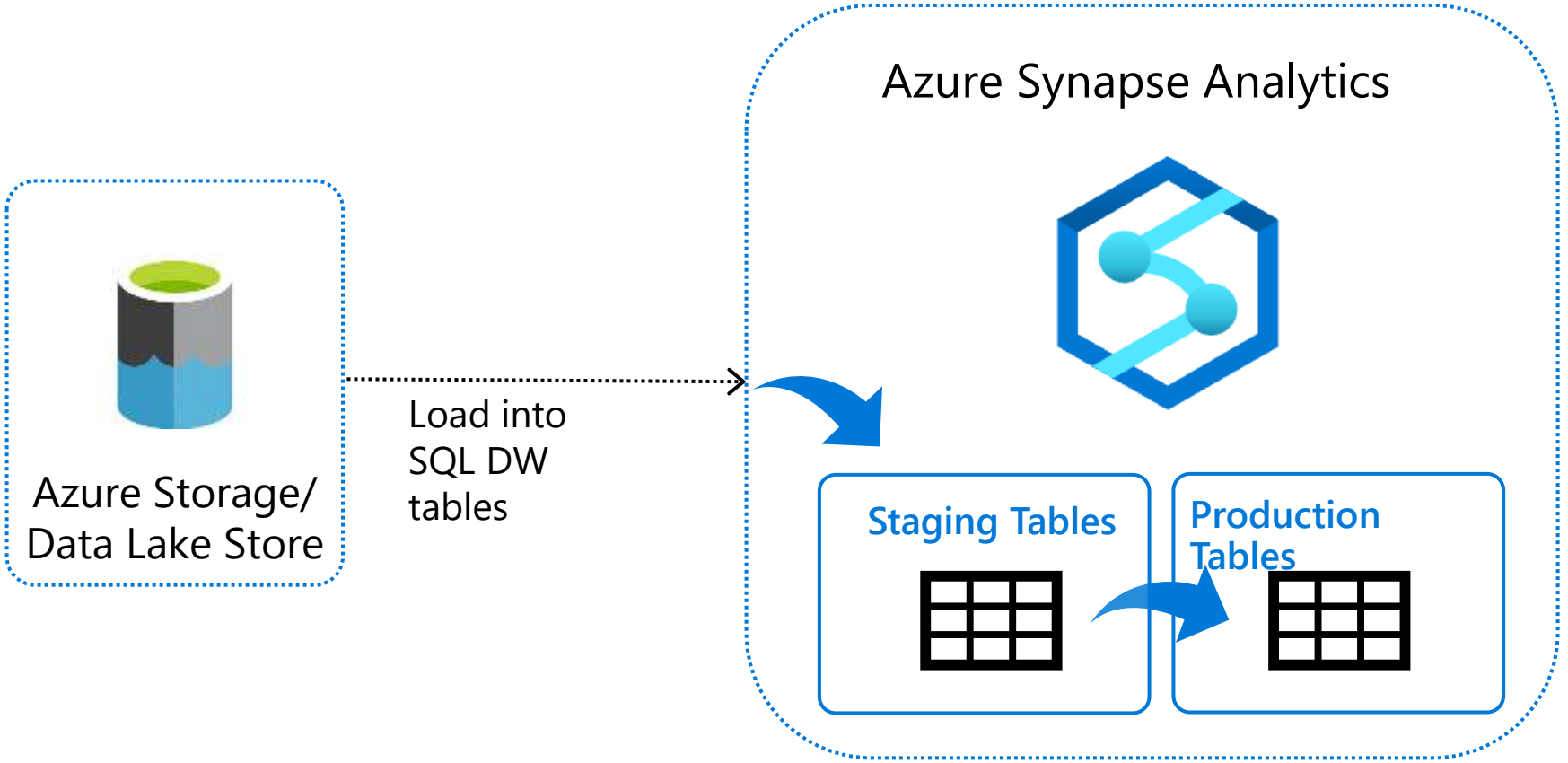
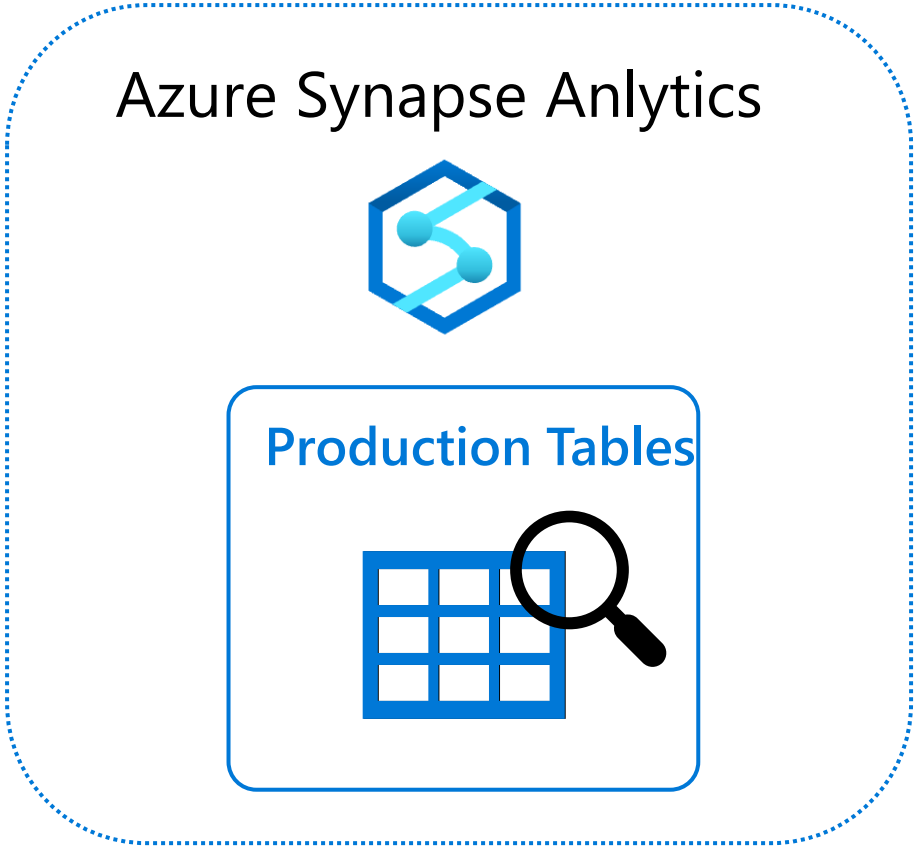
Optimize your loads

Staging data, a 2 step process



Create statistics after loading

Improve the query performance for users



Demo:
Loading data into
Azure Synapse Analytics Data Warehouse

Microsoft

Optimizing data warehousing query performance

Luis Silva
Cloud Solution Architect, Data Platform

Agenda

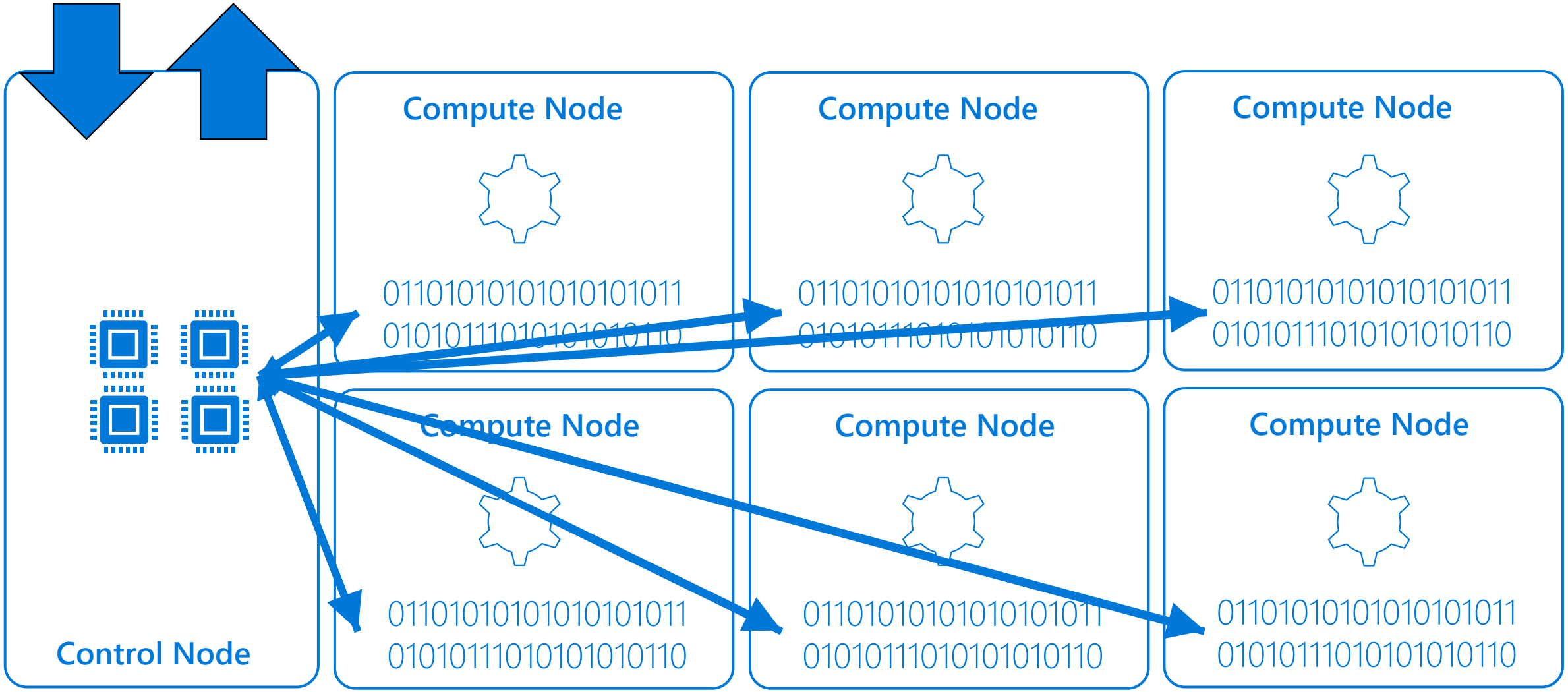
- What is Azure Synapse Analytics
- Maximizing performance
- Query performance tuning

What is Azure Synapse Analytics?

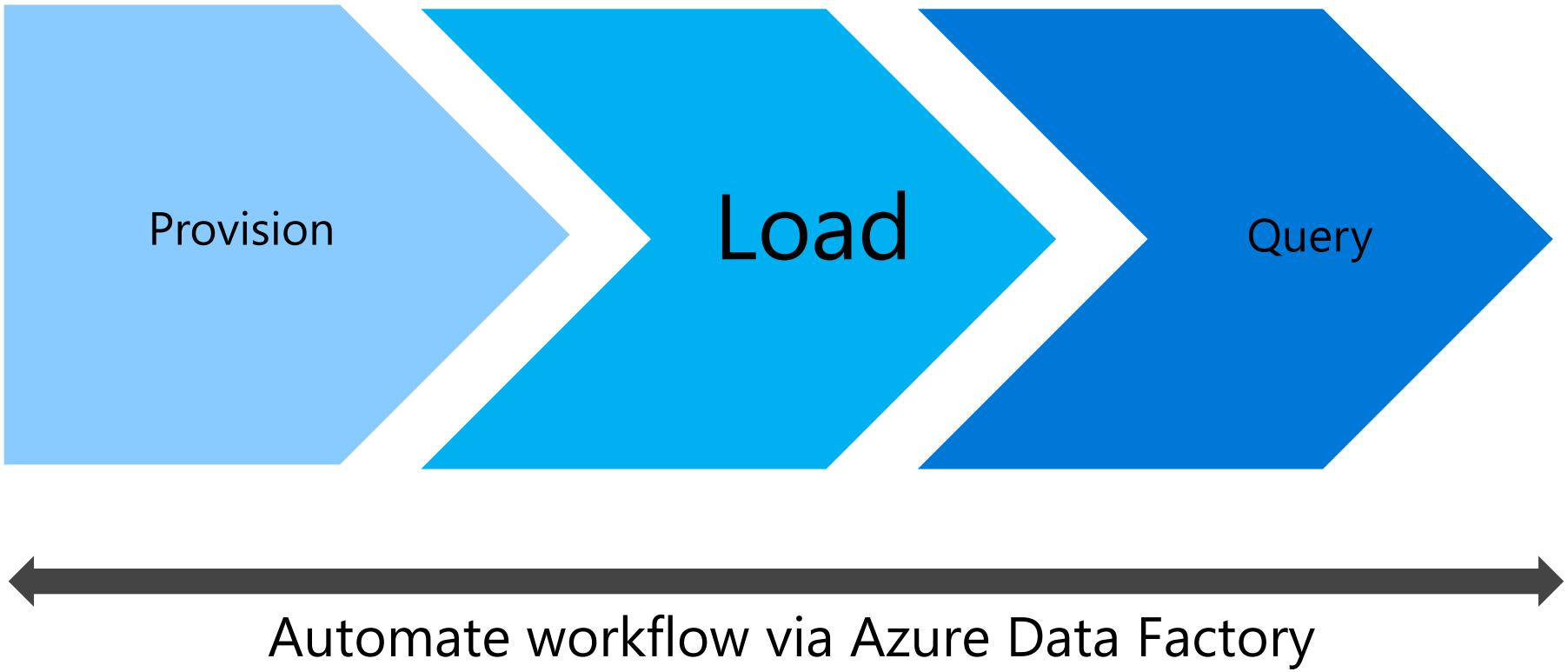
Azure Synapse Analytics

A **limitless** analytics service with **unmatched time to insight**, that delivers insights from all your data, **across data warehouses and big data** analytics systems, **with blazing speed**

Data Warehouse Architecture

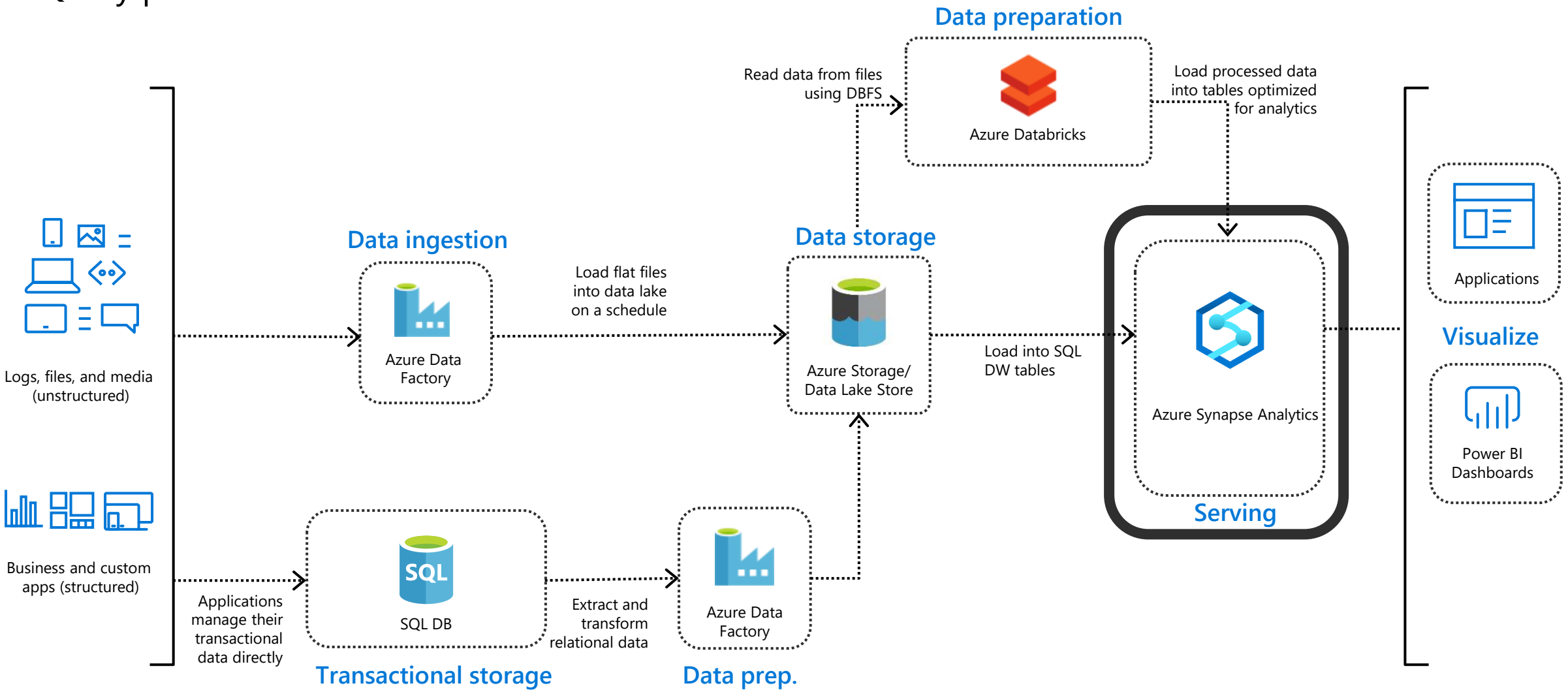


Data Warehouse Processes



Data warehouse performance in Azure Synapse Analytics

Query performance

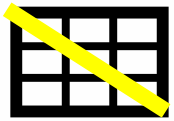


Maximizing Performance

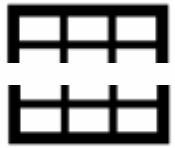
Maximizing Query Performance

Table distribution

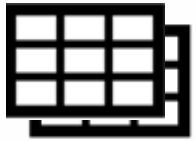
Round Robin Tables



Hash Distributed Tables

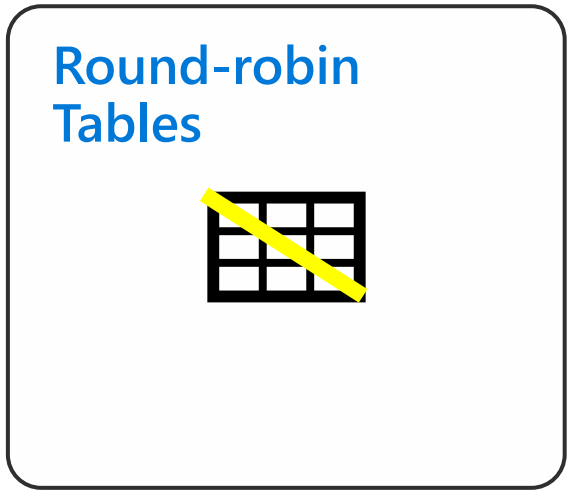


Replicated Tables



Maximizing Query Performance

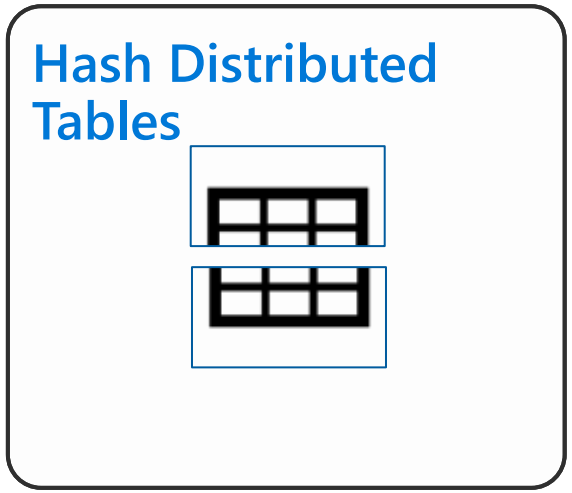
Round-robin distribution



- Is the default option for newly created tables
- Evenly distributes the data across the available compute nodes in a random manner, giving an even distribution of data across all nodes
- Loading into Round-robin tables is fast
- Queries on Round-robin tables may require more data movement as data is “reshuffled” to organize the data for the query
- Great to use for loading staging tables

Maximizing Query Performance

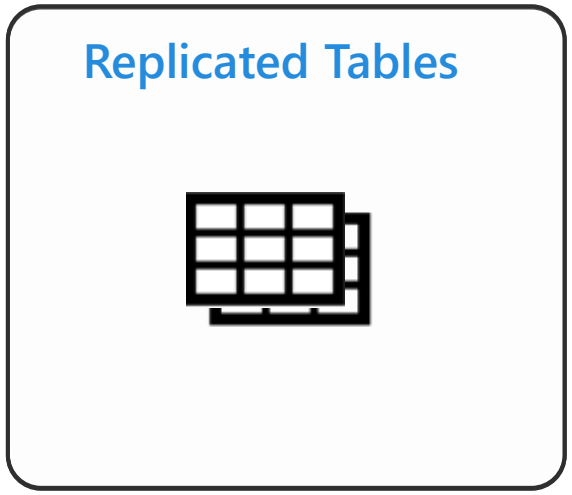
Hash distribution



- Distributes rows based on the value in the distribution column, using a deterministic hash function to assign each row to one distribution.
- Is designed to achieve high performance for queries that run against large fact tables in a star schema.
- Choosing a good distribution column is important to ensure the hash distribution performs well
- As a starting point, use on tables that are greater than 2GB in size and has frequent inserts, updates and deleted
- But don’t choose a volatile column for the hash distributed column

Maximizing Query Performance

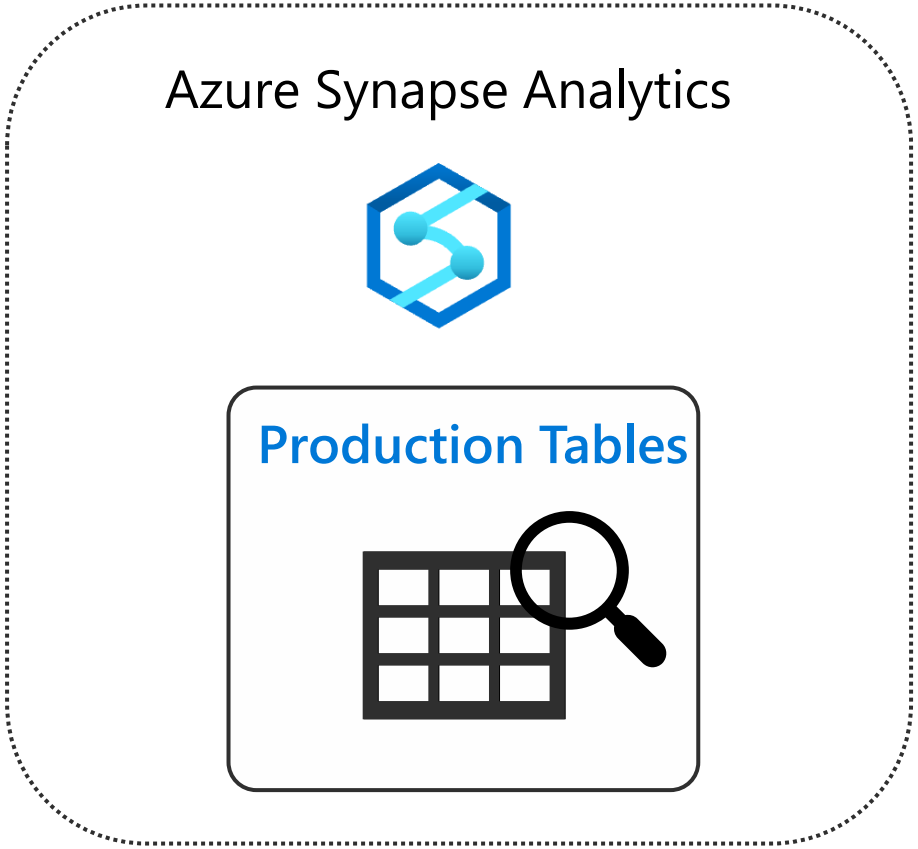
Replicated Table



- A full copy of a table is placed on every single compute node to minimize data movement
- Works well for dimension tables in a star schema that are less than 2GB in size and are used regularly in queries with simple predicates
- Should not be used on dimension tables that are updated on a regular basis
- You can convert existing round-robin tables to replicated tables to take advantage of the feature using a CTAS statement

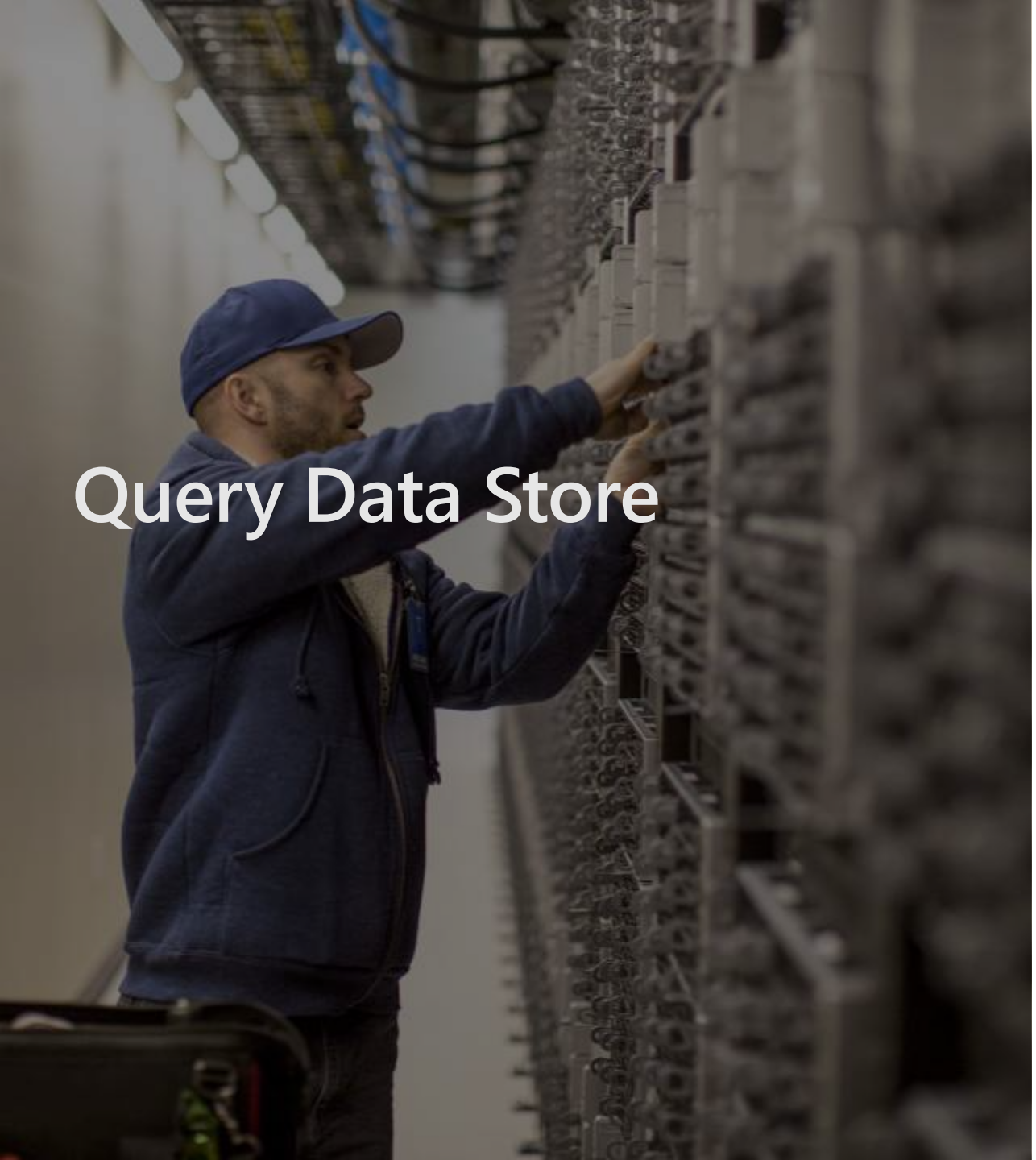
Create statistics after loading

Improve the query performance for users



Demo:
Creating distributed tables

Query Performance Tuning



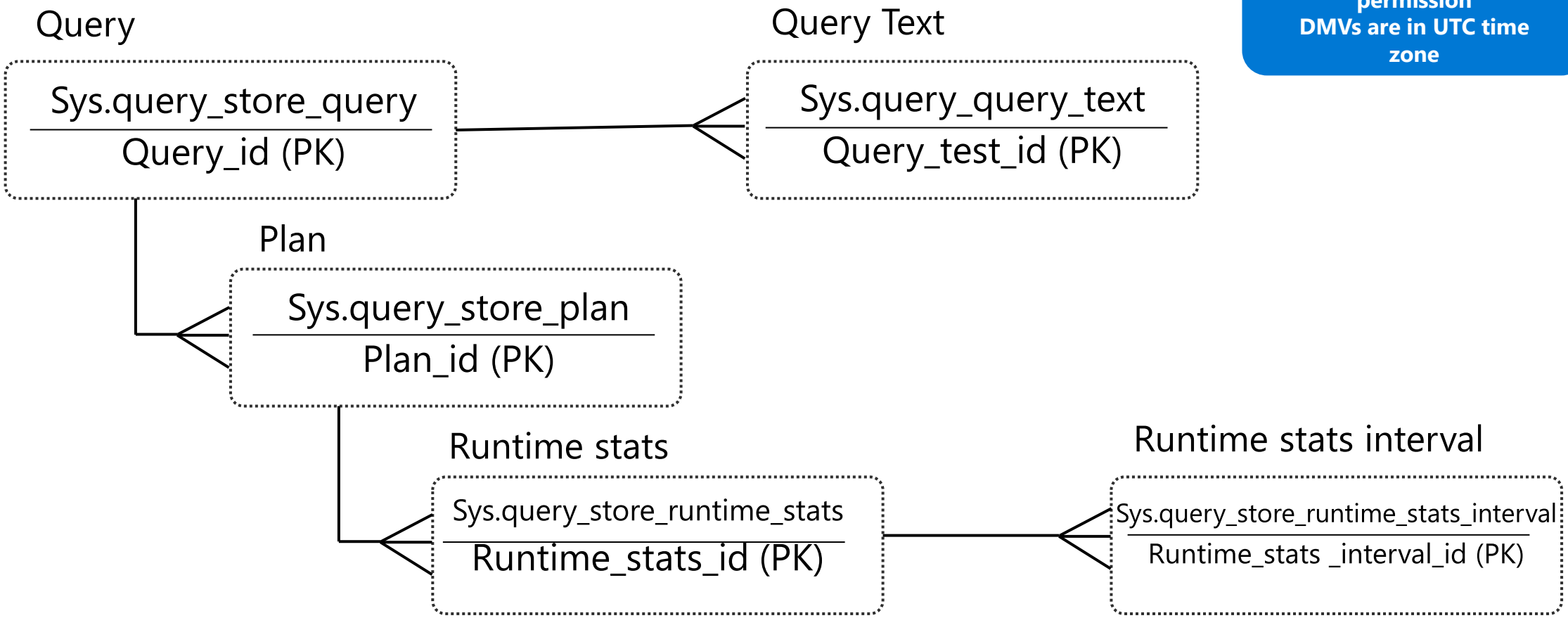
Query Data Store

- Overcomes the 10,000-row limit of DMV's output
- Pinpoint and fix queries with plan regression
  - View queries which produce multiple plans
  - 7-day retention period
  - Full query text
- A/B Testing with your Azure Synapse Analytics (SQL DW)
- Identify, improve and tune ad hoc queries
  - Top hitting queries for performance tuning

Query Data Store

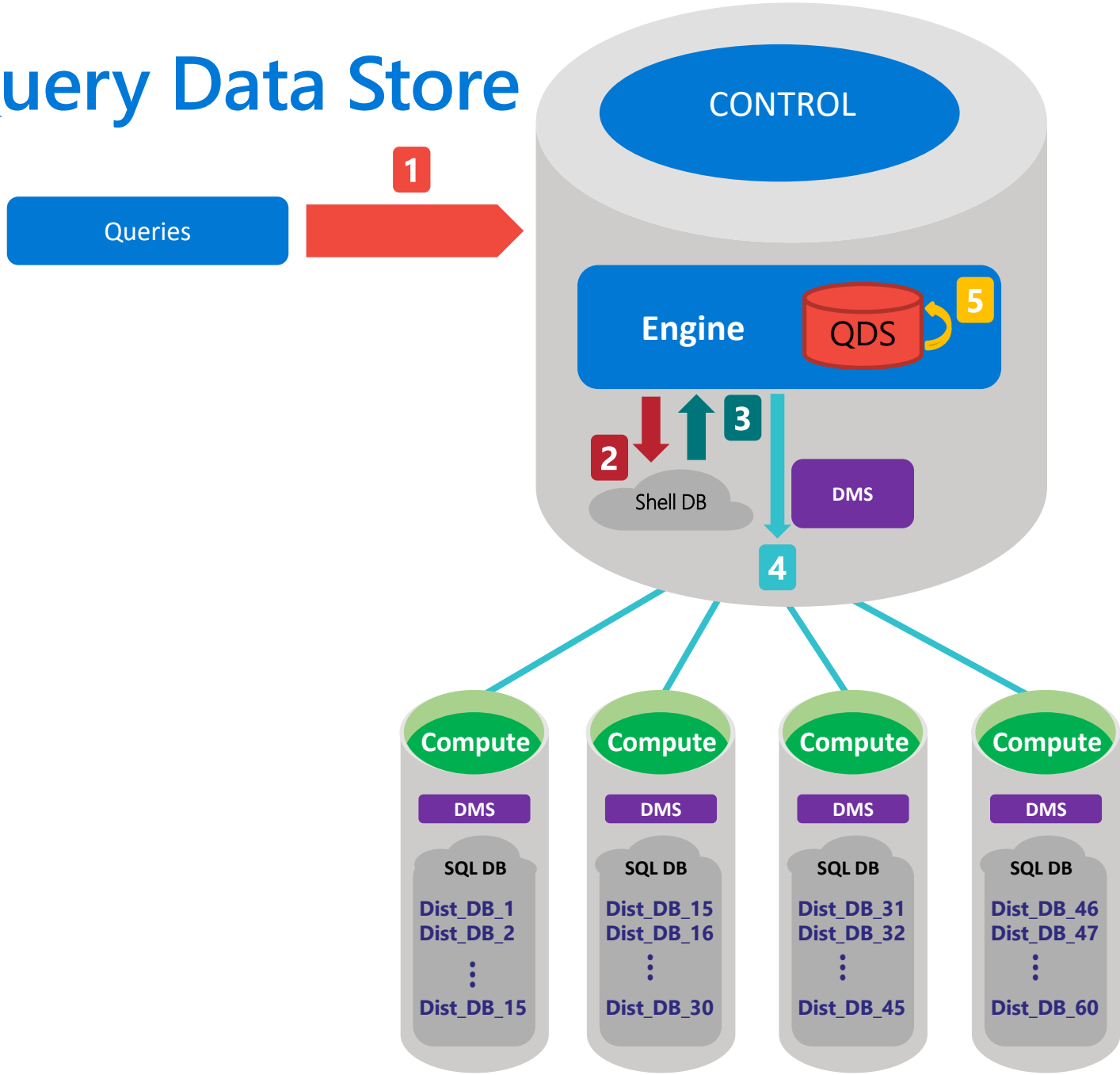
Dynamic Management Views

VIEW DATABASE STATE permission
DMVs are in UTC time zone



Query execution with Query Data Store

- Flush to disc every 15 minutes seconds
- 10GB is the max storage size
- Retention period is 7 days
- Maximum plans per query is 200



Azure Synapse Analytics recommendations

Azure Synapse Analytics

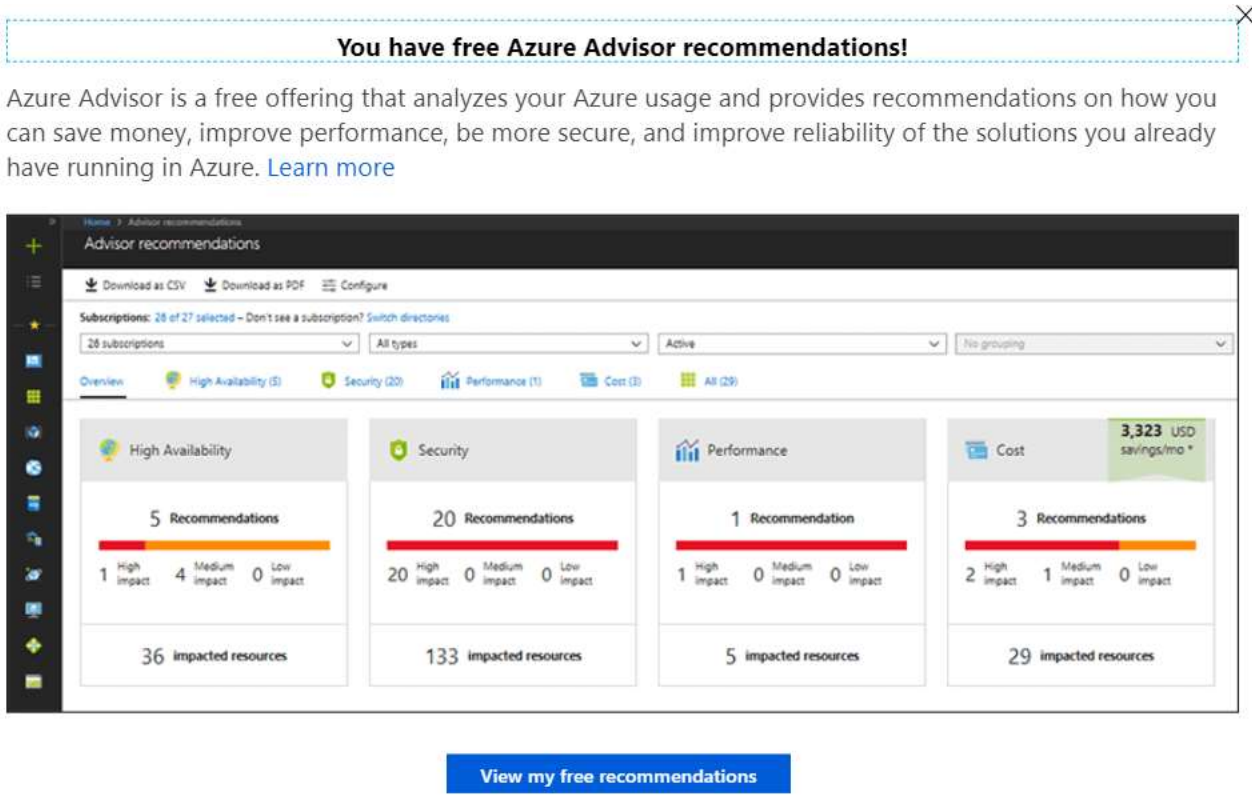
Telemetry

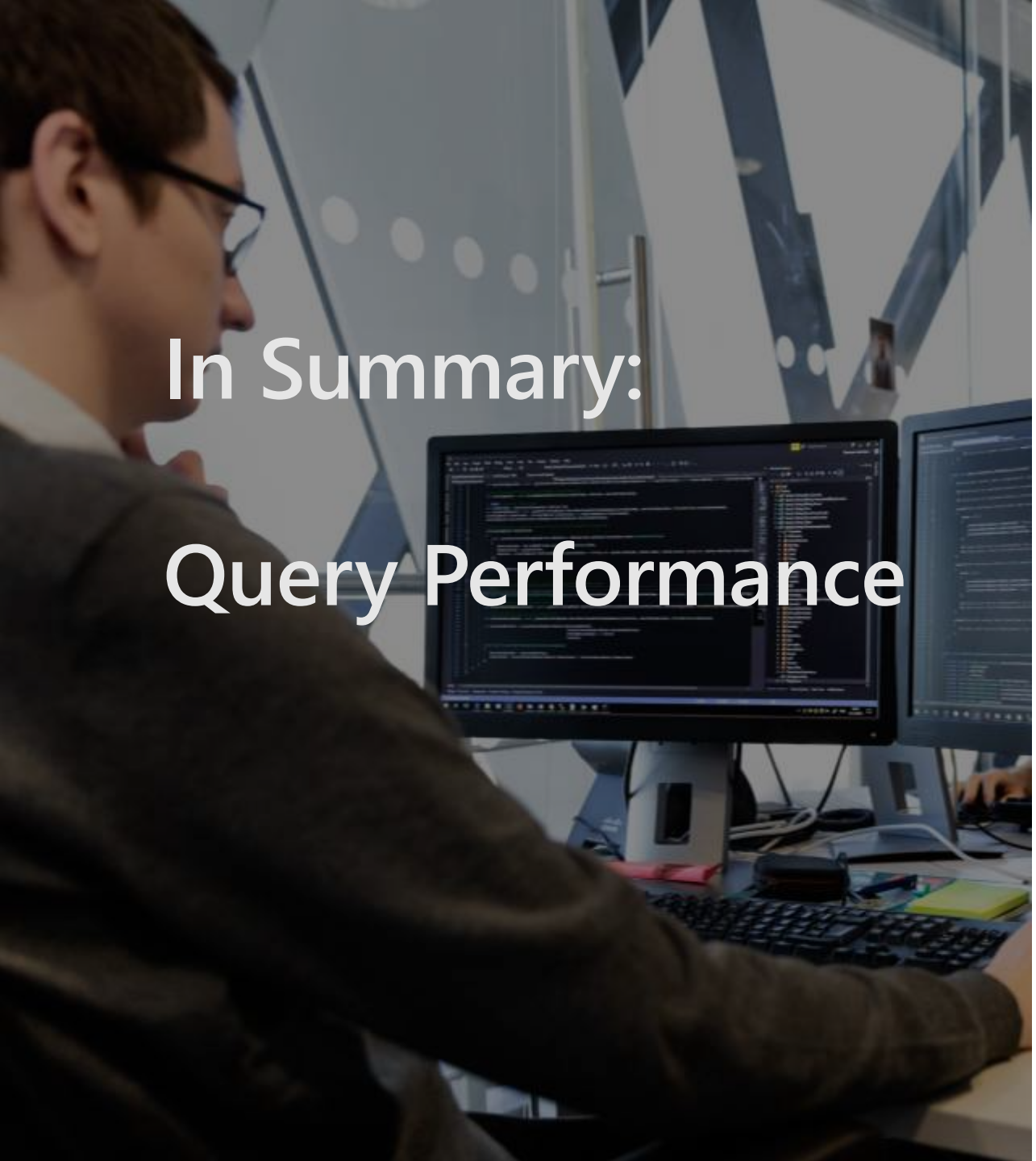
Recommendation generation (every 24 hours)

- Data skew + Replicate tables
- Stats
- Tempdb
- Adaptive Cache

Recommendation API

Azure Advisor Recommendation





In Summary:

Query Performance

- Select the proper table distribution
- Detect data skew
  - Use Query Data store
  - Consider changing key columns
  - Only as fast as your slowest distribution
- Provision additional adaptive cache capacity
- Reduce tempdb contention
- Create and update statistics

Demo:
Query Performance Tuning

Thank you!