

Microsoft Fabric

Real-time Intelligence



Devang Shah
Principal Program Manager



Paul Andrew
Technical Architect & Director



Daniel Addy
Enterprise Architect & Director



What do you want to get out of today?

menti.com

Code: 8453 8924



Anonymous.
No wrong answers.

Copilot



Add a slide about the advantages of combining real-time data with batch data in a lambda architecture.

I completed some of your request, but I'll need more practice before I can do everything in it. What else can I help you with?



By using a lambda architecture, we can take advantage of both real-time and batch data to gain a 360-degree view of our system. Real-time data allows us to monitor system performance and detect issues as they arise, while batch data provides historical context and deeper analysis. By combining these two types of data in a lambda architecture, we can gain a more complete understanding of our system's behavior and make more informed decisions.

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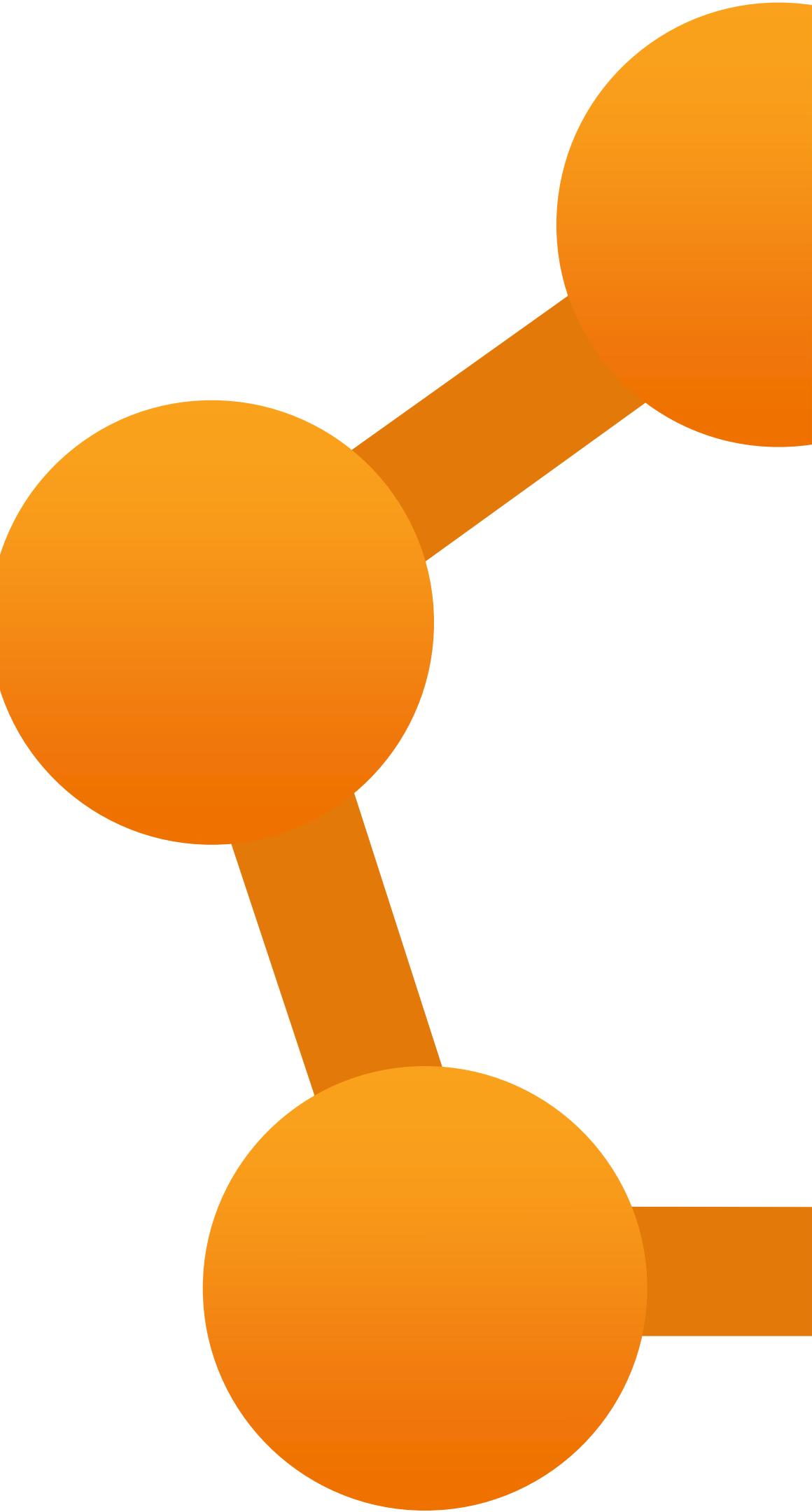


Agenda:

- | | |
|--|-----------------|
| • Context and definitions | Paul |
| • Microsoft Azure Tooling | Paul |
| • Lambda & Kappa Architecture Patterns | Paul |
| • Creating Data Stream 1 | Paul/You/Dan |
| • Microsoft Fabric Tooling | Paul/Devang |
| • Lambda & Kappa Architecture Patterns | Paul/Devang |
| • Creating Data Stream 2 | Devang/You/Paul |
| • Real-time Hub | Devang/Paul |
| • Conclusions | All |

An Engineers Guide To ~~Real-time~~ Data Analytics

Cloud Formations





What is big data?

Answer:
It depends!

Answer:
“Any data that you cannot process
in the time that you have/want
using the technology you have.”

- Buck Woody

@BuckWoodyMSFT

Volume
Velocity
Variety
Veracity
Value



What is the goal of our data solutions?

Cloud Formations - Knowledge Transfer & Training

Data
Sources

Data
Insight

Data = Information = Knowledge = Power

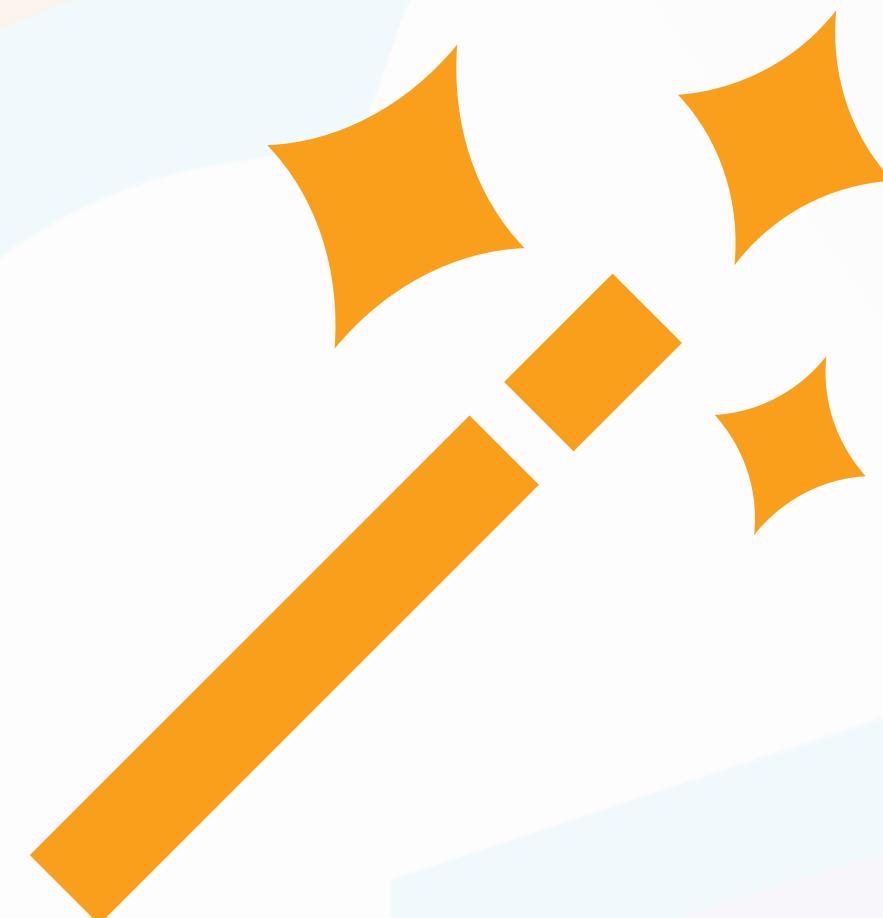


How do we deliver our data insights?

Cloud Formations - Knowledge Transfer & Training

Data Sources

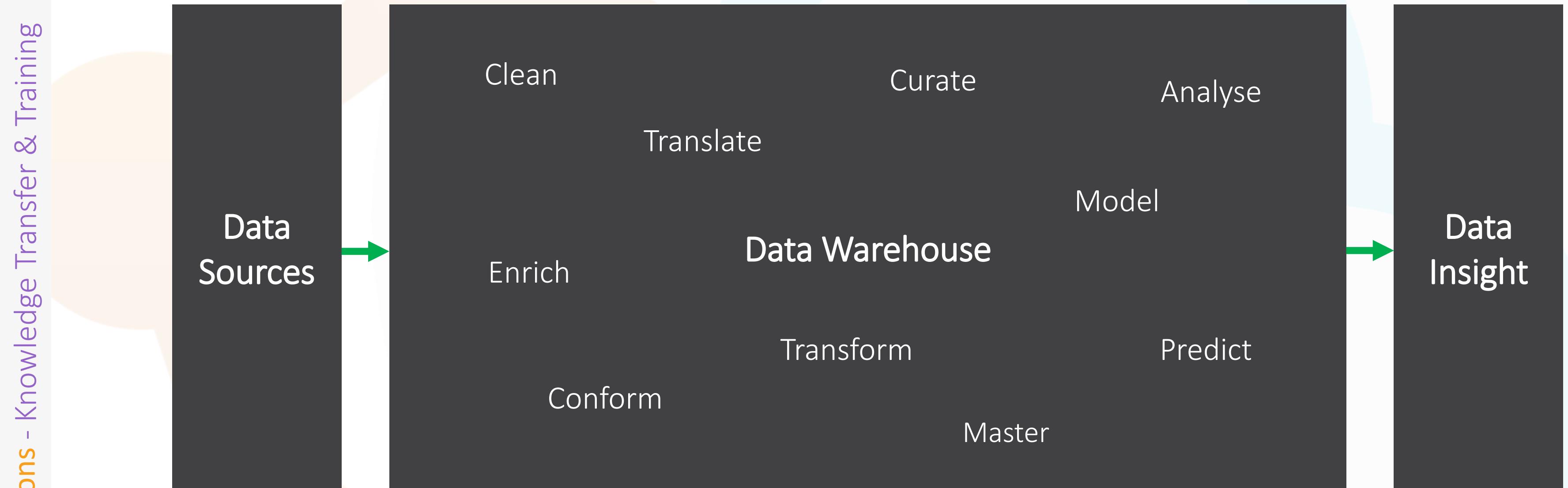
Data Insight



Data = Information = Knowledge = Power



How do we deliver our data insights?



Cloud Formations - Knowledge Transfer & Training

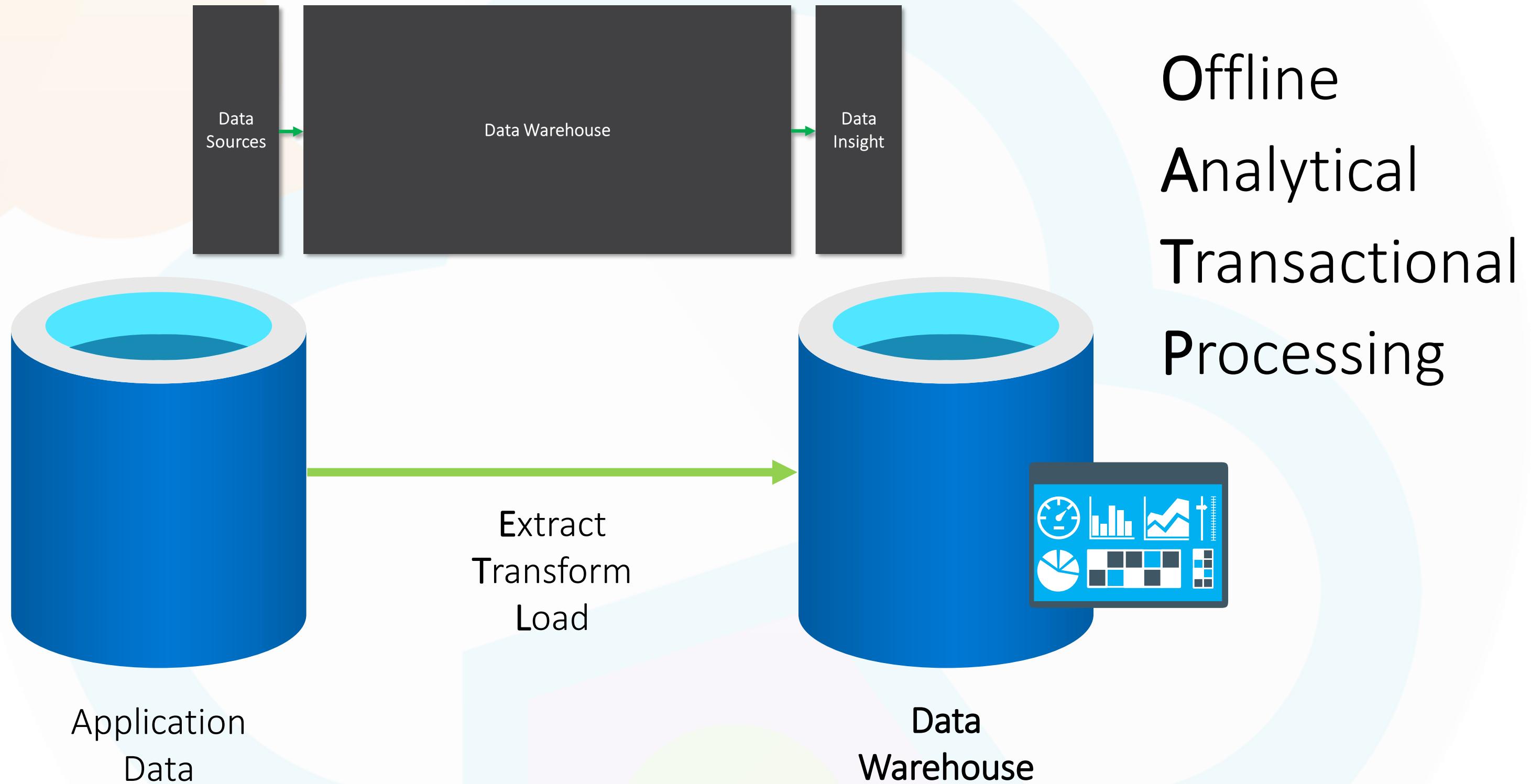
Data = Information = Knowledge = Power



Data Warehouse

Online
Line
Transactional
Processing

Cloud Formations - Knowledge Transfer & Training



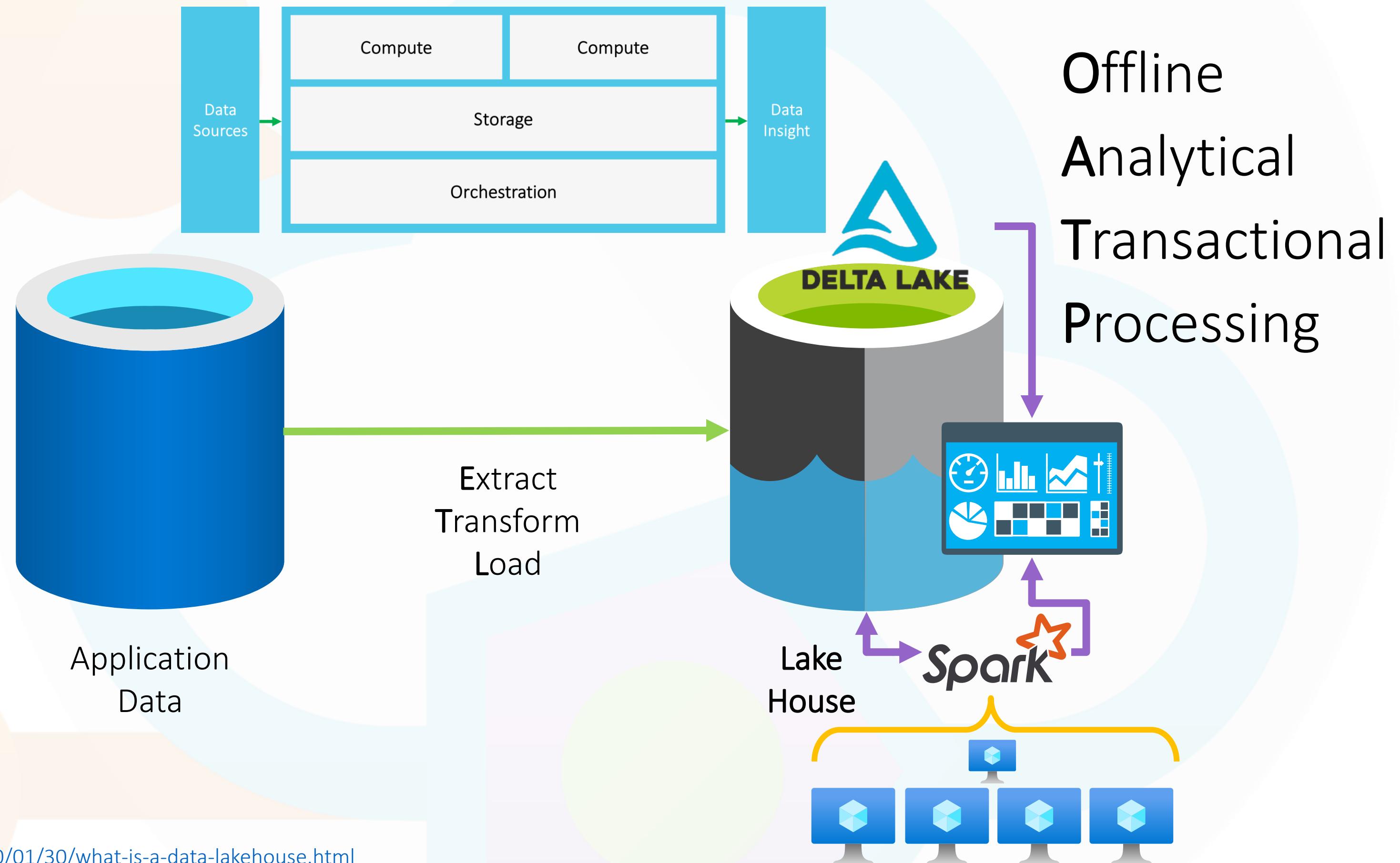
Offline
Analytical
Transactional
Processing

Lake House (Data-Ware-Lake-Delta-Beach-House-Lakes)



Online
Line
Transactional
Processing

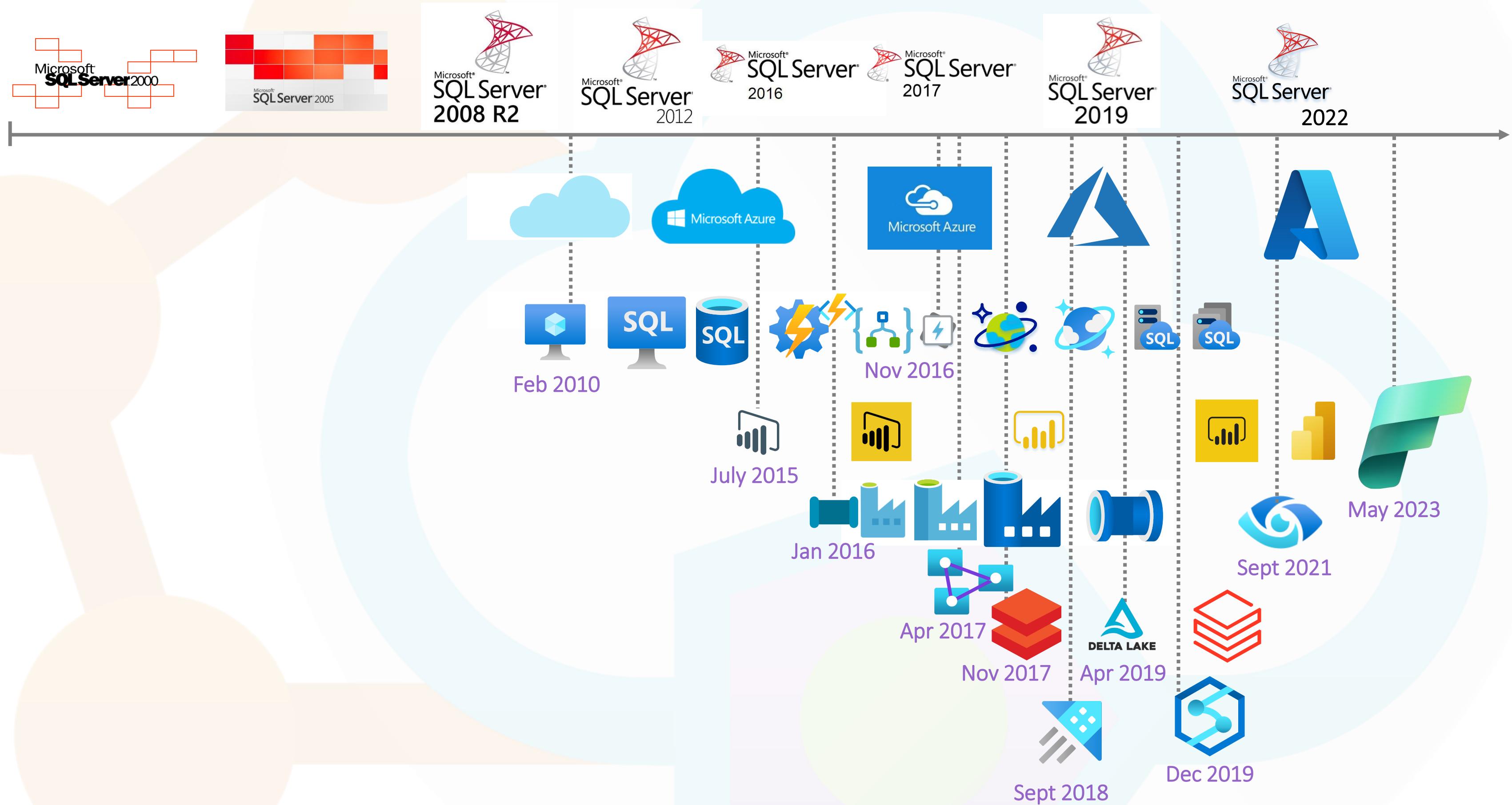
Cloud Formations - Knowledge Transfer & Training



A Timeline of Microsoft Data Technology



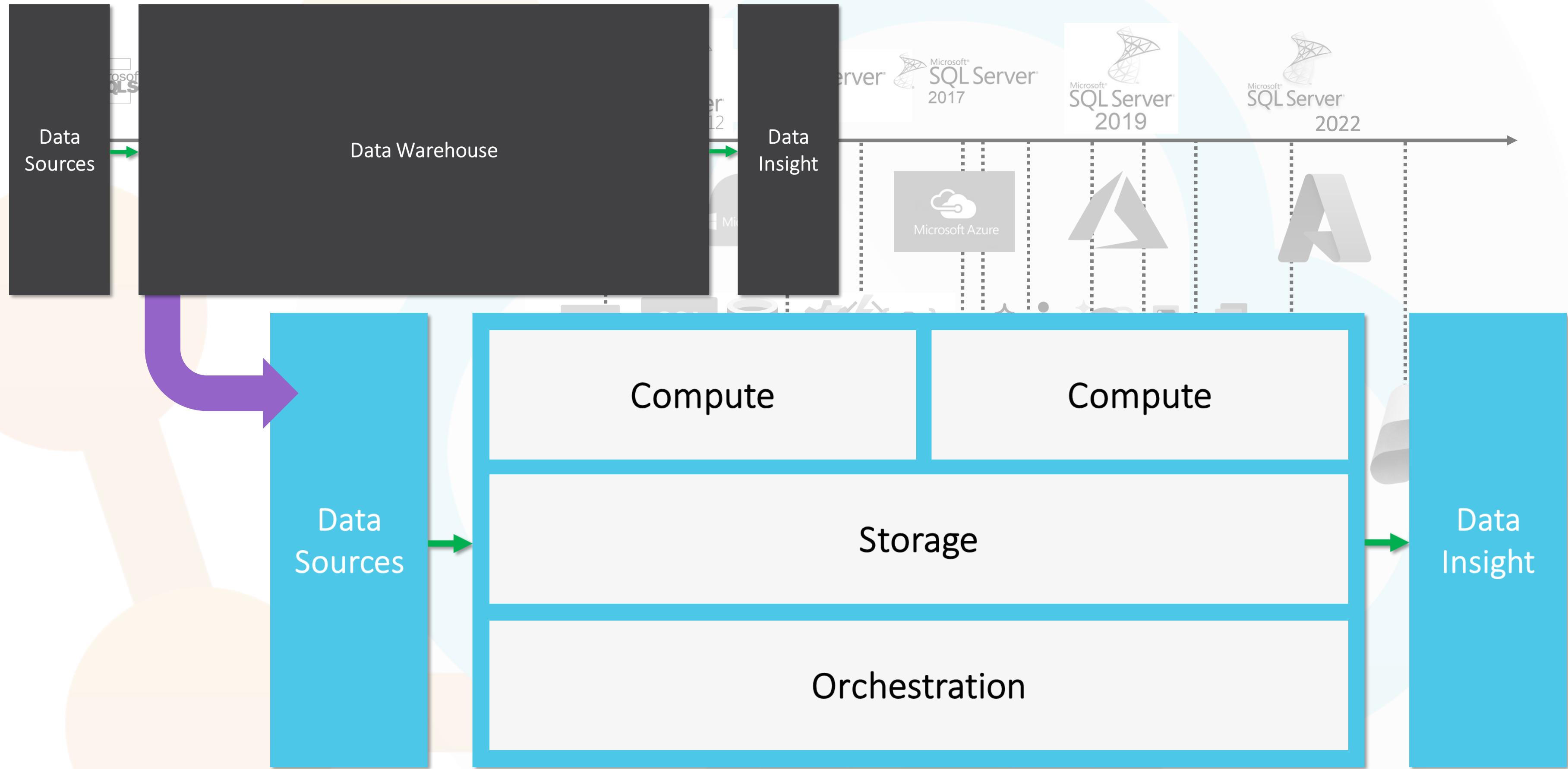
Cloud Formations - Knowledge Transfer & Training



A Timeline of Microsoft Data Technology



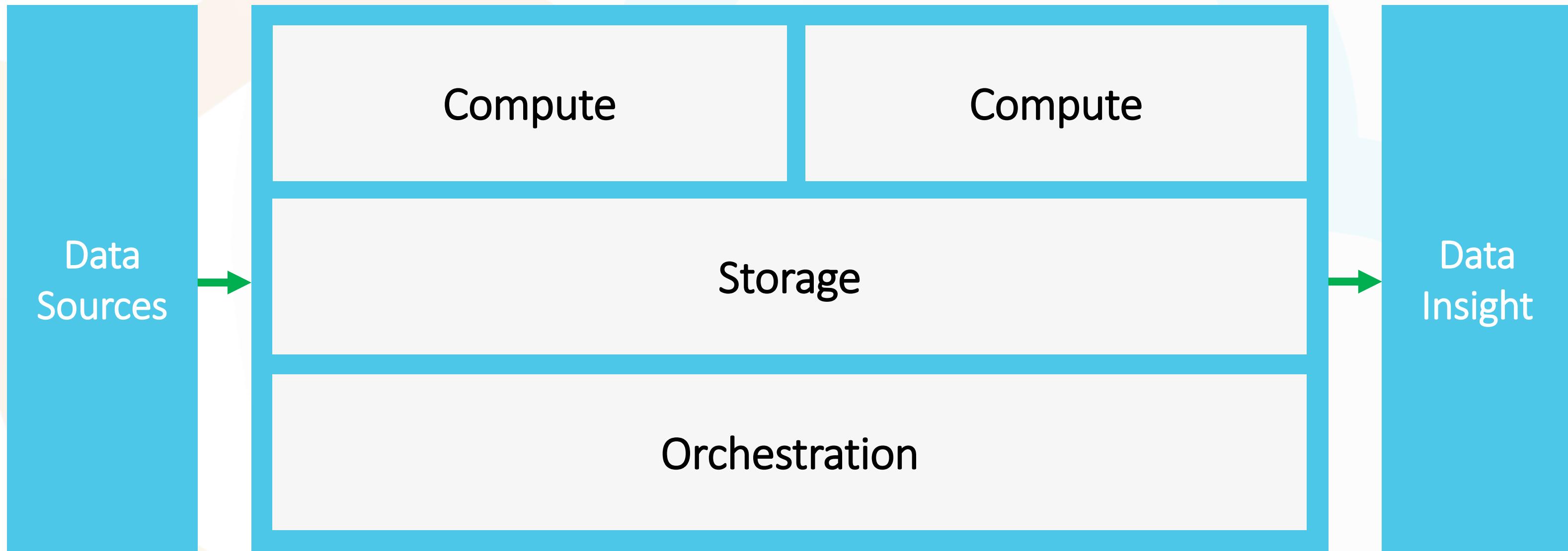
Cloud Formations - Knowledge Transfer & Training





My First Reference Architecture

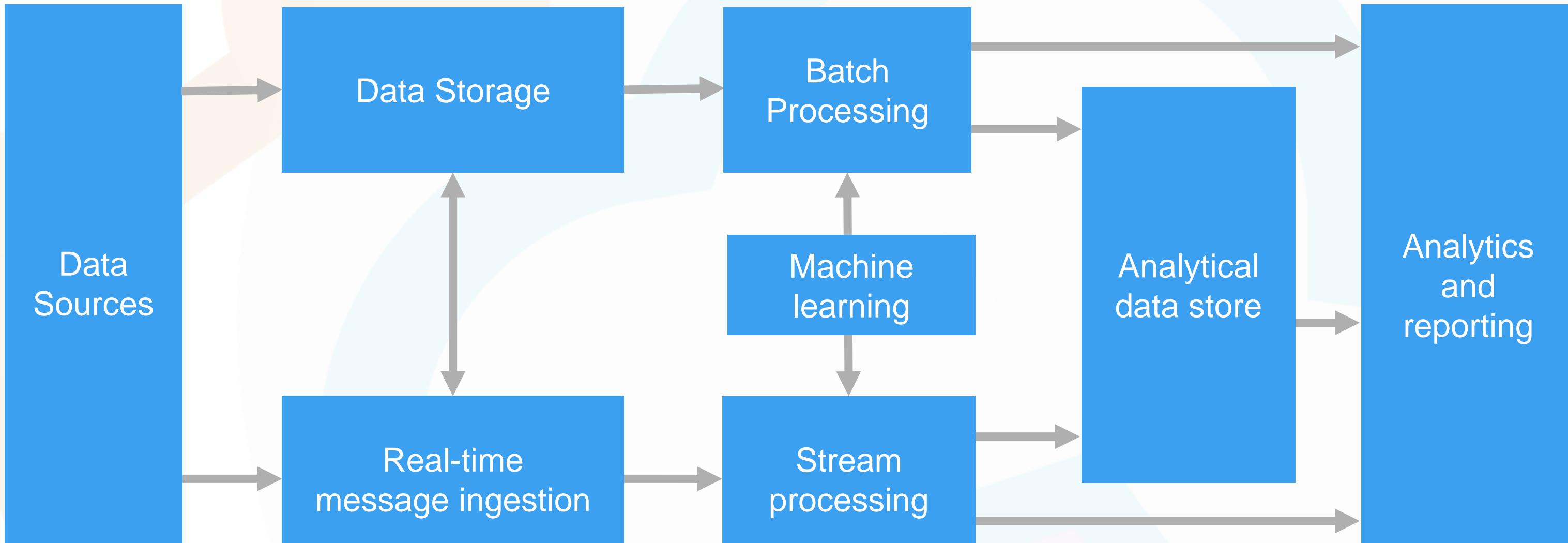
Cloud Formations - Knowledge Transfer & Training





Components of a Big Data Architecture

Cloud Formations - Knowledge Transfer & Training

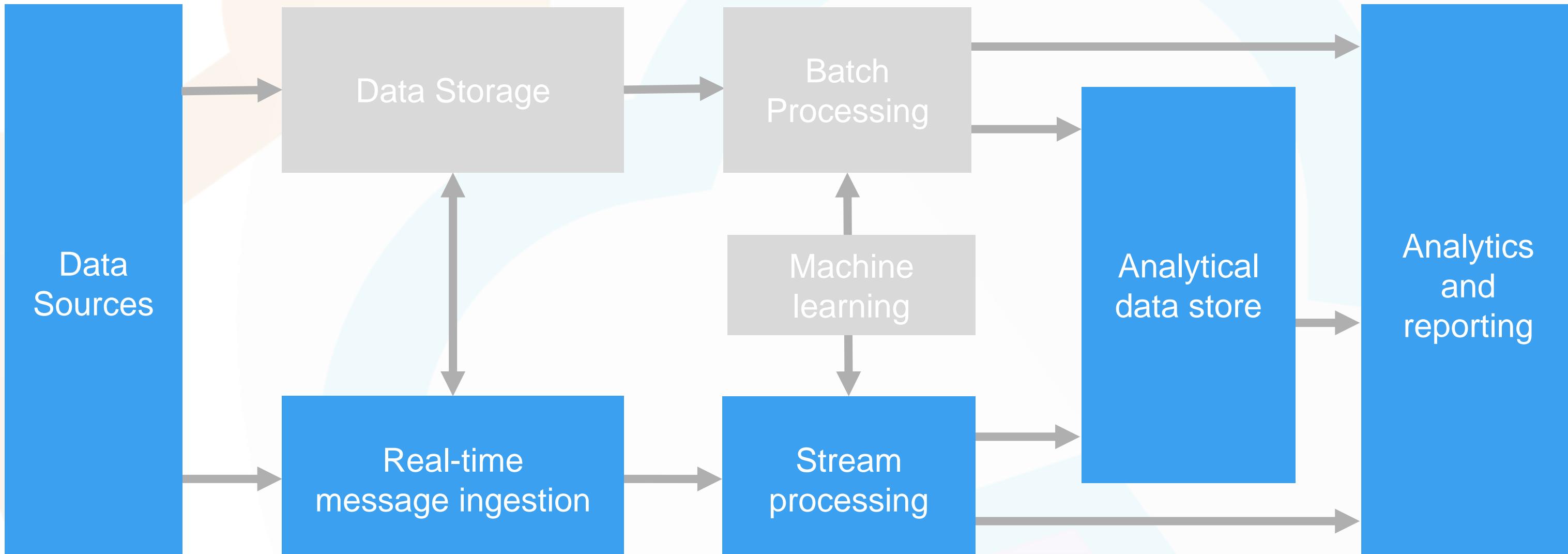


Orchestration

Components of a Big Data Architecture



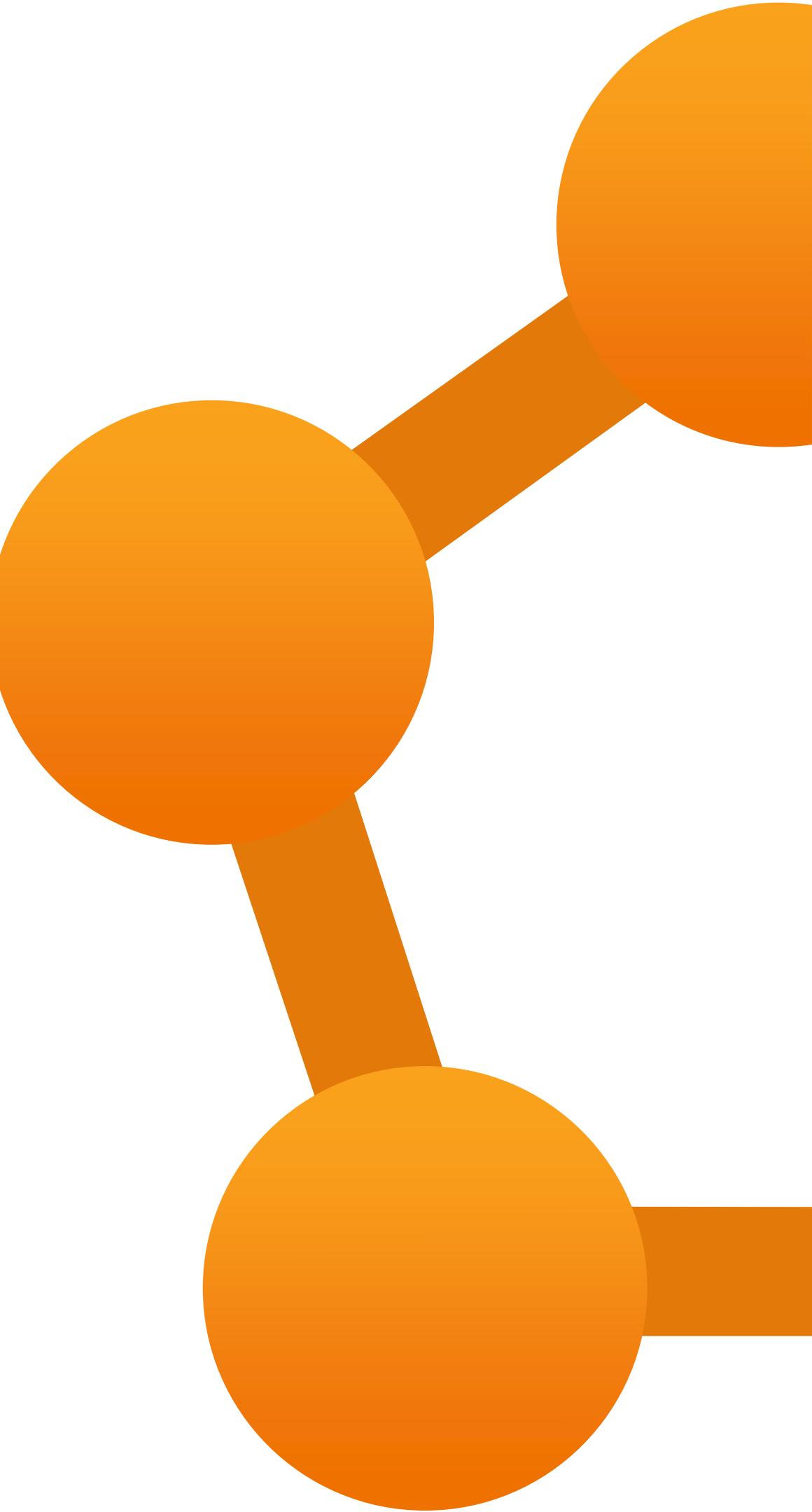
Cloud Formations - Knowledge Transfer & Training



Orchestration

An Engineers Guide To Real-time Data Analytics

Cloud Formations

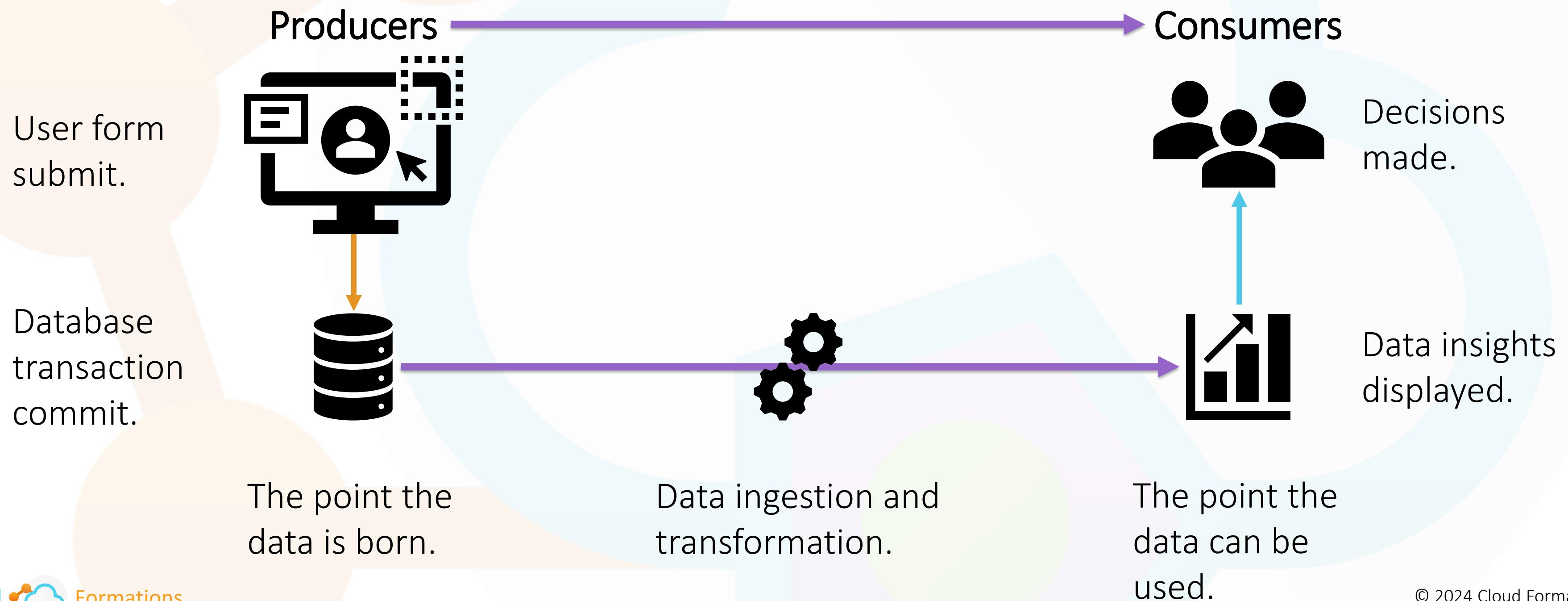


What do we mean by real-time data?

Answer (big data):

~~"Any data that you cannot process
in the time that you have/want"~~

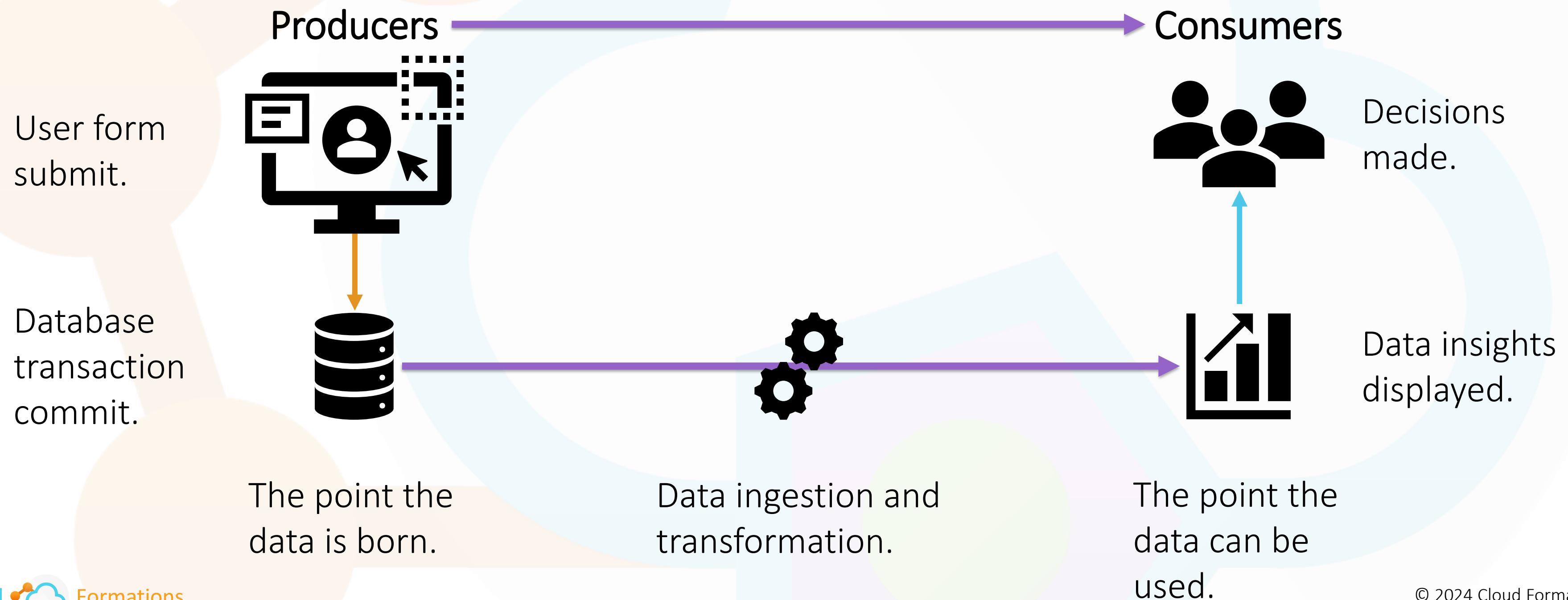
using the technology you have."



What do we mean by real-time data?

Answer:

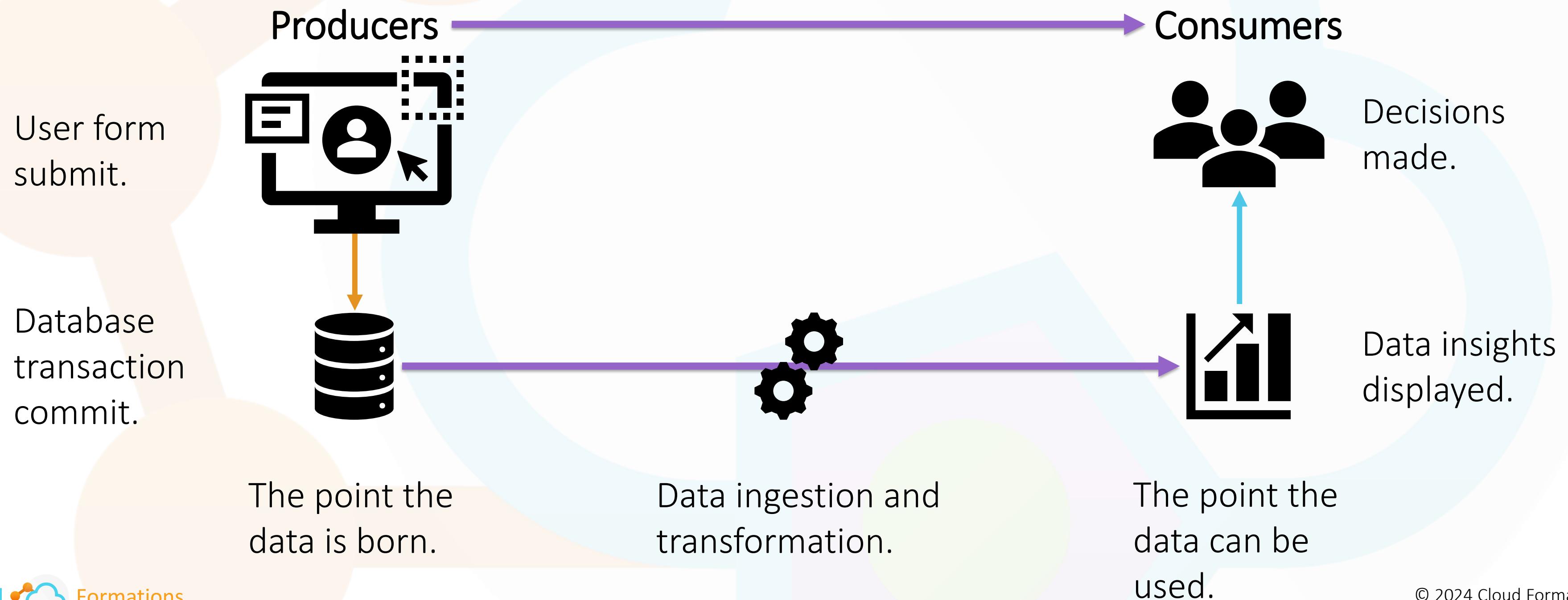
“Delivering data from the producer to consumer as fast as possible using the technology you have.”



What do we mean by near real-time data?

Answer:

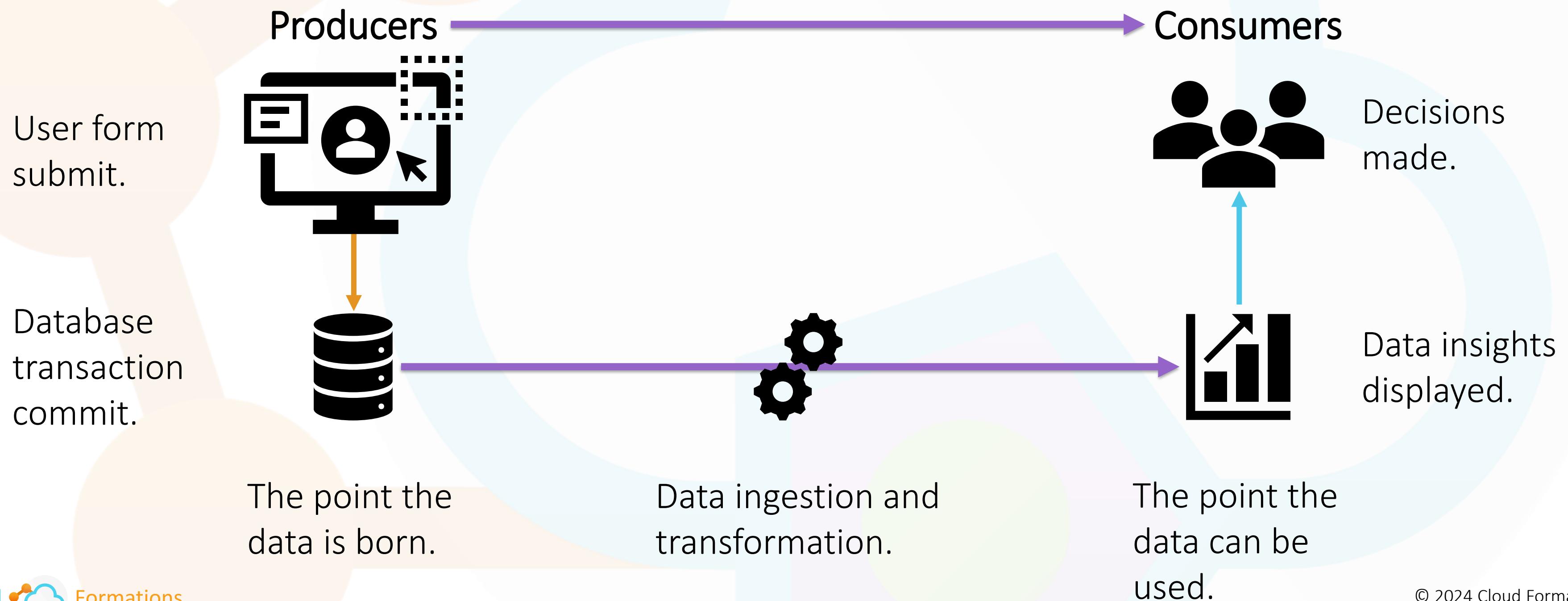
“Delivering data from the producer to consumer within 1 minute of it being created (born).”



What do we mean by a data stream?

Answer:

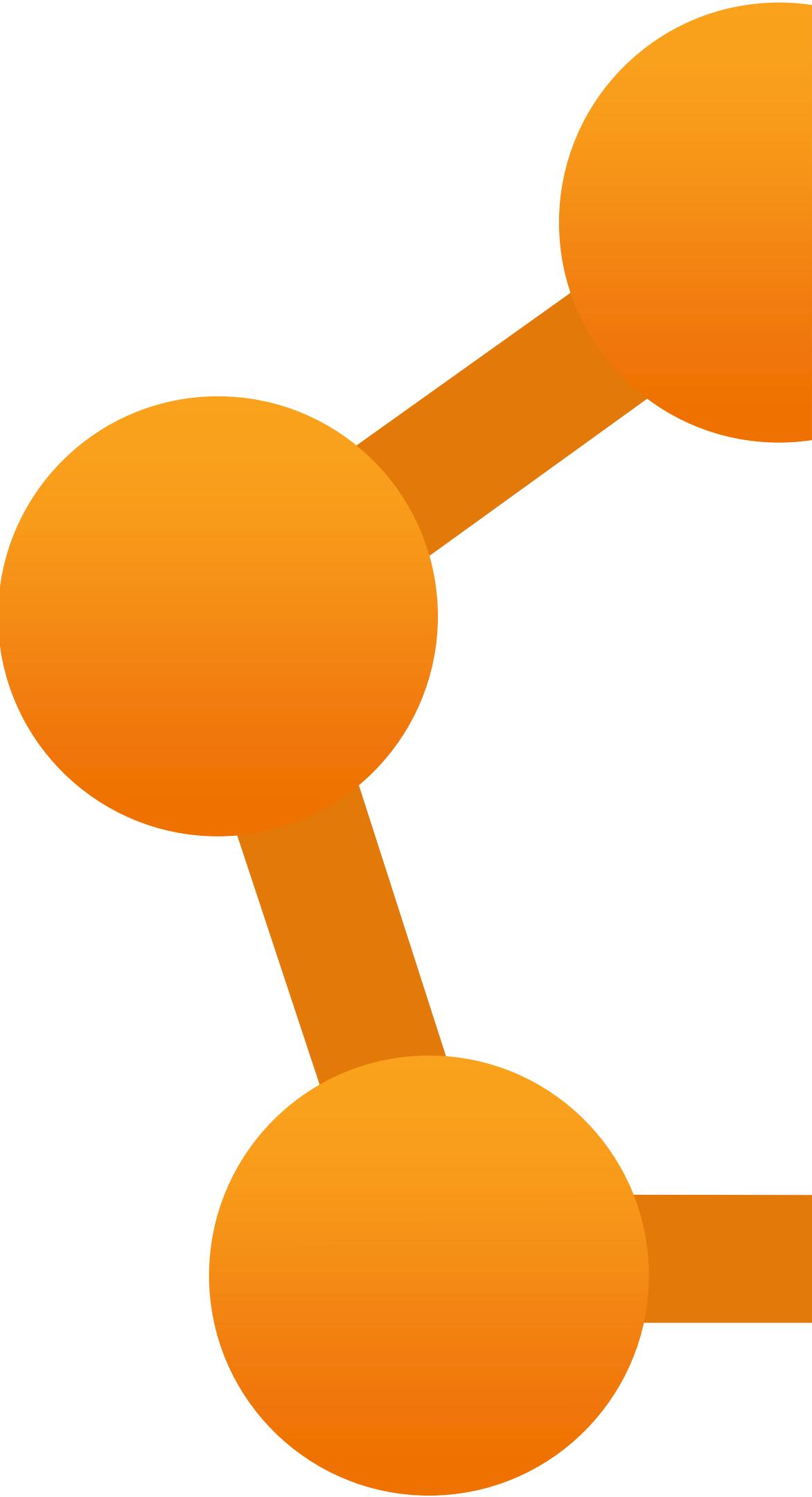
“Data that is constantly flowing from producer to consumer in near real-time.”





Tooling

Cloud Formations



The Azure Icon Game

Microsoft Azure Search resources, services, and docs (G+) paul@mrpaulandrew.com MRPAULANDREW (MRPAULANDREW)

All services | All

Databases (21)

- Azure Cosmos DB
- Azure Cosmos DB API for MongoDB
- Azure SQL
- SQL databases
- Azure Database for MySQL servers
- Azure Database for PostgreSQL servers
- SQL servers
- Dedicated SQL pools (formerly SQL DW)
- Azure Synapse Analytics
- Azure Database Migration Services
- Azure Cache for Redis
- SQL Server stretch databases
- Data factories
- Virtual clusters
- Managed databases
- Elastic Job agents
- SQL managed instances
- SQL Server registries

Analytics (15)

- Azure Synapse Analytics
- Azure Synapse Analytics (private link hubs)
- Azure Databricks
- HDInsight clusters
- Power BI Embedded
- Stream Analytics jobs
- Data Lake Analytics
- Event Hubs
- Event Hubs Clusters
- Log Analytics workspaces
- Data Lake Storage Gen1
- Power Platform
- Analysis Services
- Azure Data Explorer clusters
- Event Hubs

AI + machine learning (26)

- Azure Synapse Analytics
- Bot Services
- Cognitive Services
- Applied AI services
- Anomaly detectors
- Cognitive services multi-service account
- Computer vision
- Contact moderation
- Custom vision
- Face APIs
- Form recognizers
- Immersive readers
- Metrics advisors
- Personalizers
- QnA makers
- Cognitive Search
- Language
- Translators
- Machine learning
- Machine Learning Studio (classic) web services
- Machine Learning Studio (classic) workspaces
- Genomics accounts
- Machine Learning Studio (classic) web service plans
- Bonsai

Internet of things (25)

- IoT Hub
- Device Provisioning Services
- IoT Central Applications
- Function App
- Event Grid Subscriptions
- Time Series Insights environments
- Time Series Insights event sources
- Time Series Insights reference data sets
- Time Series Insights access policies
- Stream Analytics jobs
- Azure Cosmos DB
- Azure Cosmos DB API for MongoDB
- Logic apps
- Machine Learning Studio (classic) workspaces
- Machine Learning Studio (classic) web services
- Event Hubs
- Event Hubs Clusters
- Notification Hubs
- Notification Hub Namespaces
- Azure Maps Accounts
- Windows 10 IoT Core Services
- Azure Stack Edge / Data Box Gateway
- Azure Stack Edge
- Event Hubs

Mixed reality (2)

- Spatial Anchors Accounts
- Remote Rendering Accounts

Integration (27)

- Logic apps
- Service Bus
- API Management services
- Event Grid Subscriptions
- Event Grid Topics

can you name them all?



Azure Portal

0



Microsoft Azure

0



SQL Database



0



Databricks



0



Functions



Service Bus

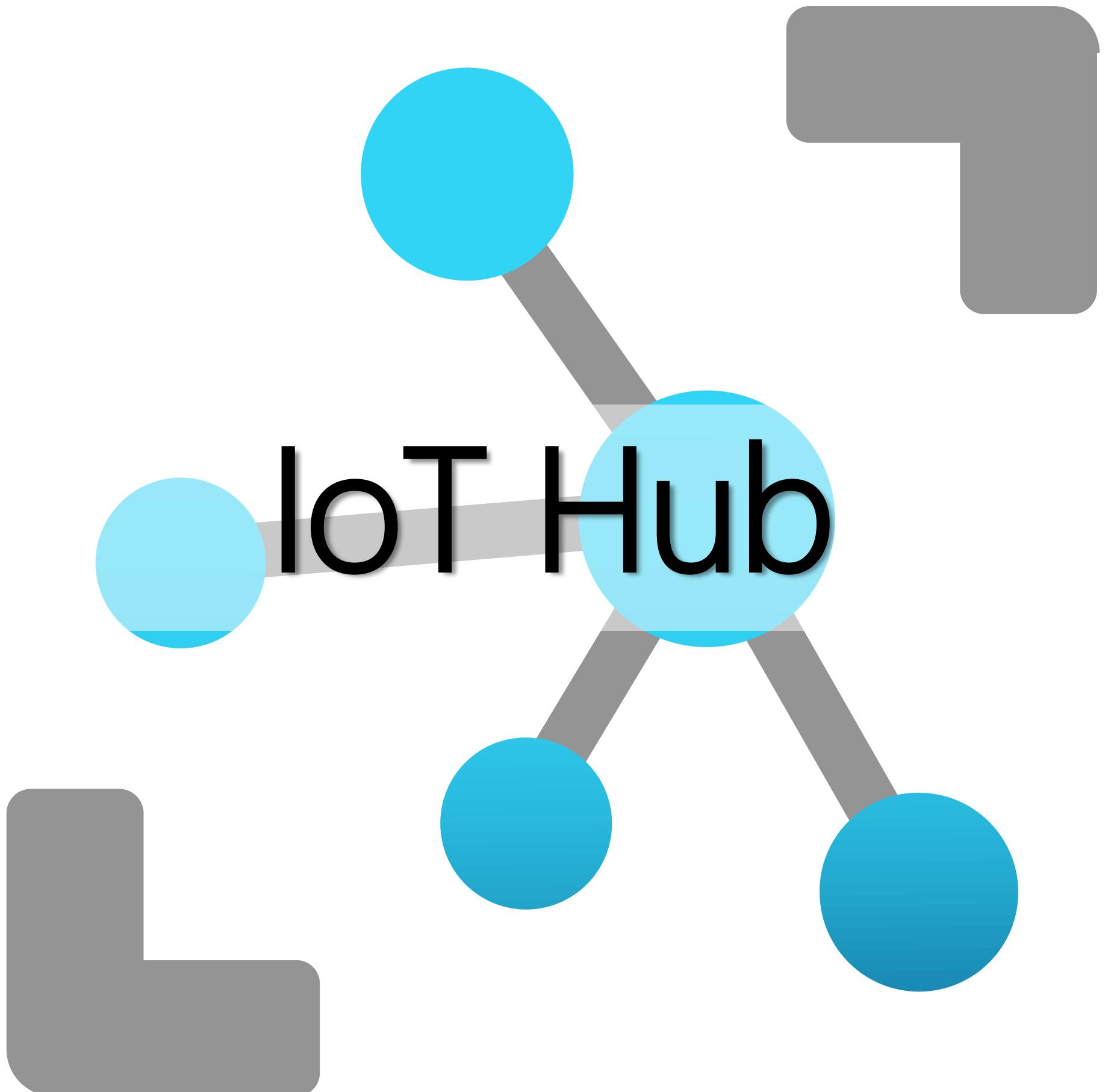


Event Grid





Event Hub



0



0



Data Explorer



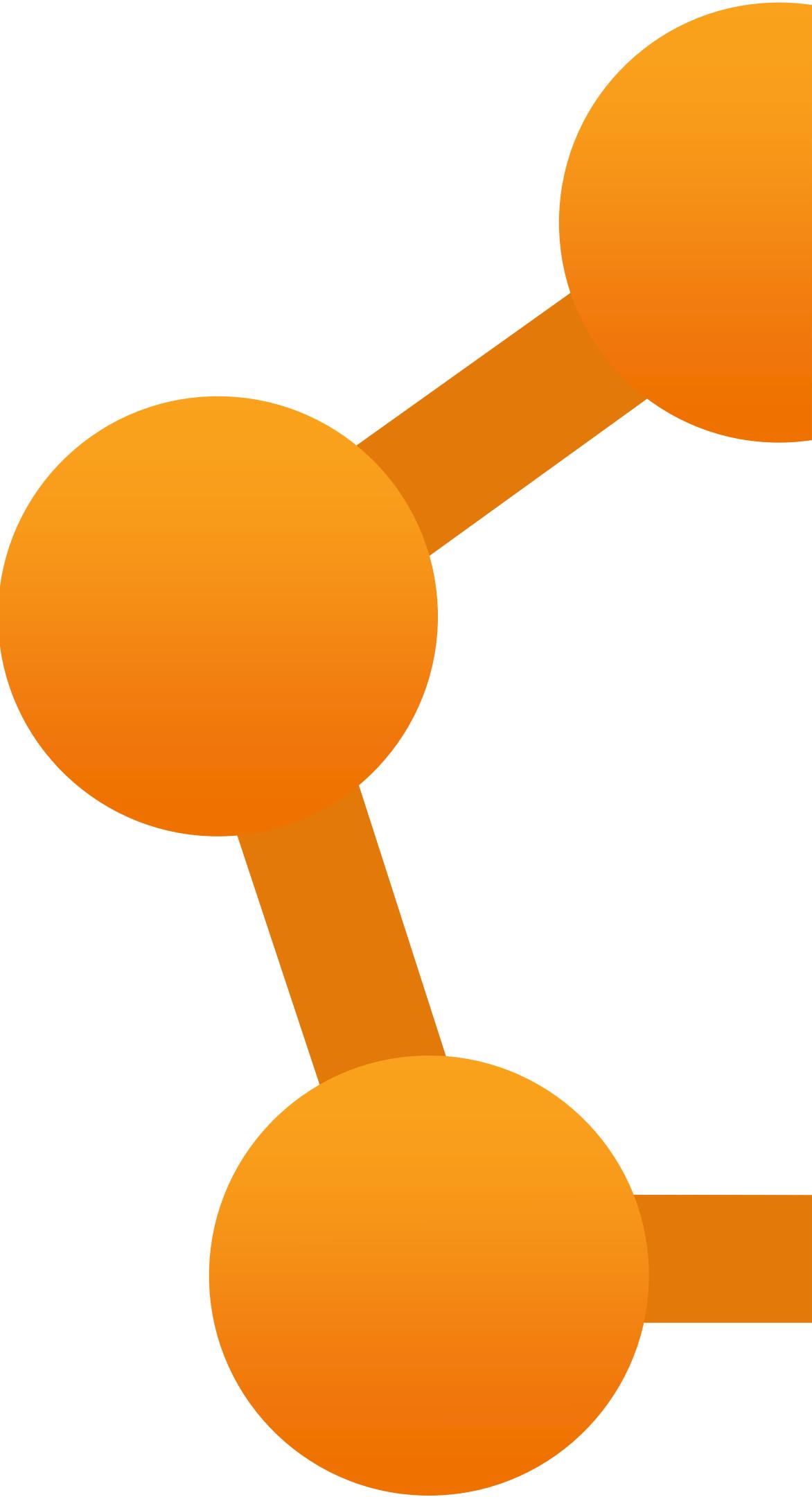
Management API

0



Tooling

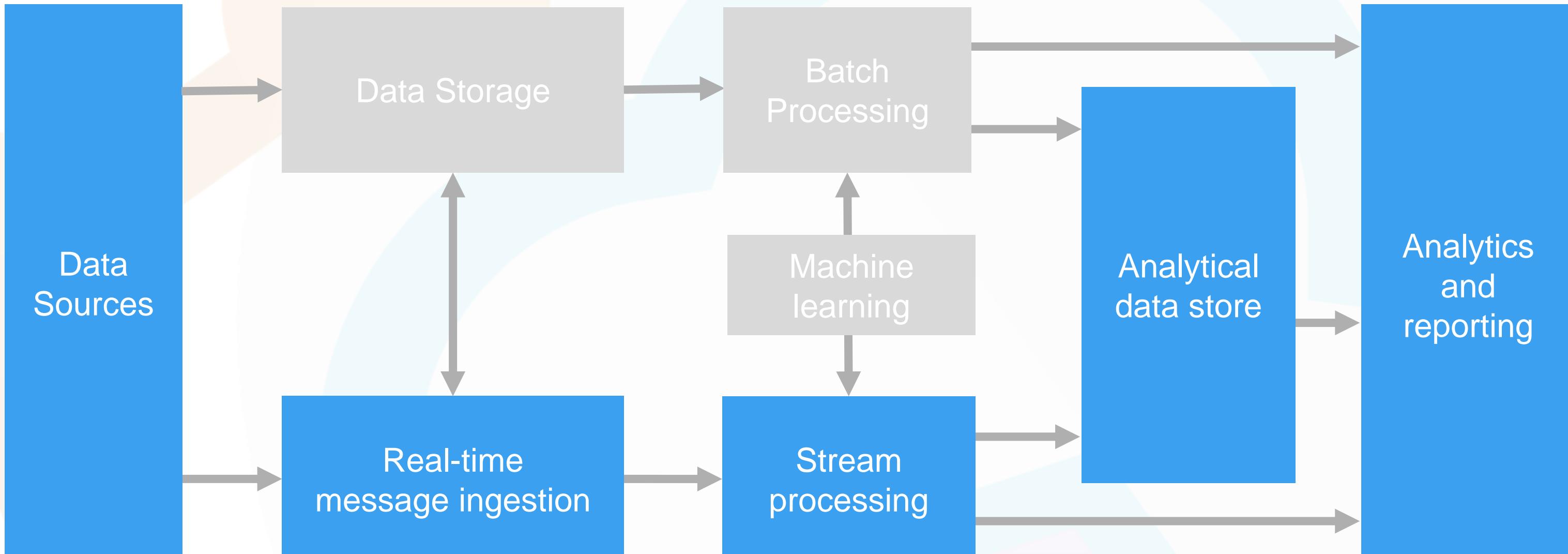
Cloud Formations



Components of a Big Data Architecture



Cloud Formations - Knowledge Transfer & Training

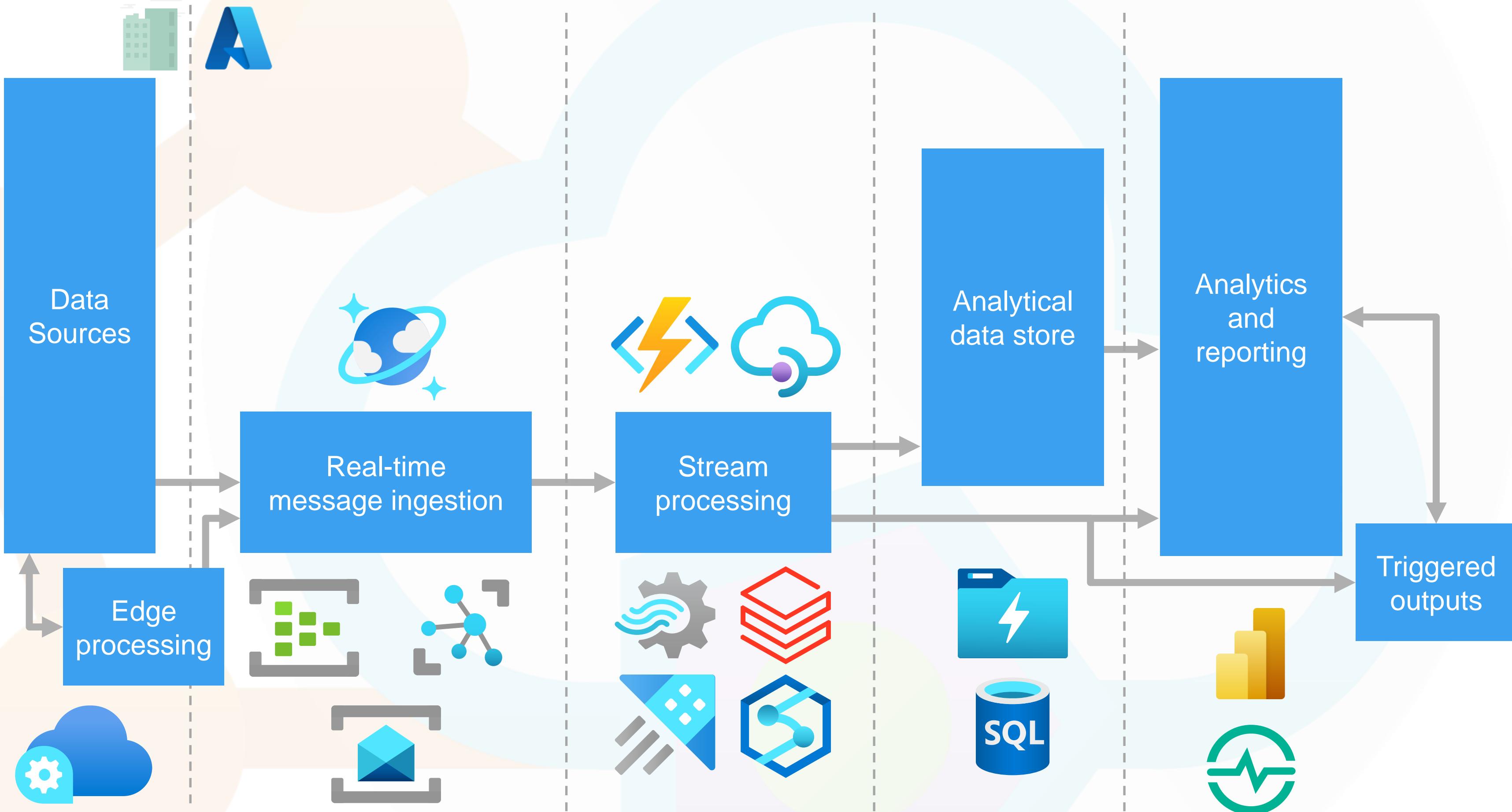


Orchestration

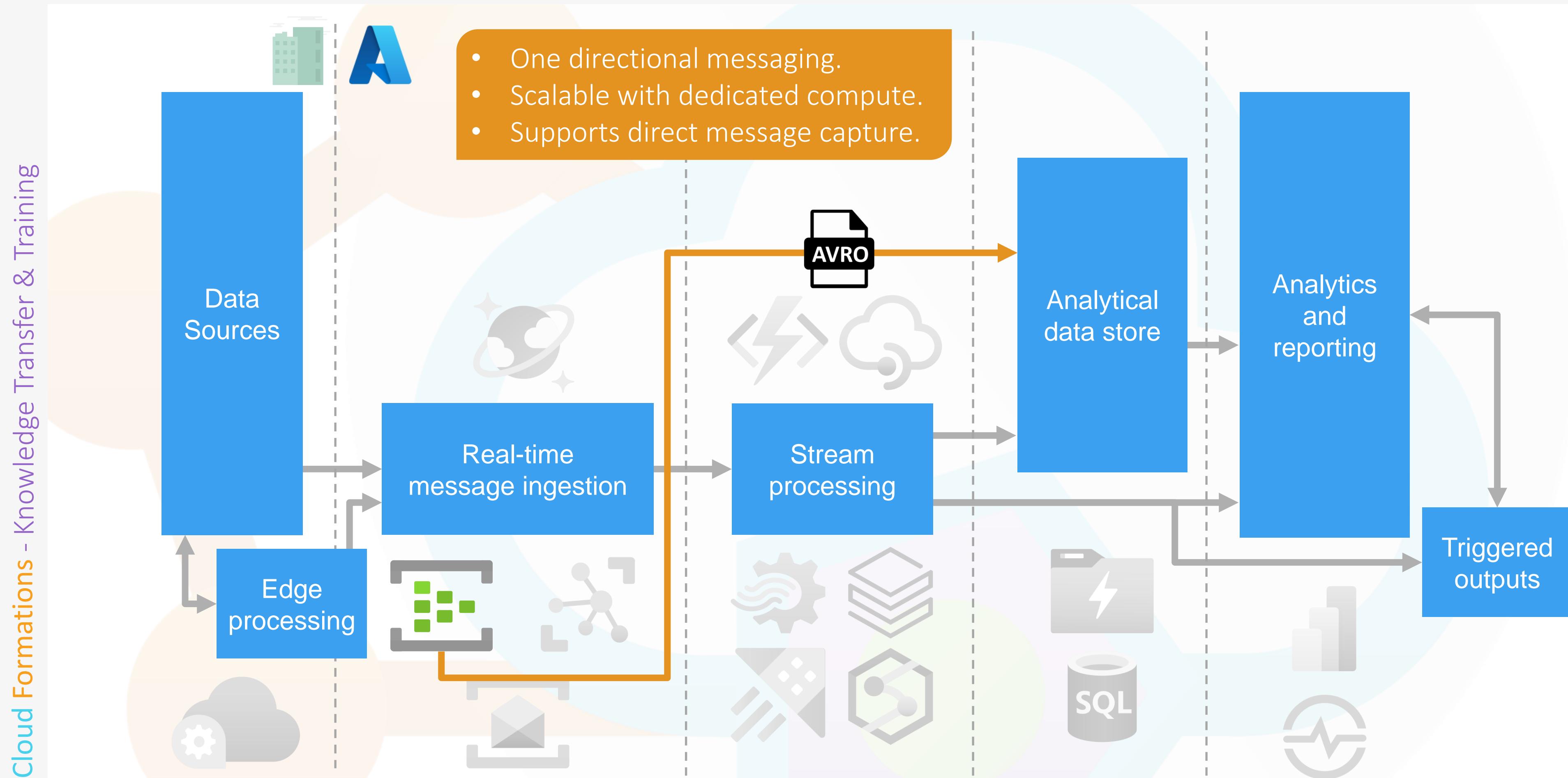
Azure Tooling



Cloud Formations - Knowledge Transfer & Training



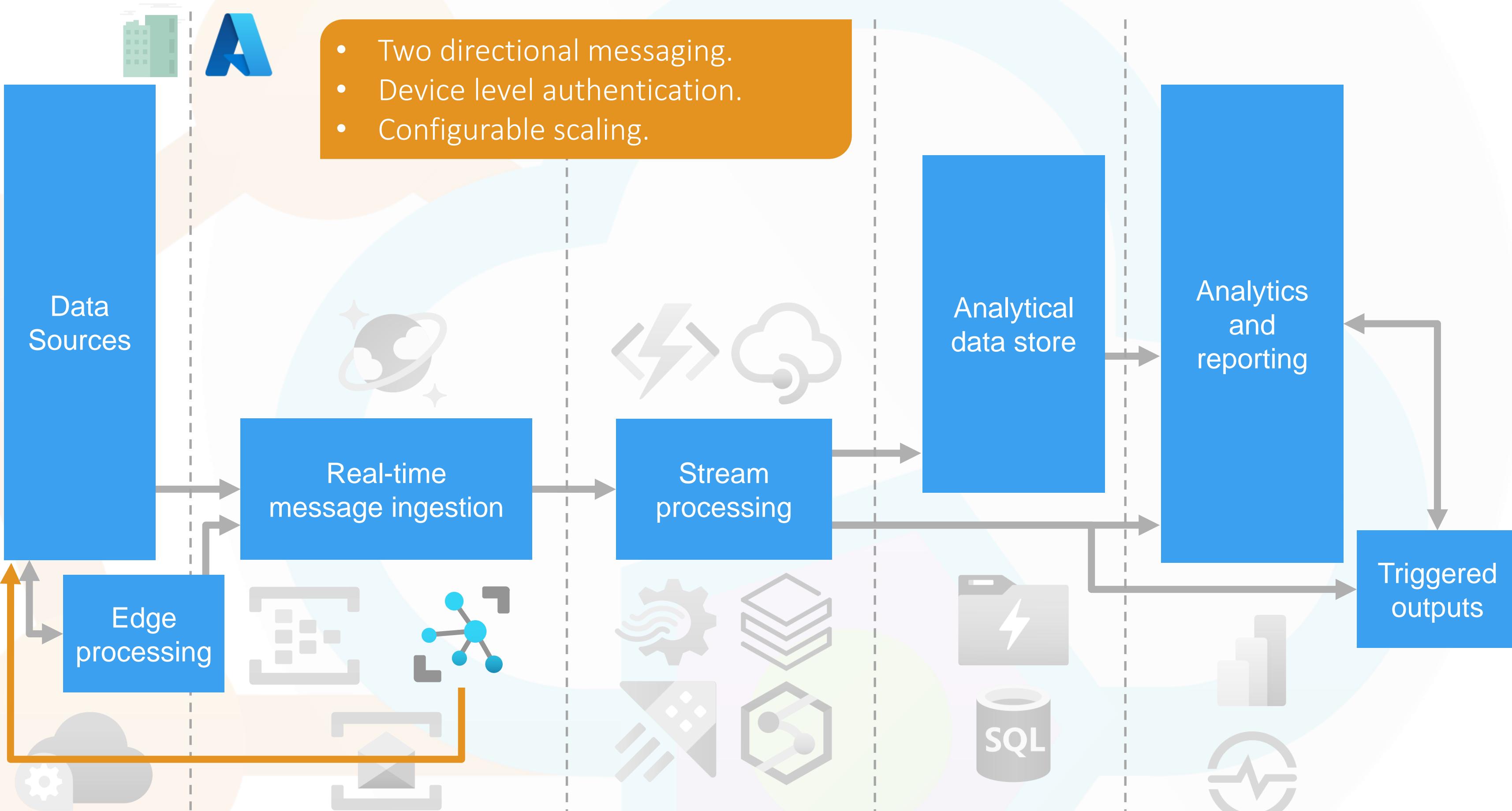
Azure Tooling – Event Hub



Azure Tooling – IoT Hub



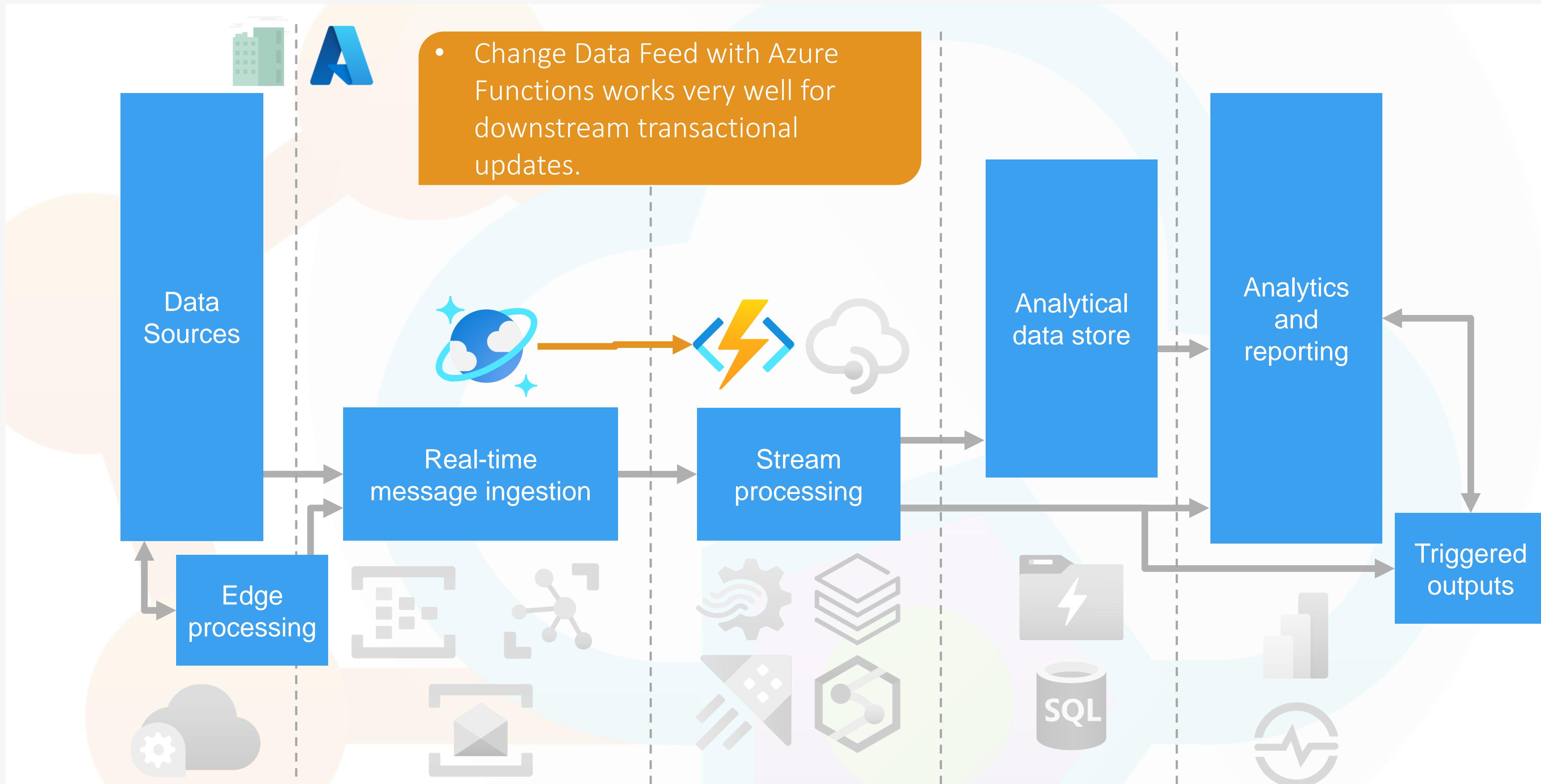
Cloud Formations - Knowledge Transfer & Training



Azure Tooling – Cosmos DB



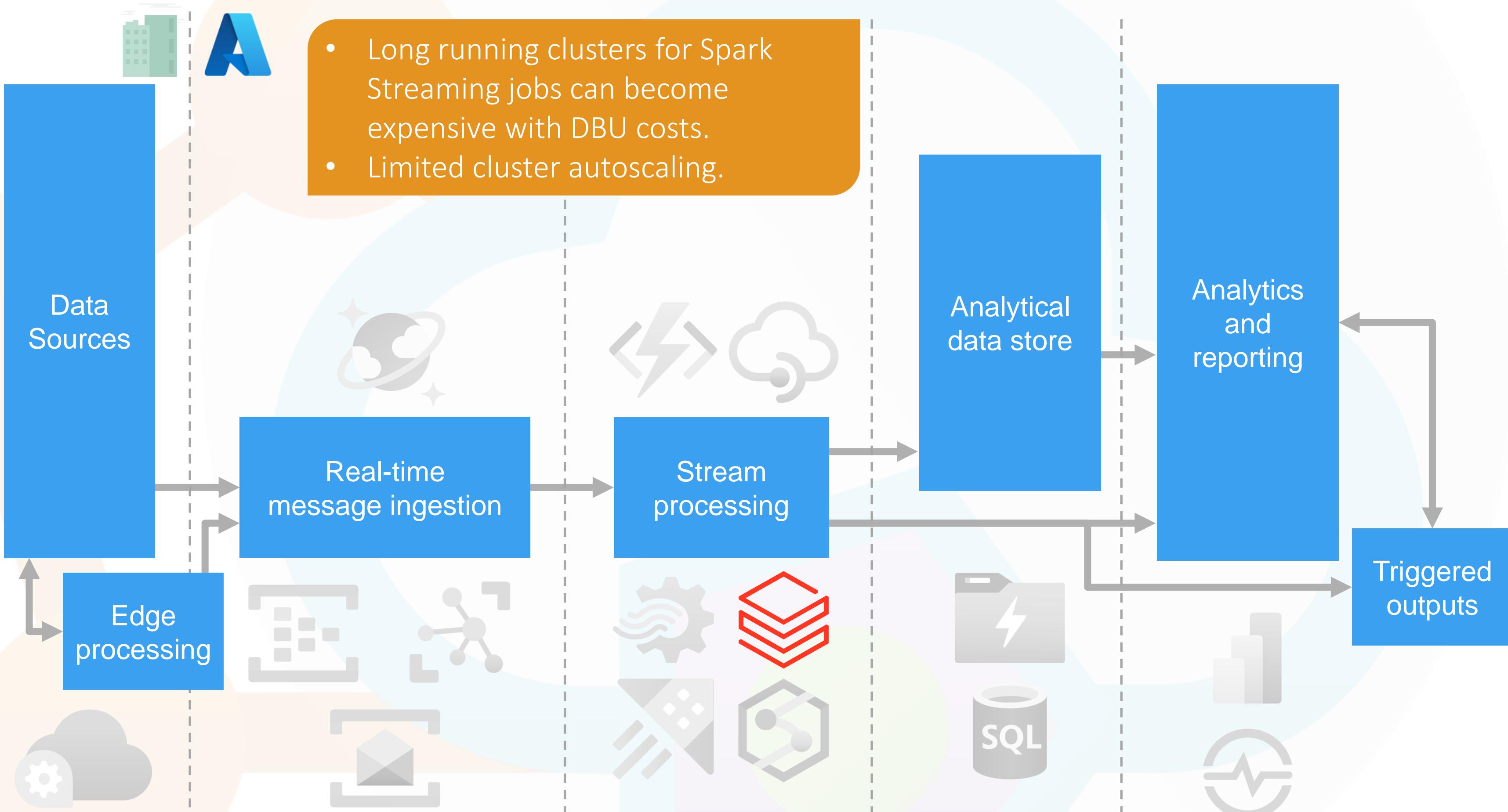
Cloud Formations - Knowledge Transfer & Training



Azure Tooling – Databricks



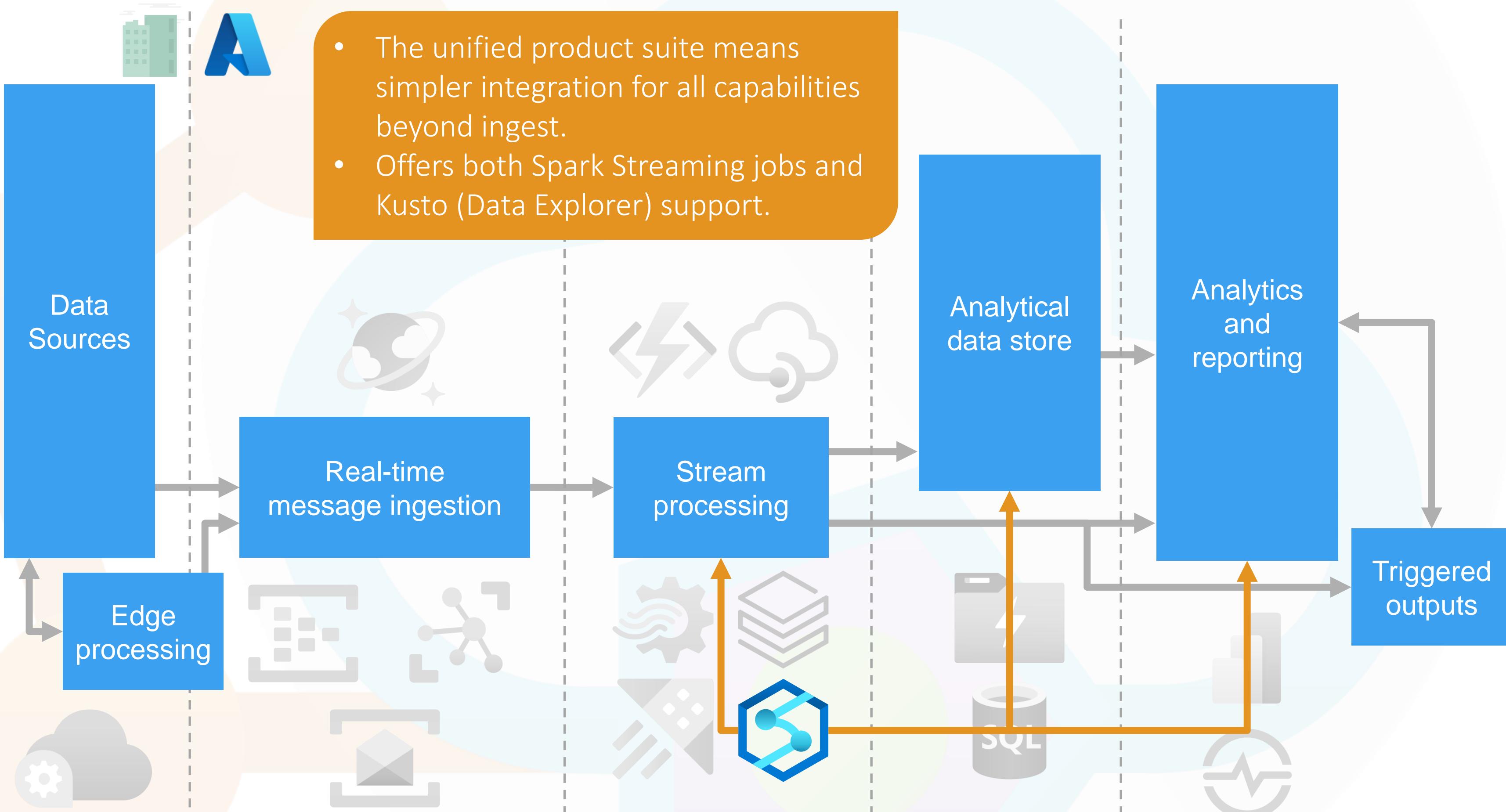
Cloud Formations - Knowledge Transfer & Training



Azure Tooling – Synapse Analytics



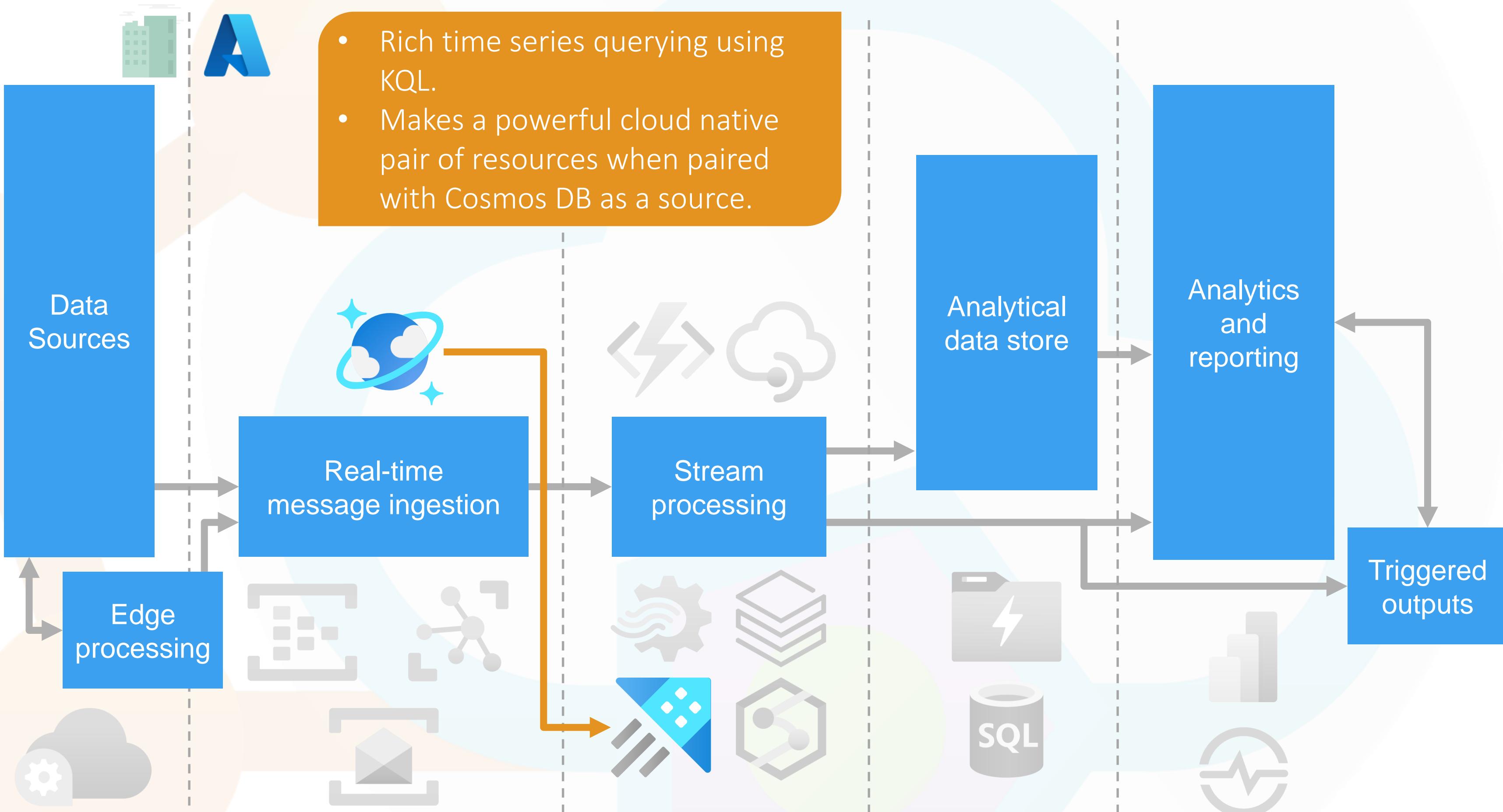
Cloud Formations - Knowledge Transfer & Training



Azure Tooling – Data Explorer



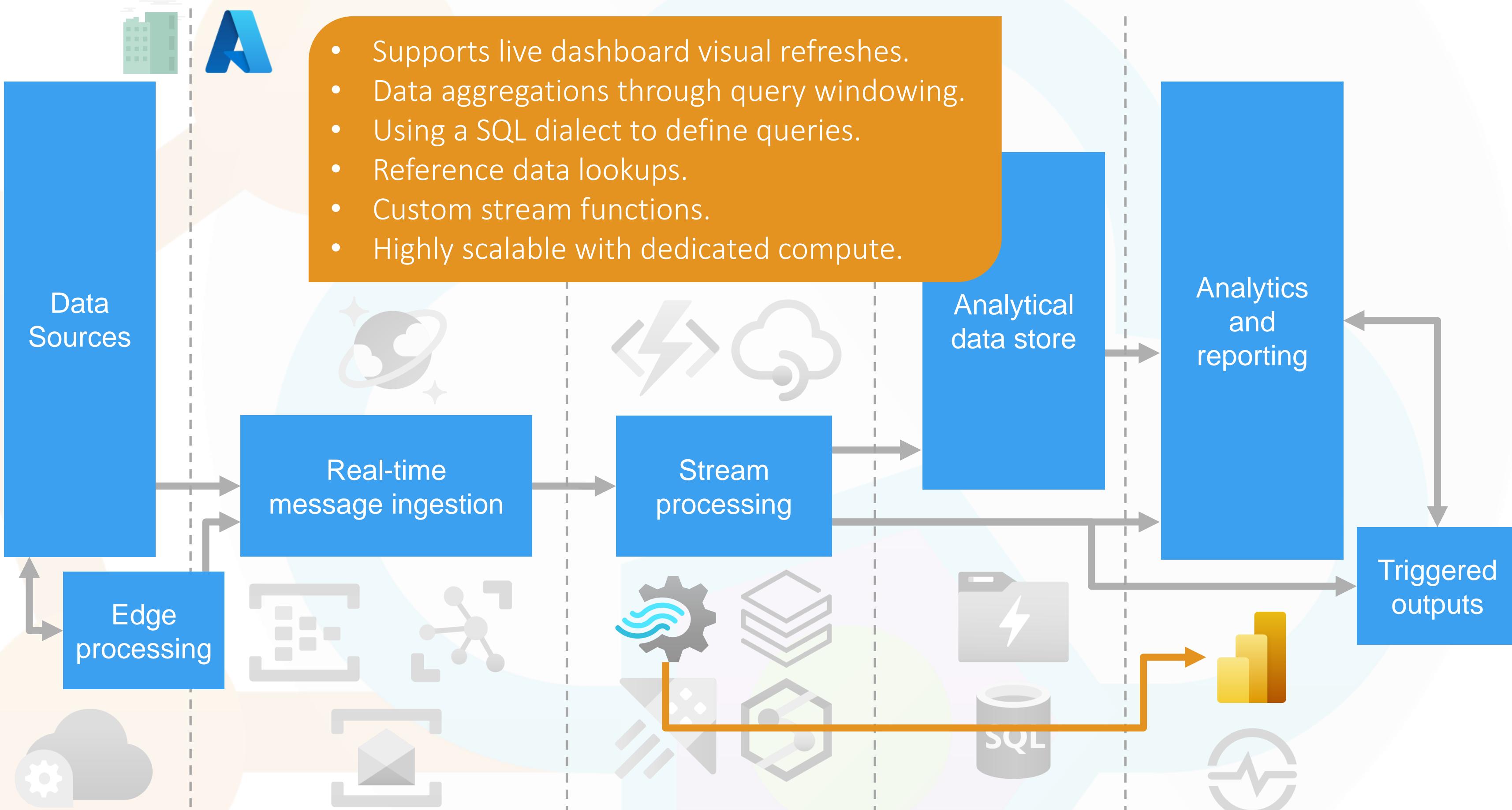
Cloud Formations - Knowledge Transfer & Training



Azure Tooling – Stream Analytics



Cloud Formations - Knowledge Transfer & Training



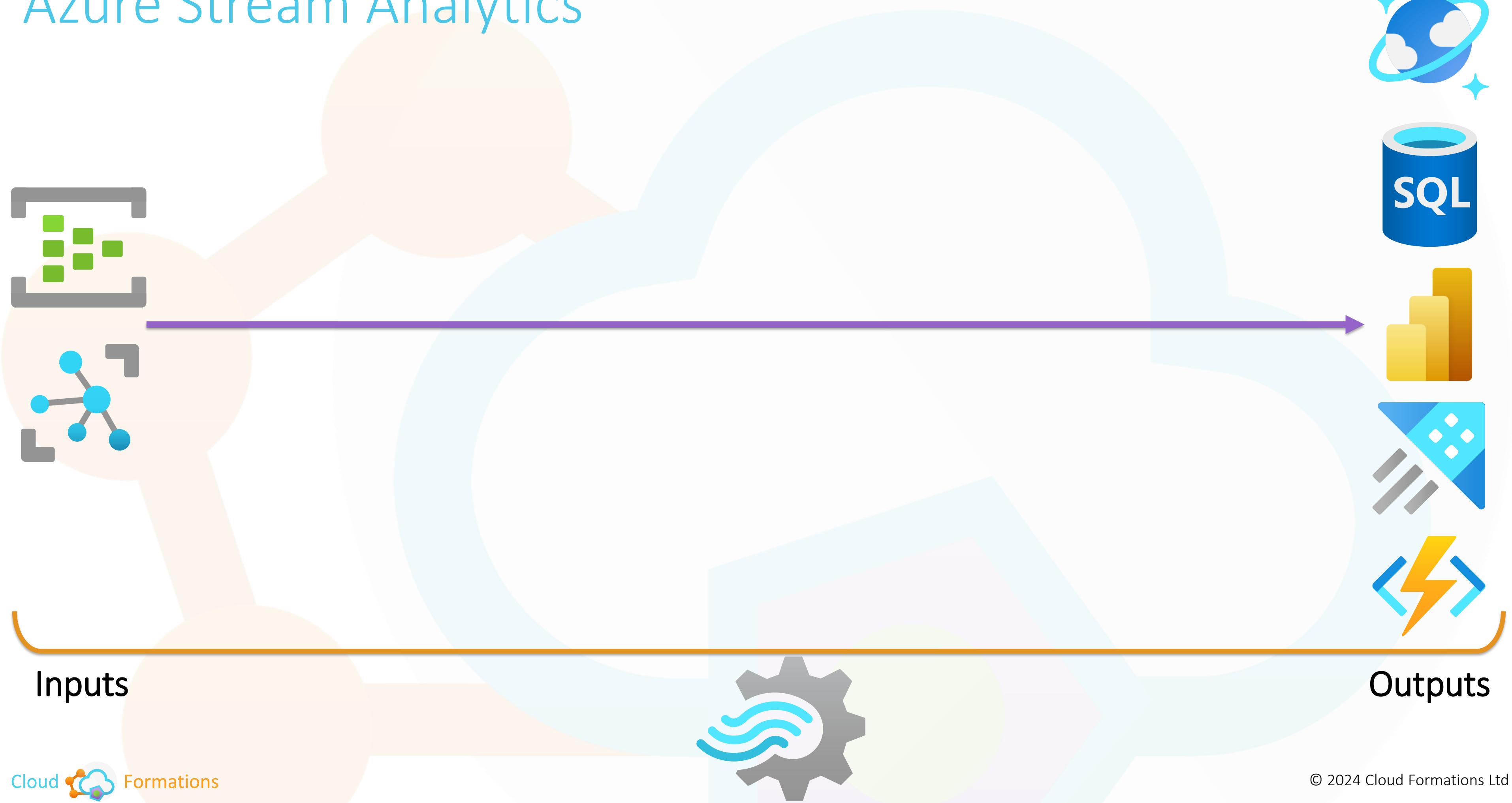


Azure Tooling – Stream Analytics

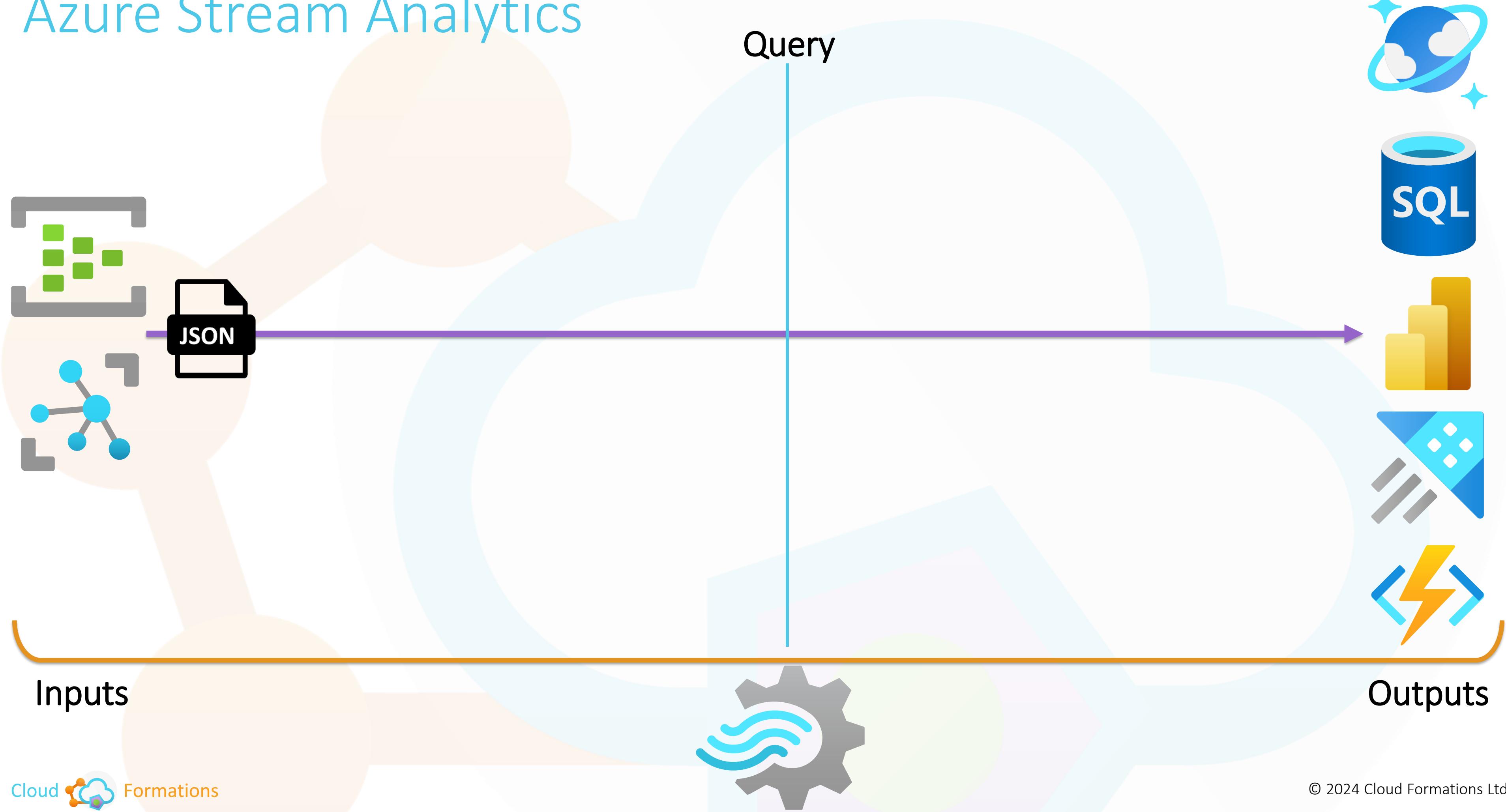
Cloud Formations - Knowledge Transfer & Training



Azure Stream Analytics



Azure Stream Analytics



Azure Stream Analytics

Query

SELECT

```
SUM(CAST(eh.UnitPrice AS float)) AS UnitPrice,  
SUM(CAST(eh.LineTotal AS float)) AS LineTotal,  
SUM(CAST(eh.OrderQty AS float)) AS OrderQty,  
COUNT(*) AS RecordCount
```

INTO

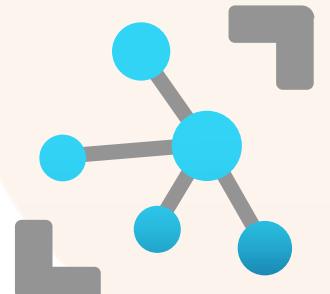
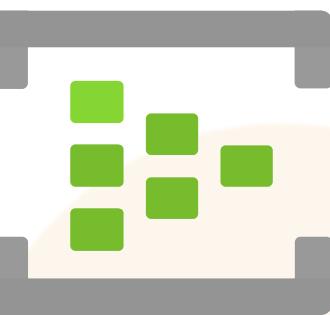
```
[powerbi]
```

FROM

```
[eventhub] AS eh
```

GROUP BY

```
eh.EventEnqueuedUtcTime,  
SlidingWindow(second, 30)
```



Inputs

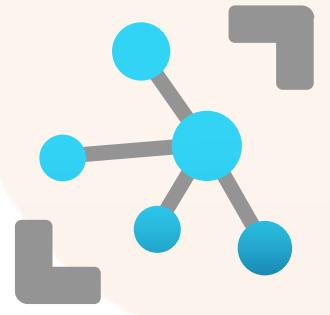
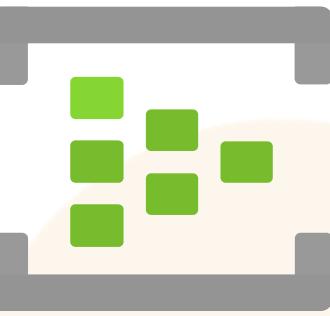


Outputs

Azure Stream Analytics

Query

```
SELECT  
    eh.EventEnqueuedUtcTime,  
    prd.Name AS ProductName,  
    SUM(CAST(eh.UnitPrice AS float)) AS UnitPrice,  
    SUM(CAST(eh.LineTotal AS float)) AS LineTotal,  
    SUM(CAST(eh.OrderQty AS float)) AS OrderQty,  
    COUNT(*) AS RecordCount  
INTO  
    [powerbi]  
FROM  
    [eventhub] AS eh  
    INNER JOIN [Products] AS prd  
        ON eh.[ProductId] = prd.[ProductId]  
GROUP BY  
    eh.EventEnqueuedUtcTime,  
    prd.Name,  
    SlidingWindow(second, 30)
```



Inputs

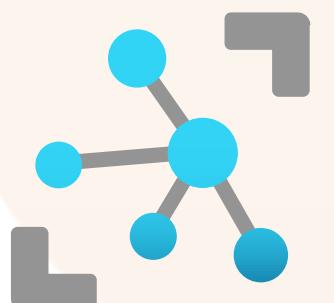
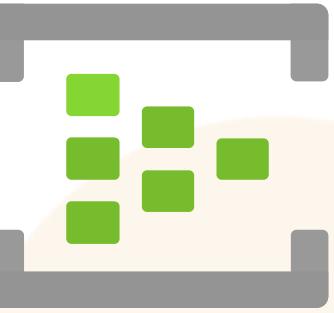
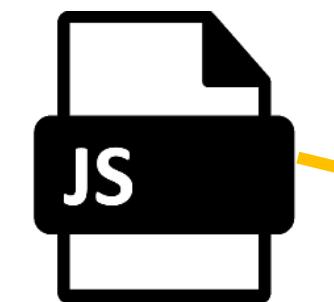


Outputs

Azure Stream Analytics

Query

```
SELECT
    eh.EventEnqueuedUtcTime,
    udf.CleanString(prd.Name) AS ProductName,
    SUM(CAST(eh.UnitPrice AS float)) AS UnitPrice,
    SUM(CAST(eh.LineTotal AS float)) AS LineTotal,
    SUM(CAST(eh.OrderQty AS float)) AS OrderQty,
    COUNT(*) AS RecordCount
INTO
    [powerbi]
FROM
    [eventhub] AS eh
    INNER JOIN [Products] AS prd
        ON eh.[ProductId] = prd.[ProductId]
GROUP BY
    eh.EventEnqueuedUtcTime,
    prd.Name,
    SlidingWindow(second, 30)
```

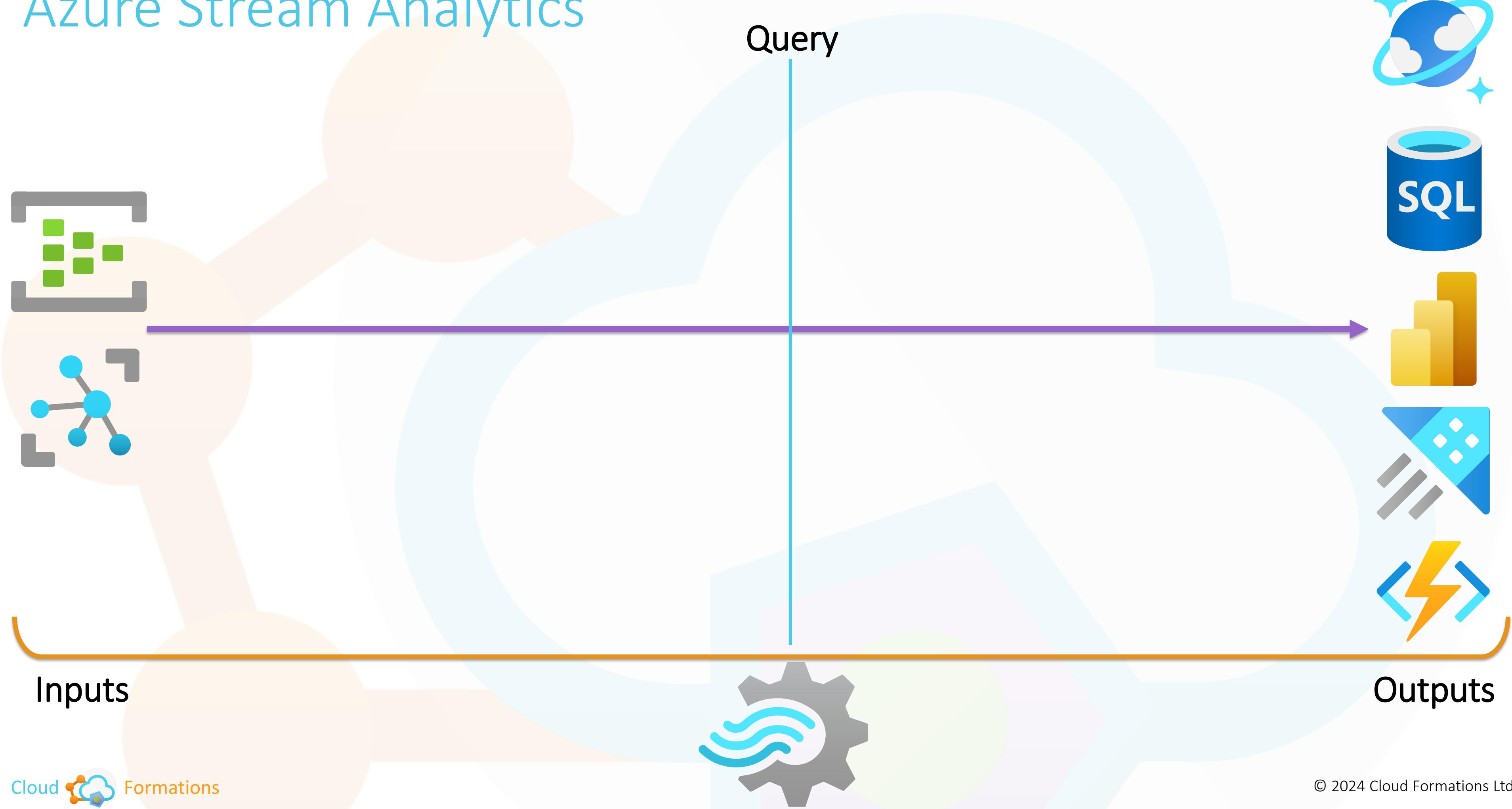


Inputs ...
Source Data
Reference Data
Custom Functions

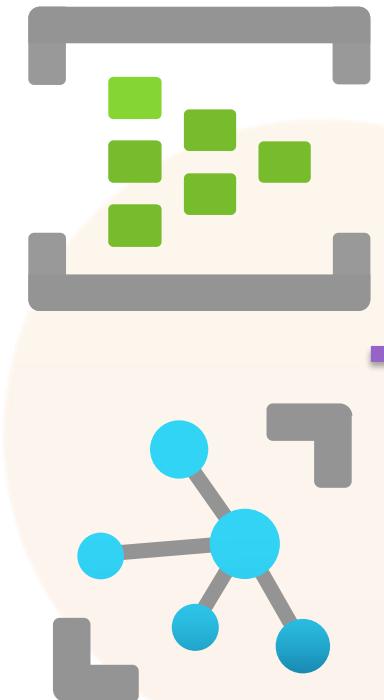


Outputs

Azure Stream Analytics



Azure Stream Analytics



Query Window

- 1. Sliding
- 2. Tumbling
- 3. Hopping

“A window contains event data along a timeline and enables you to perform various operations against the events within that window.”

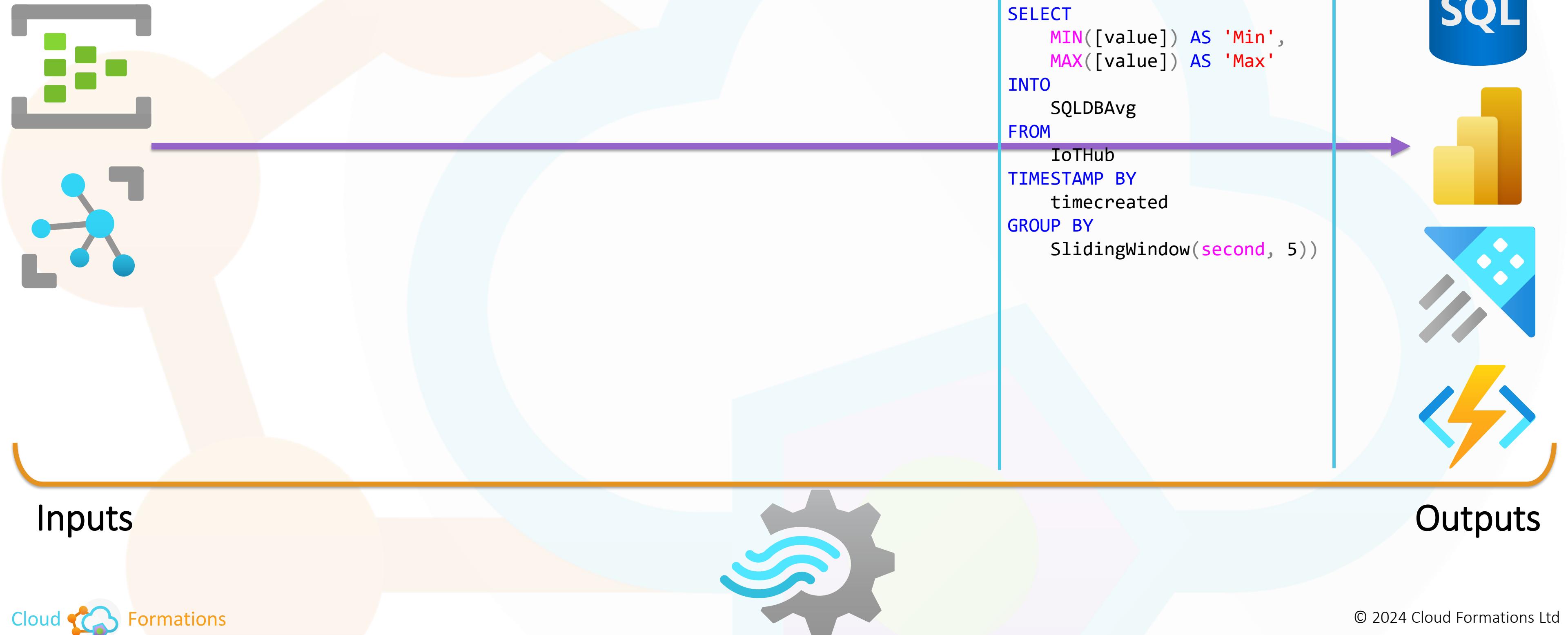
Inputs



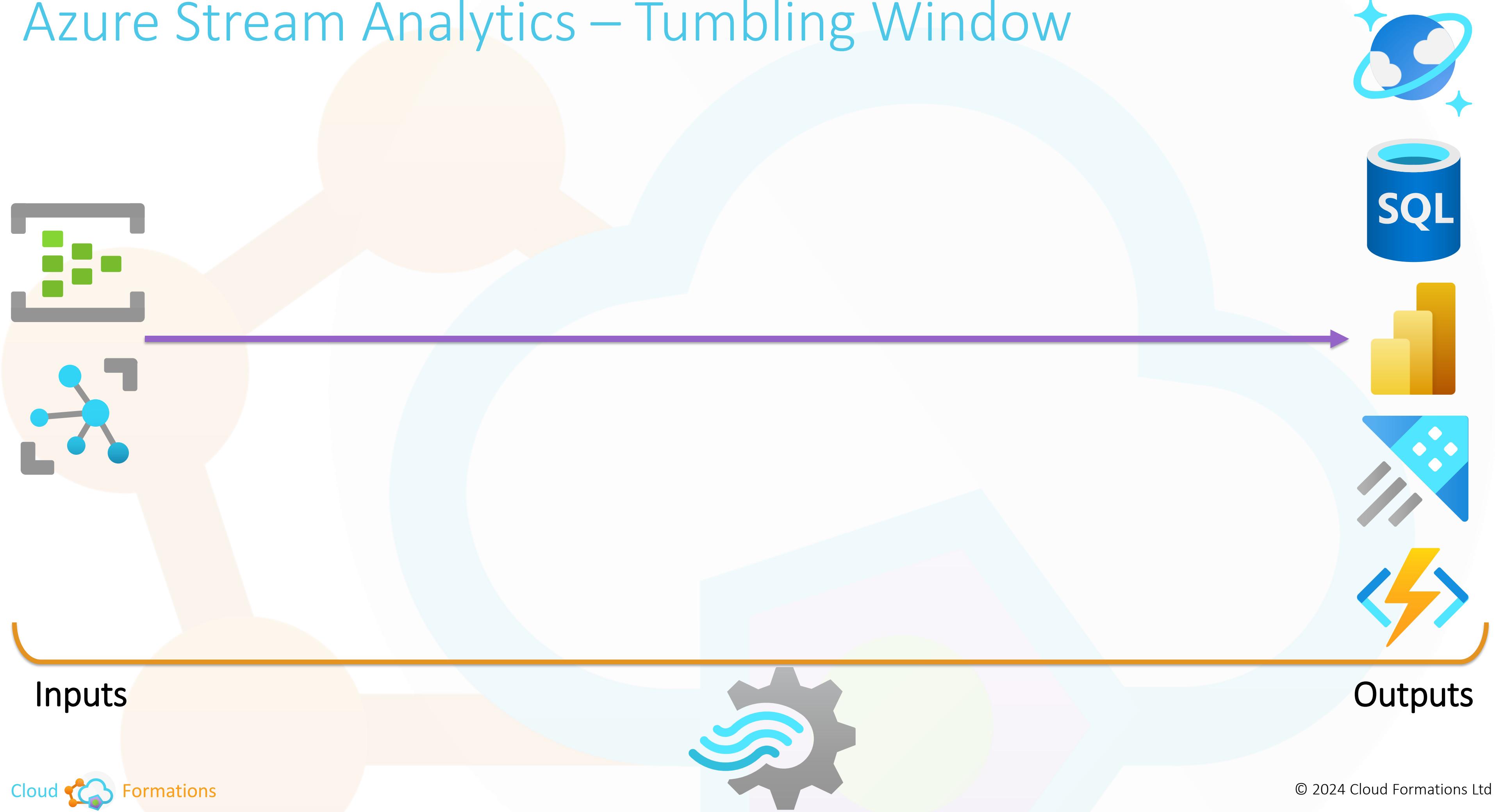
Outputs



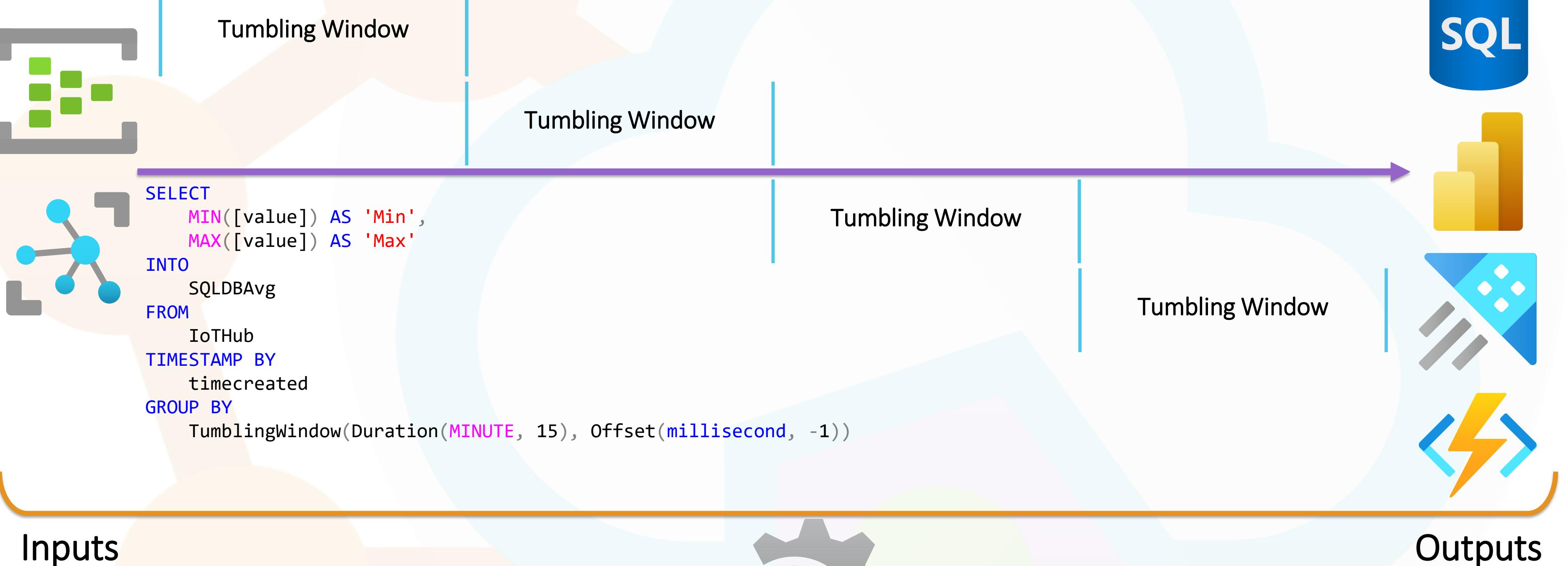
Azure Stream Analytics – Sliding Window



Azure Stream Analytics – Tumbling Window



Azure Stream Analytics – Tumbling Window

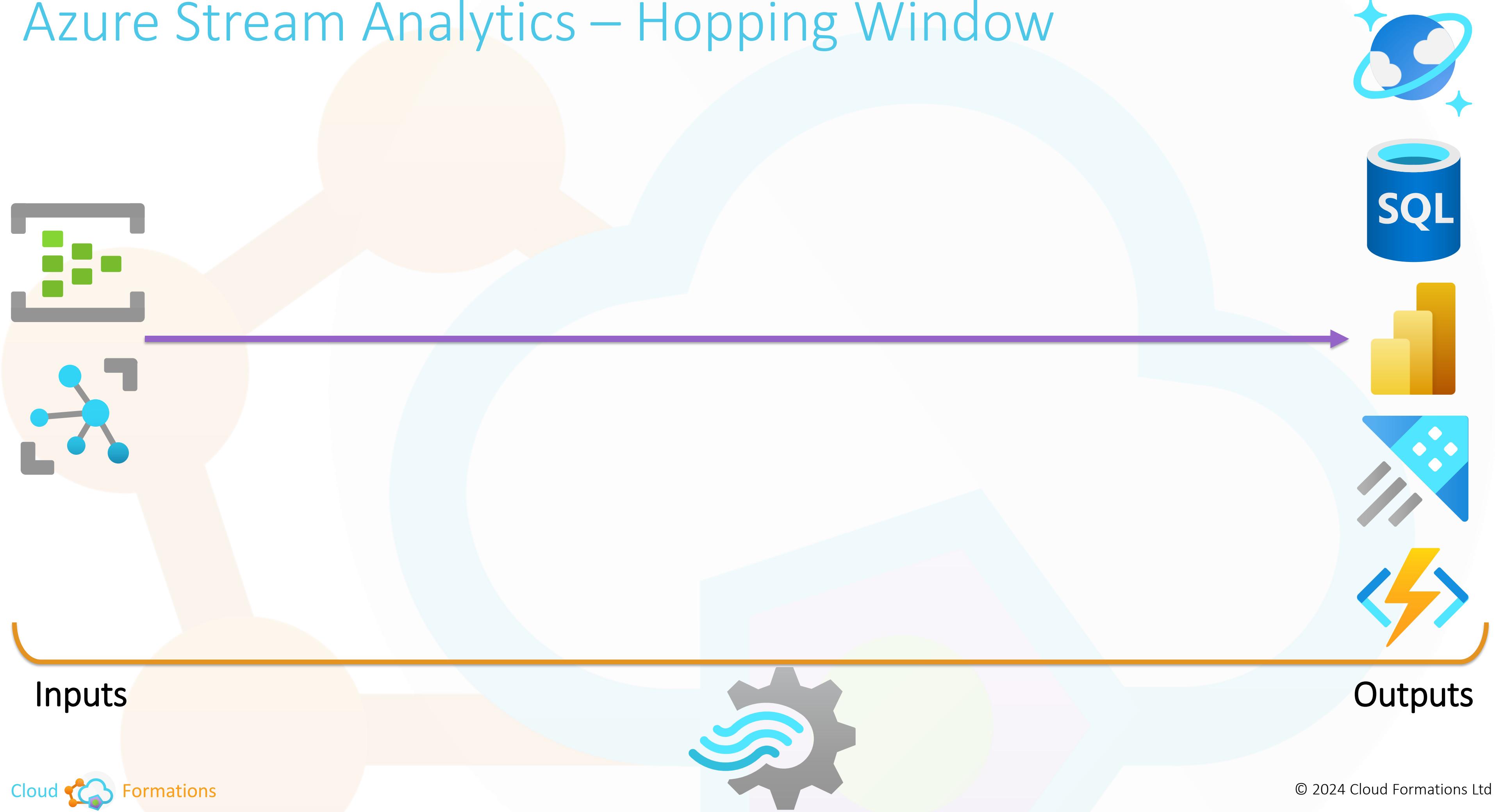


Inputs

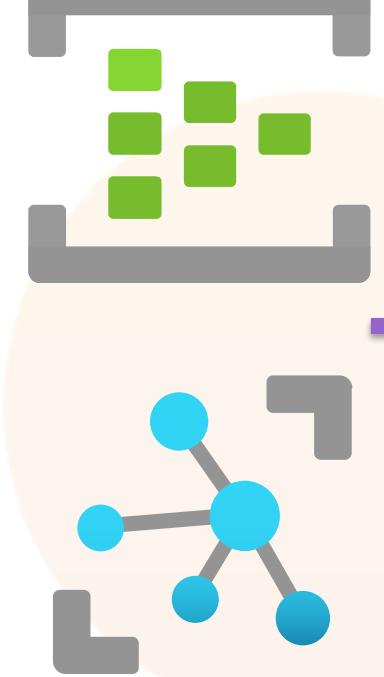
Outputs



Azure Stream Analytics – Hopping Window



Azure Stream Analytics – Hopping Window



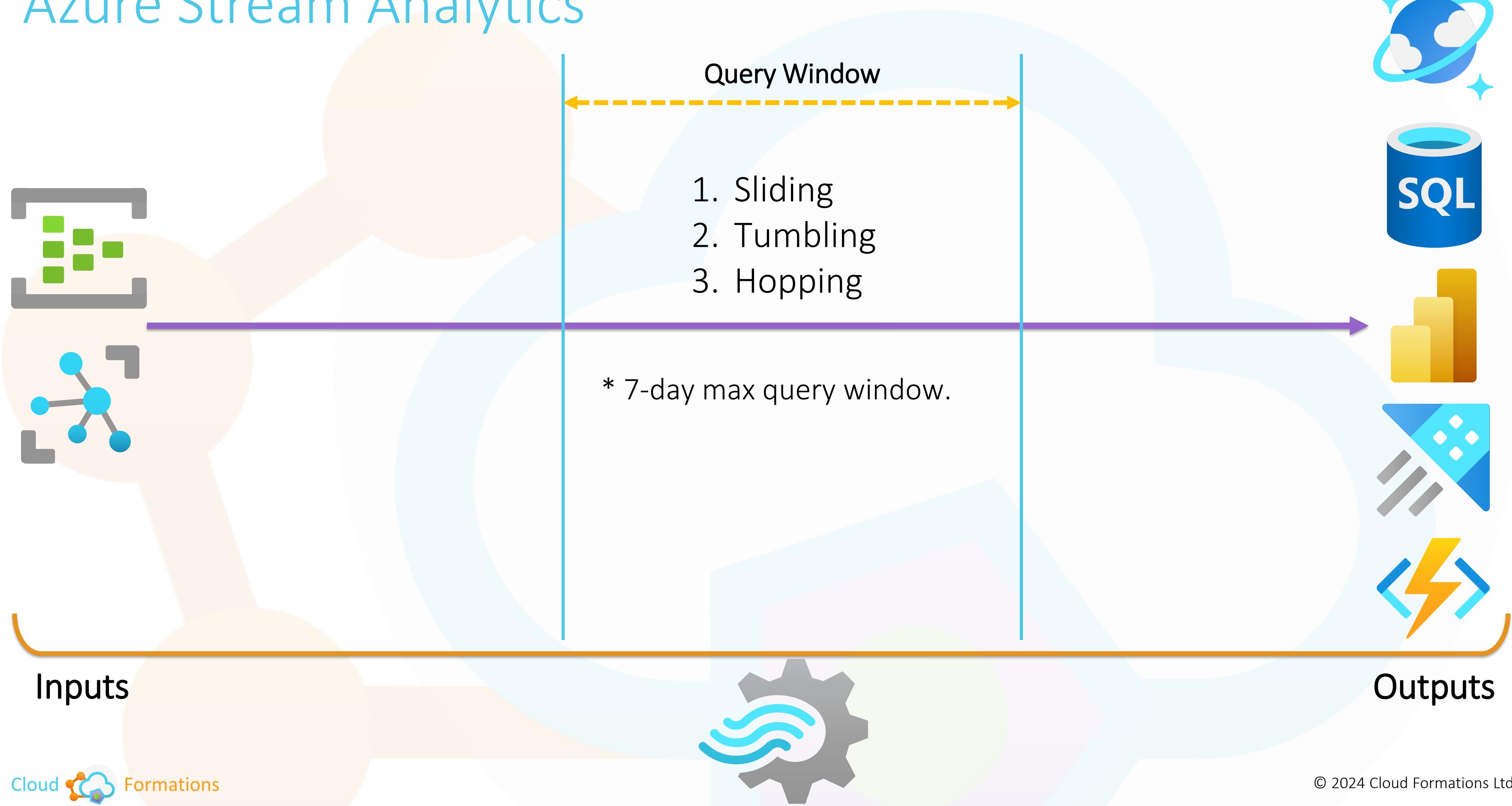
```
SELECT  
    MIN([value]) AS 'Min',  
    MAX([value]) AS 'Max'  
INTO  
    SQLDBAvg  
FROM  
    IoTHub  
    TIMESTAMP BY  
        timecreated  
GROUP BY  
    HoppingWindow(Duration(MINUTE, 15), Hop(MINUTE, 5), Offset(millisecond, -1))
```

Inputs



Outputs

Azure Stream Analytics

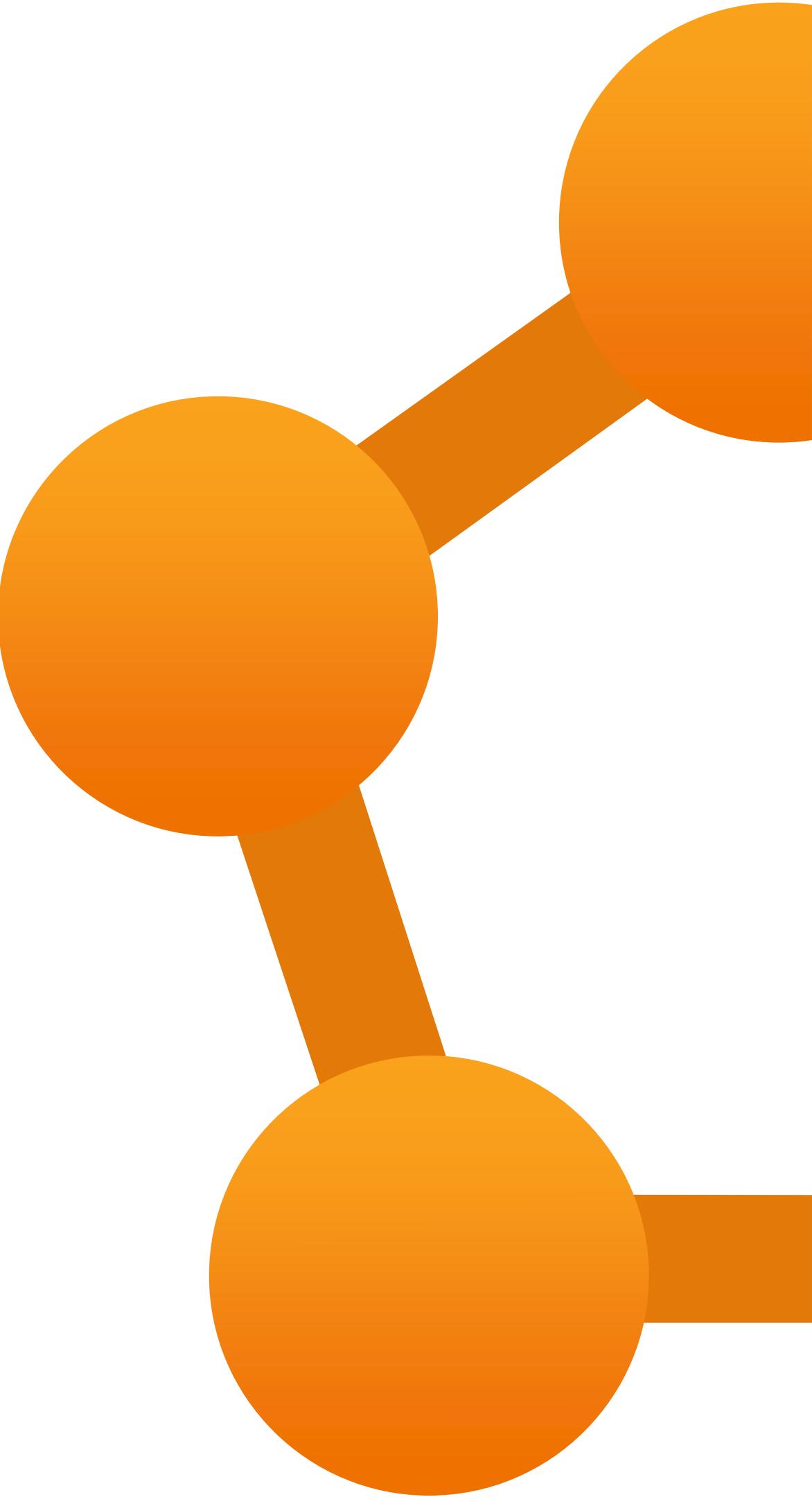


$\lambda \ K$

Lambda & Kappa

Architectures – *Part 1*

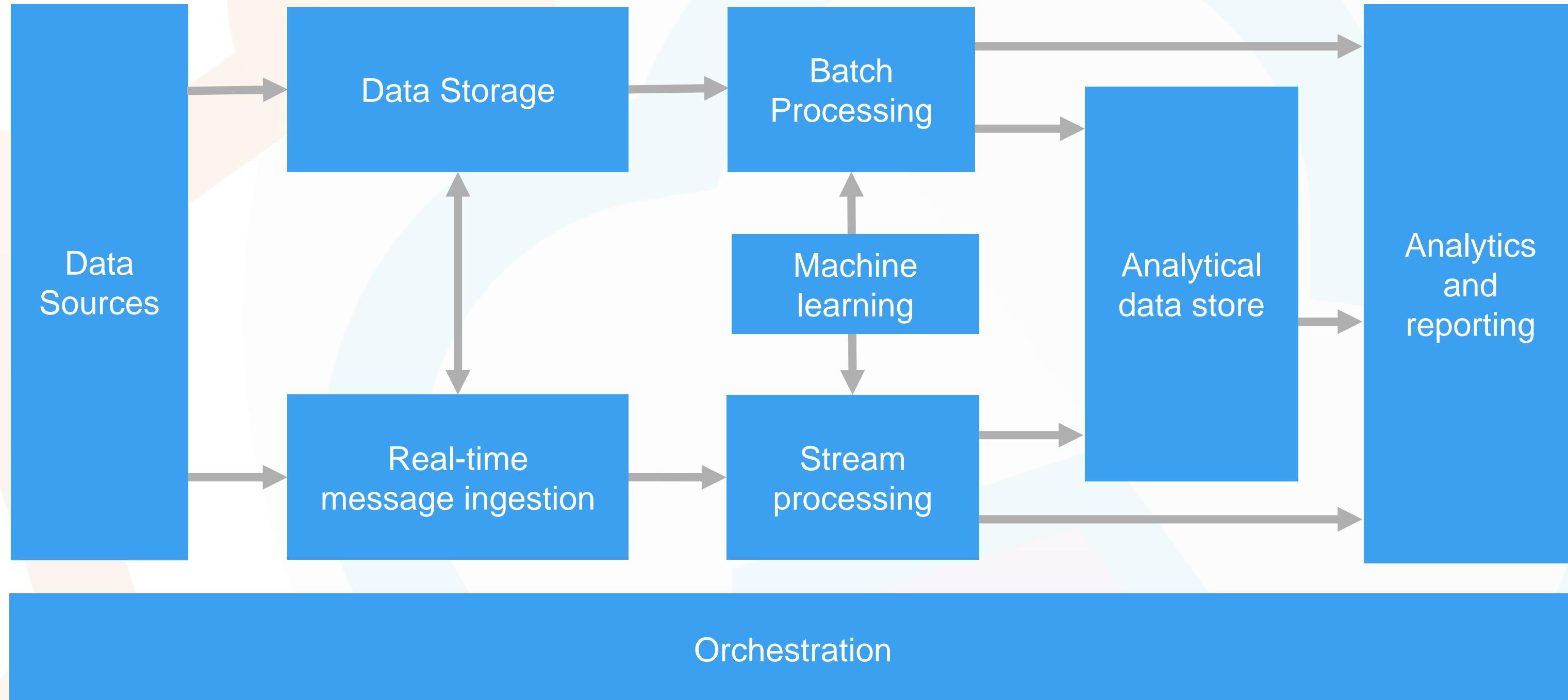
Cloud Formations



An Evolution Of Bringing Batch & Stream Data Together



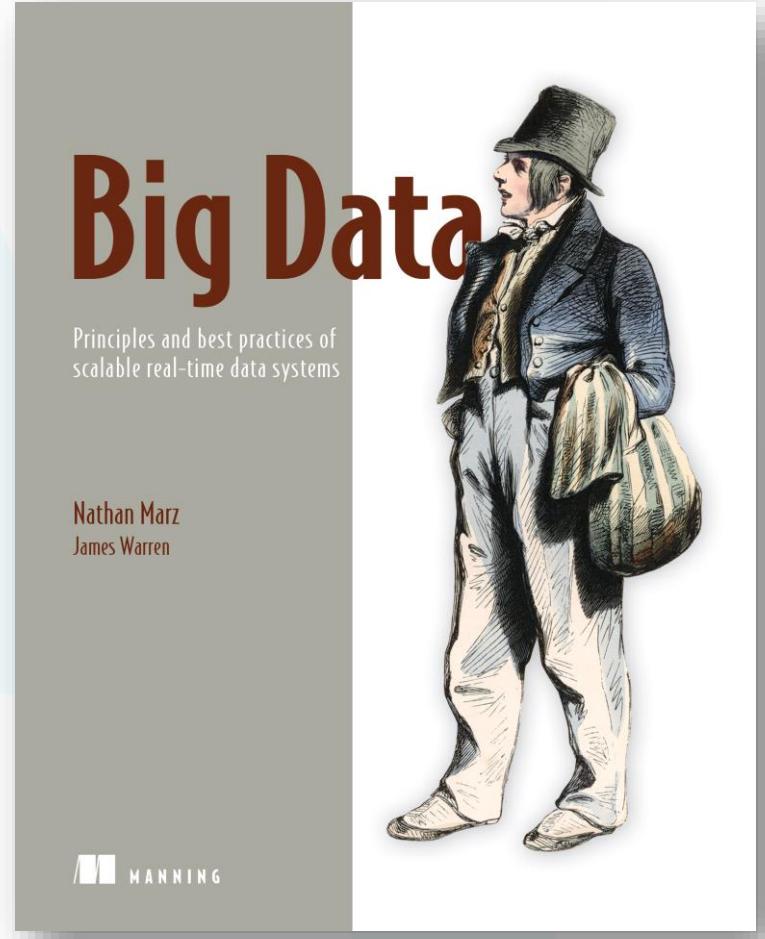
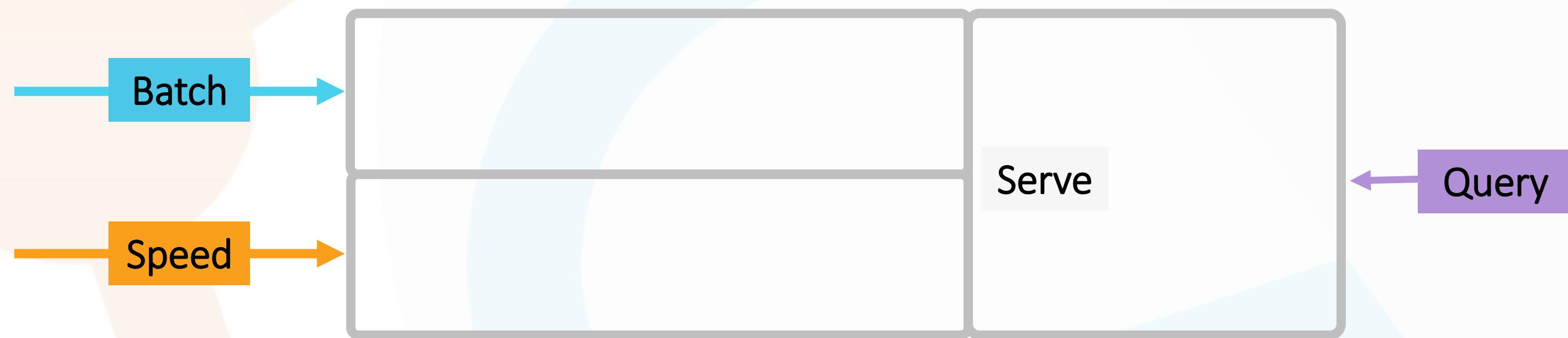
Cloud Formations - Knowledge Transfer & Training





Lambda & Kappa Architectures

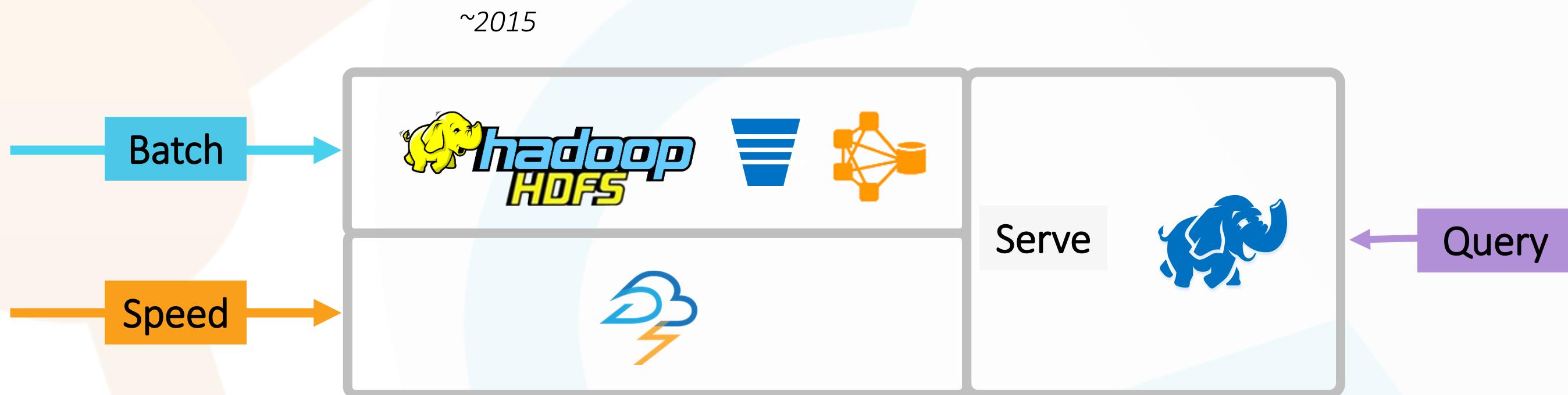
Cloud Formations - Knowledge Transfer & Training



Lambda & Kappa Architectures



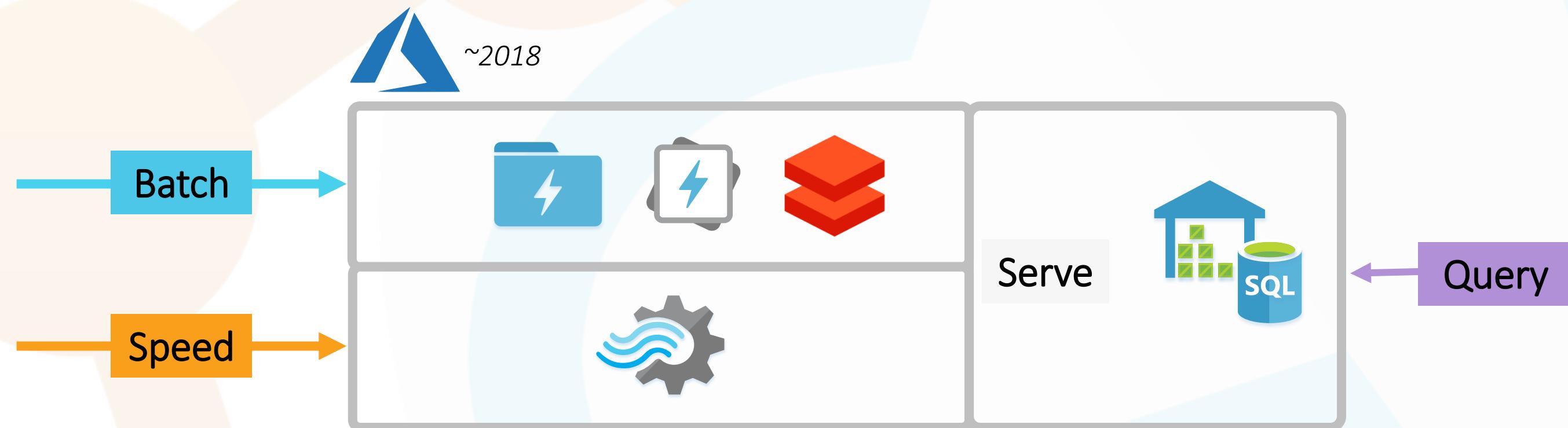
Cloud Formations - Knowledge Transfer & Training





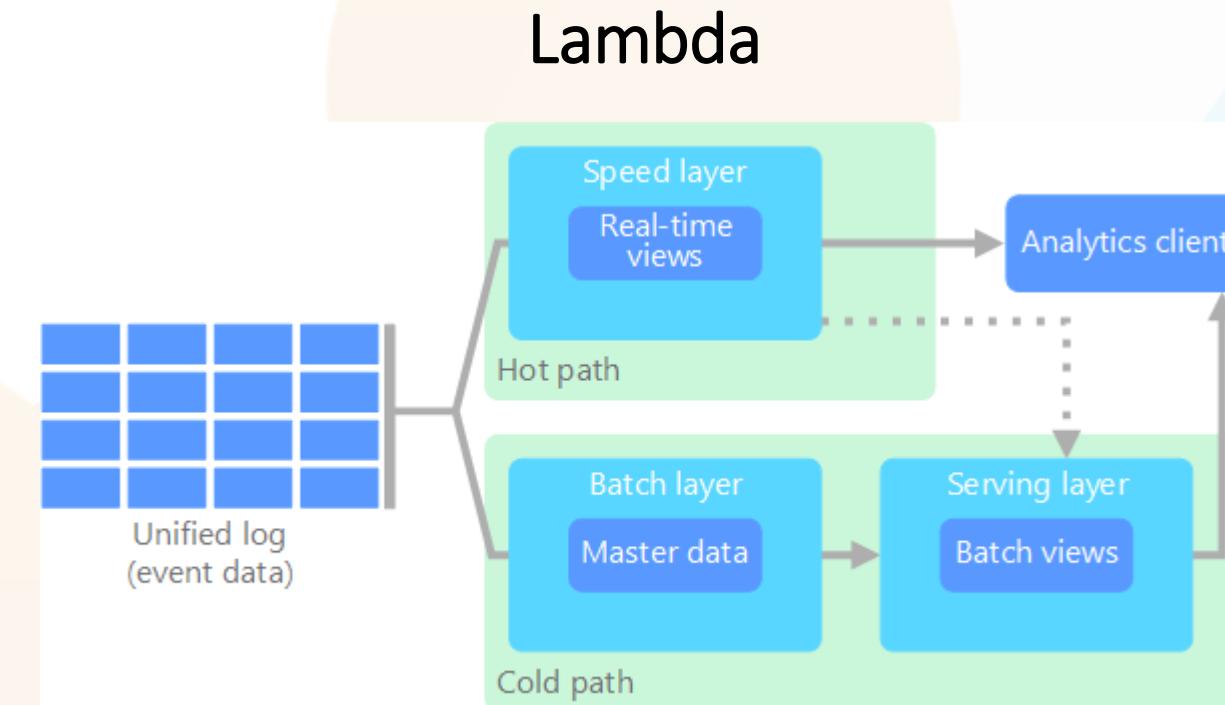
Lambda & Kappa Architectures

Cloud Formations - Knowledge Transfer & Training





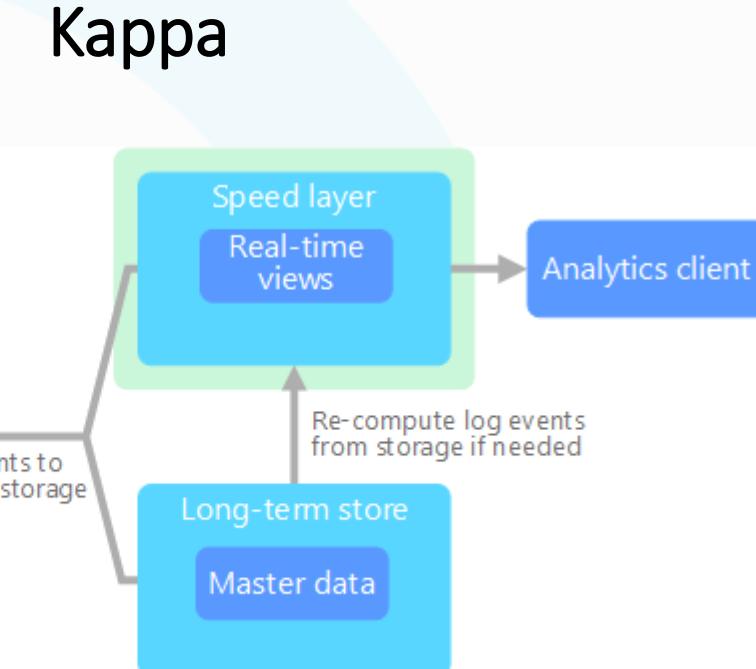
Lambda & Kappa Architectures



"The **lambda architecture**, first proposed by [Nathan Marz](#), addresses this problem by creating two paths for data flow. All data coming into the system goes through these two paths:

A **batch layer** (cold path) stores all of the incoming data in its raw form and performs batch processing on the data. The result of this processing is stored as a **batch view**.

A **speed layer** (hot path) analyzes data in real time. This layer is designed for low latency, at the expense of accuracy."



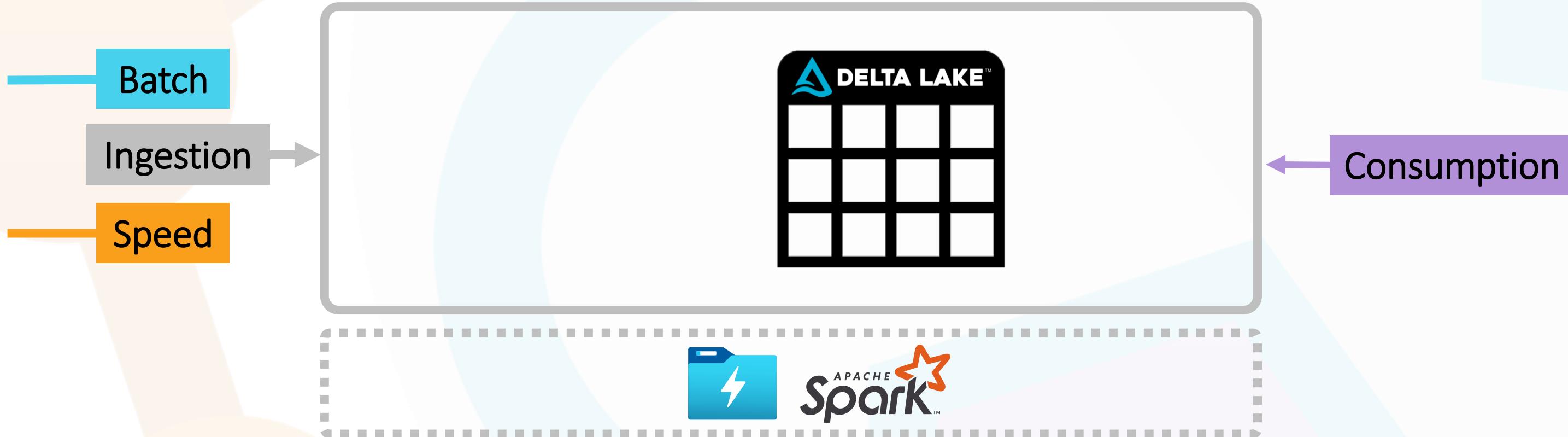
"A drawback to the lambda architecture is its complexity. Processing logic appears in two different places — the cold and hot paths — using different frameworks. This leads to duplicate computation logic and the complexity of managing the architecture for both paths.

The **kappa architecture** was proposed by [Jay Kreps](#) as an alternative to the lambda architecture. It has the same basic goals as the lambda architecture, but with an important distinction: All data flows through a single path, using a stream processing system."



Lambda & Kappa Architectures

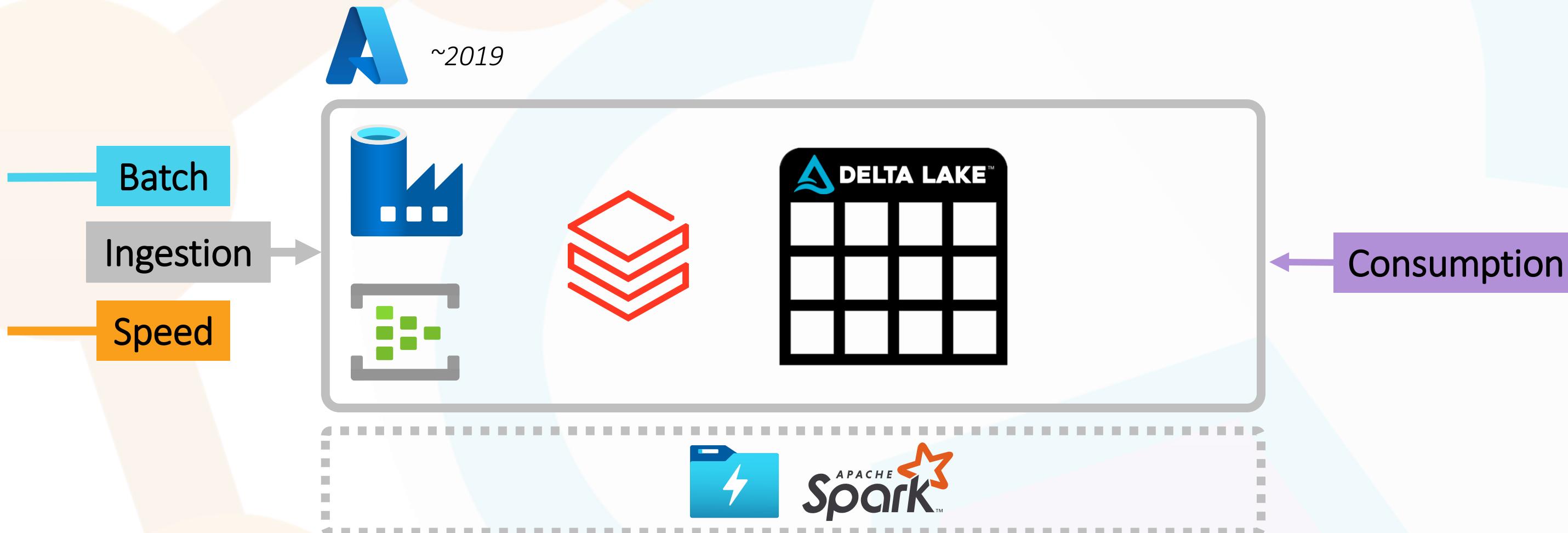
Cloud Formations - Knowledge Transfer & Training



Lambda & Kappa Architectures



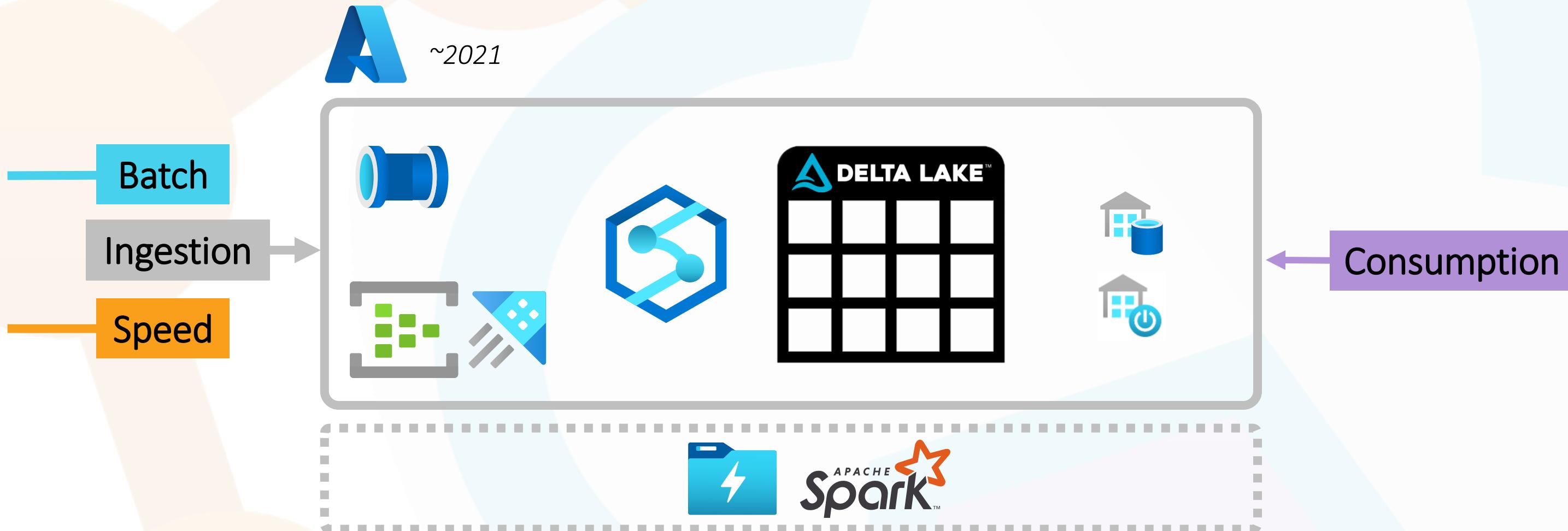
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Lambda & Kappa Architectures

Cloud Formations - Knowledge Transfer & Training



Lambda & Kappa Architectures vs Technology



Cloud Formations - Knowledge Transfer & Training

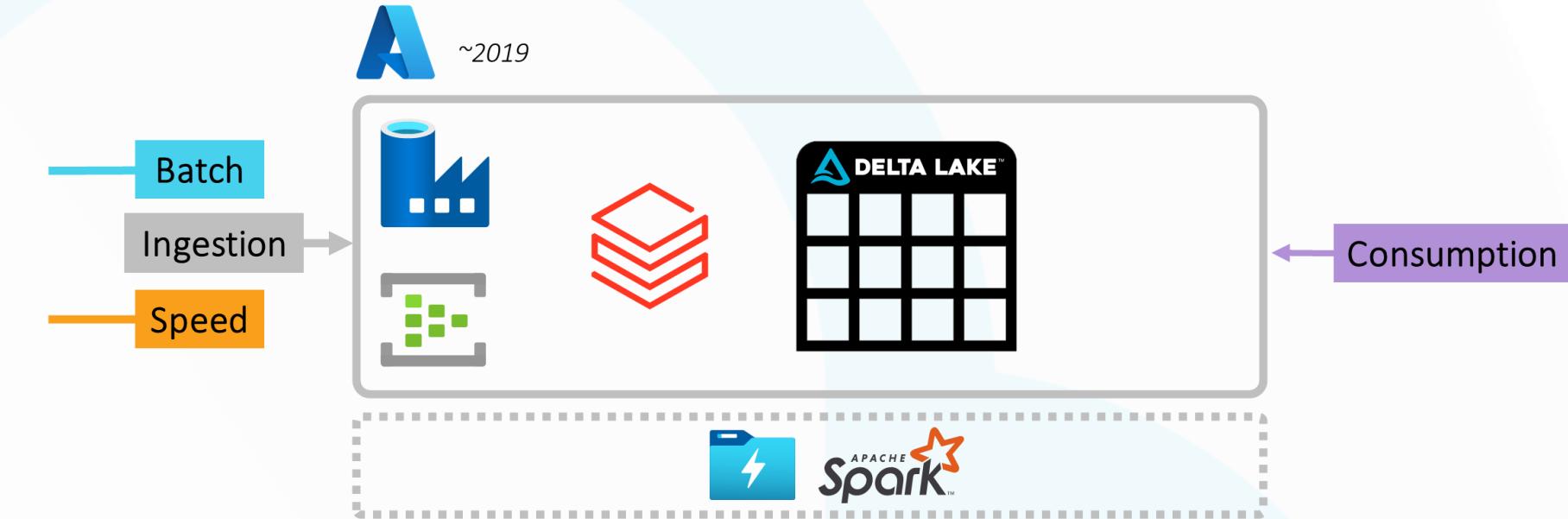
Lambda

~2015

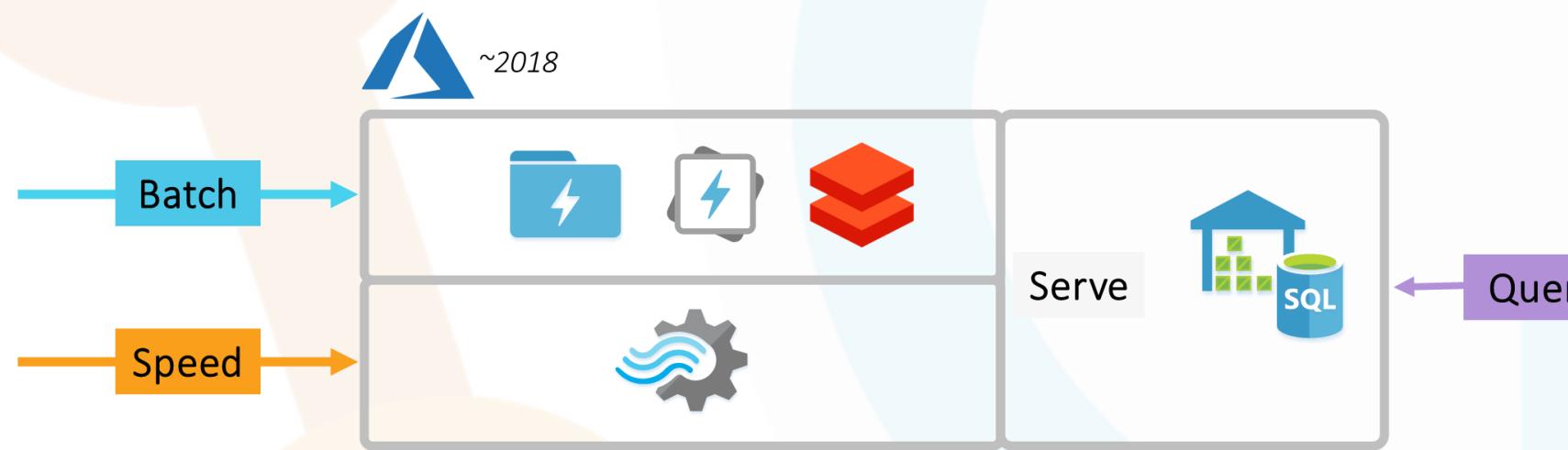


Kappa

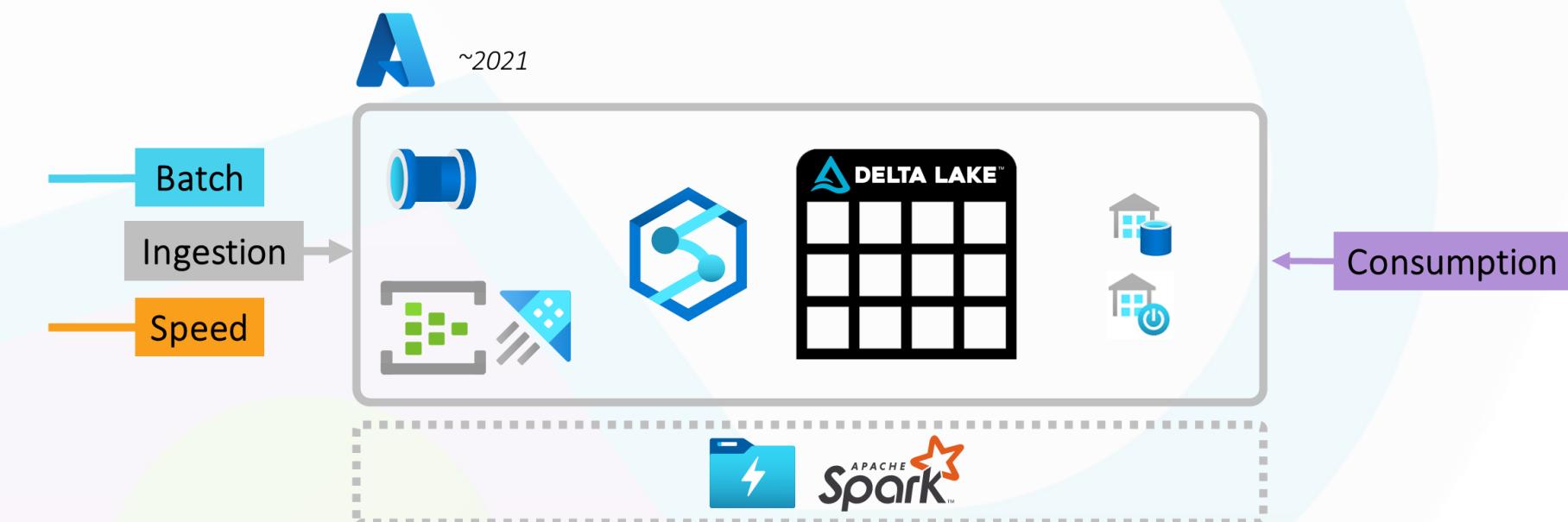
~2019



~2018



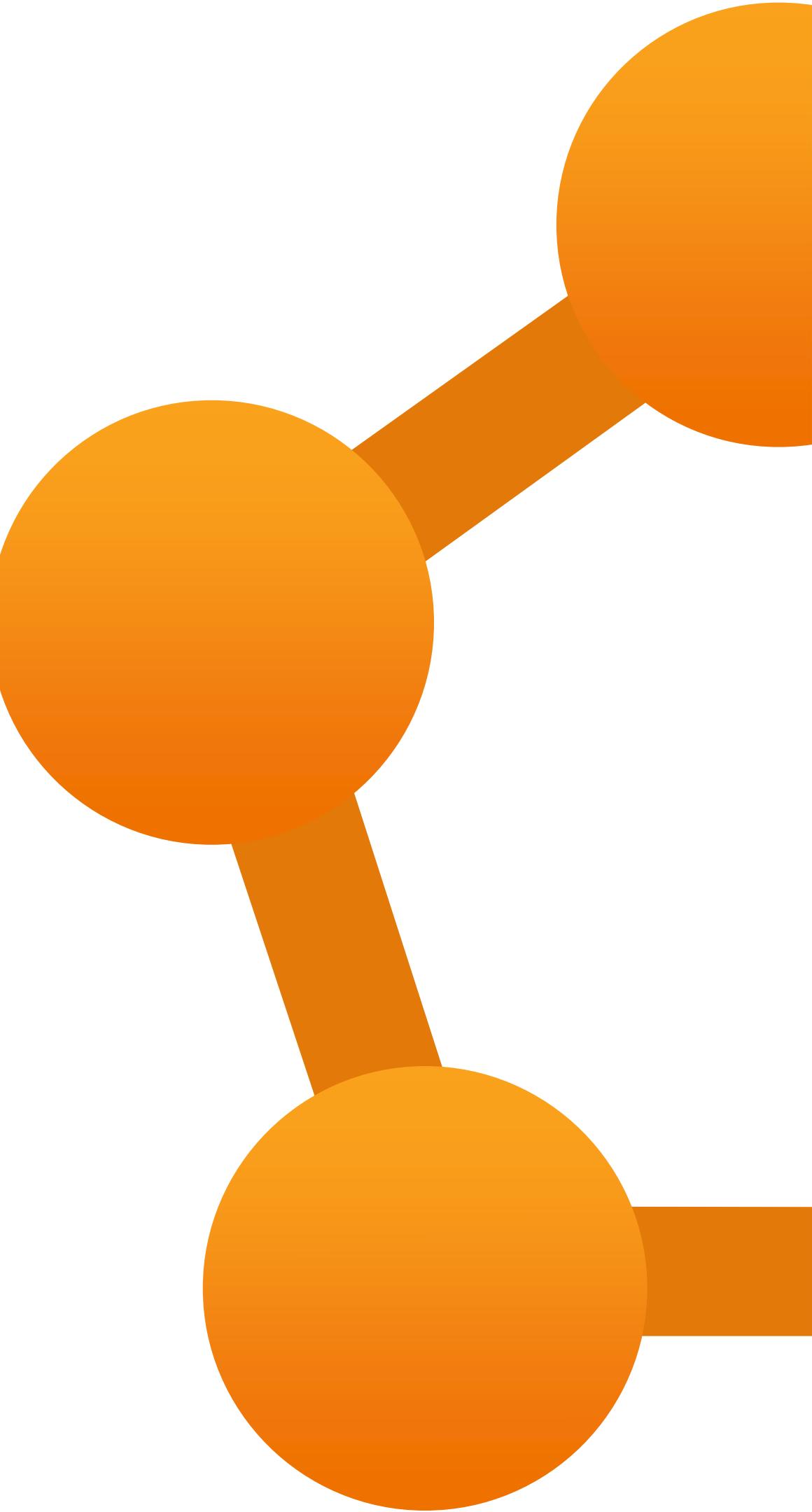
~2021



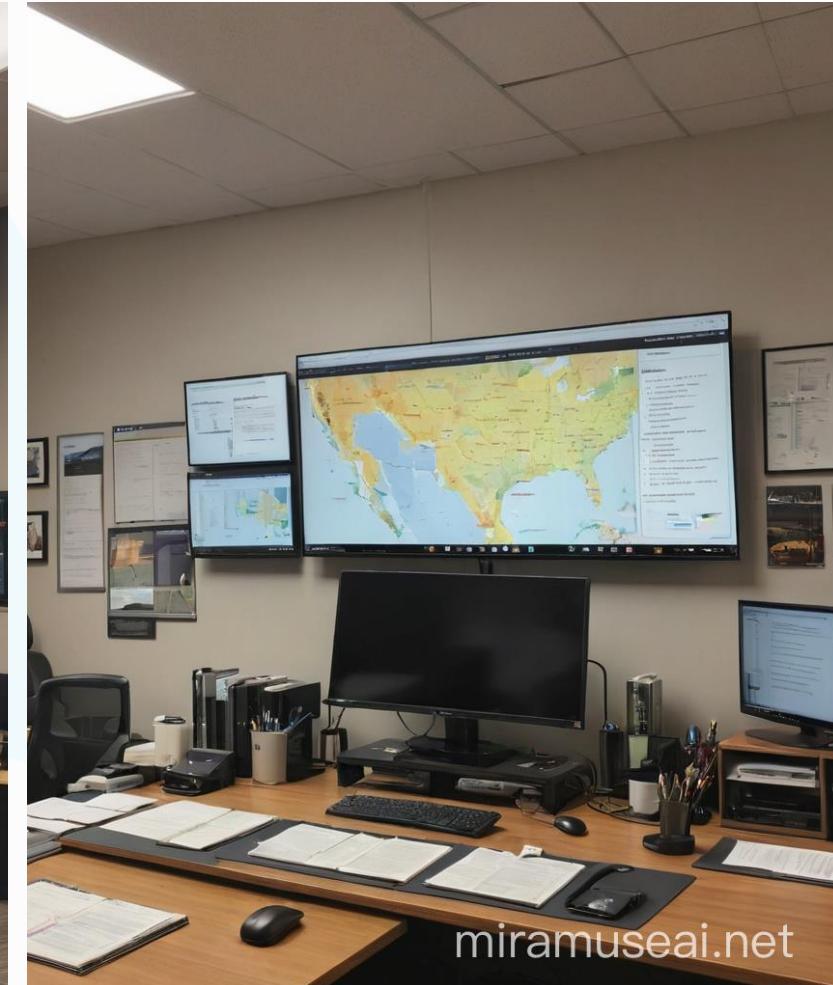
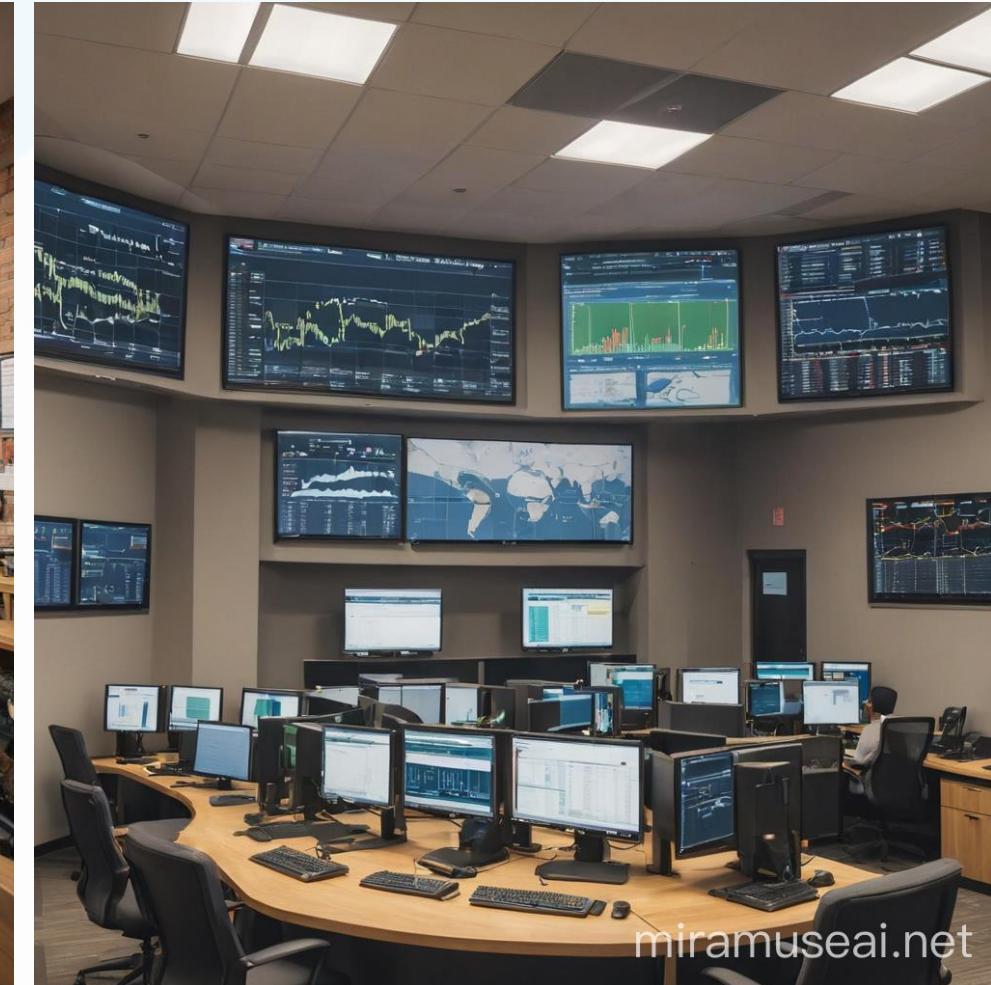
Let's Build Something!

Data Stream 1

Cloud Formations



Our Use Case



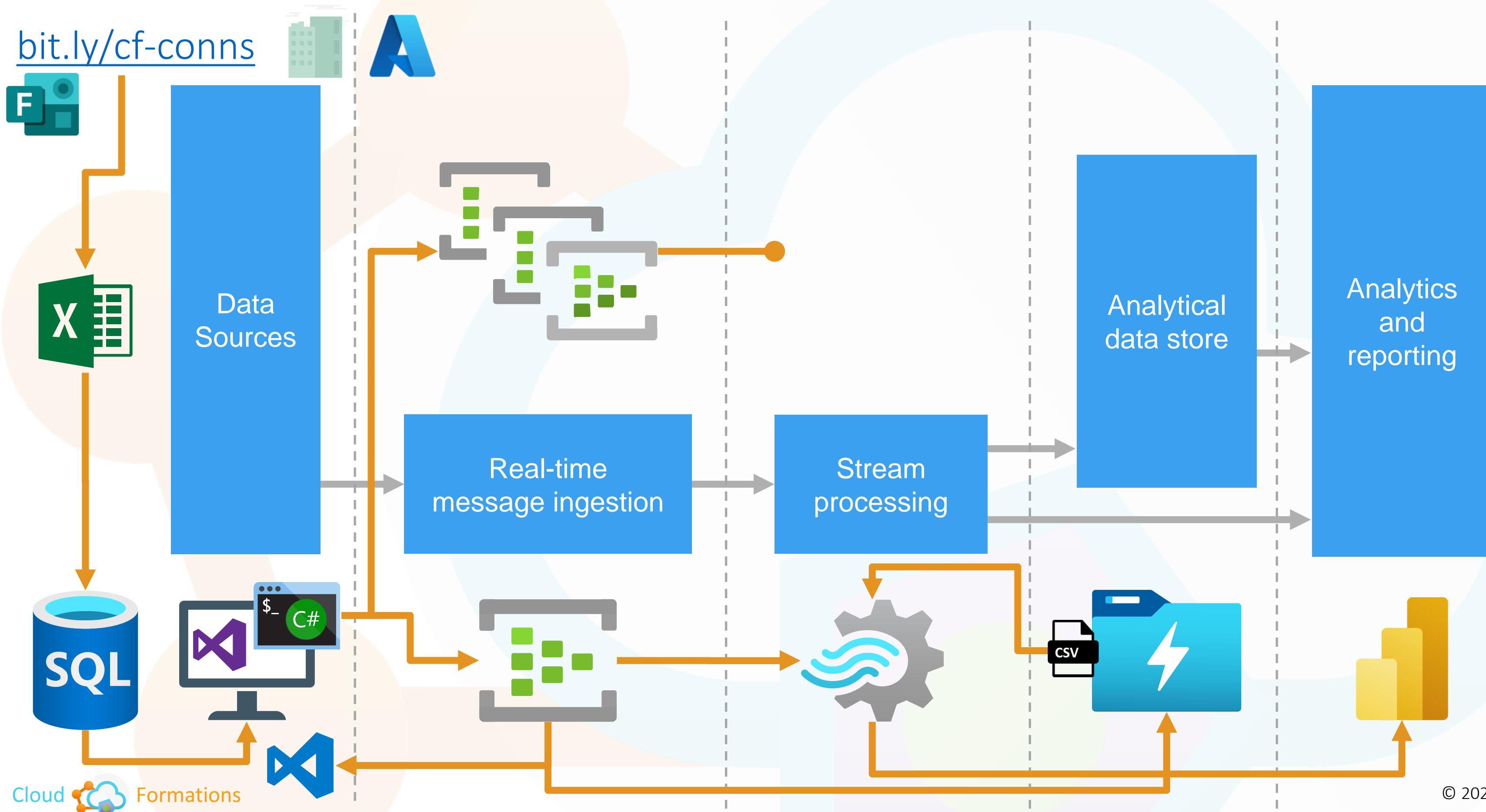
A bike shop front with large glass windows showing bike related products on the shelves inside. The shop front has a sign with the name Adventure Works.

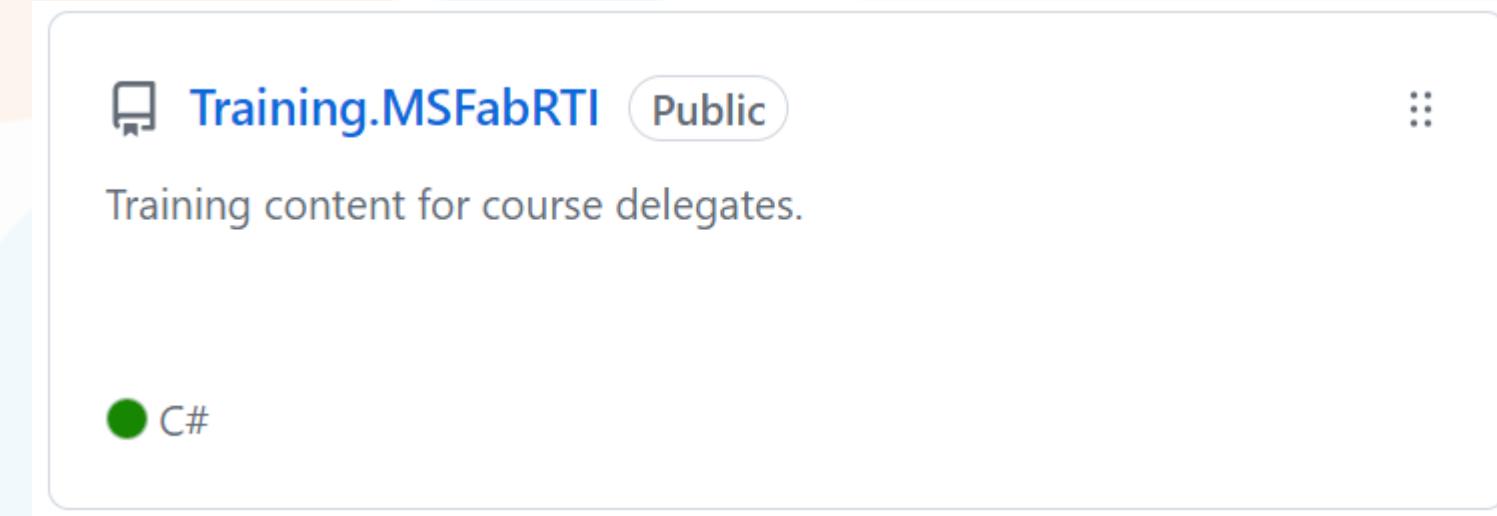
A bike shop called Adventure Works, standing inside looking at the cashier which includes a modern point of sale till system. On the wall behind the cashier are bike related products.

At the corporate head offices of Adventure Works standing in the main operations room. On the wall are large televisions showing a range of data analytics dashboards with charts and technical information.

Inside the office of the CEO at the company Adventure Works, on the desk is a business plan to role out more retail stores across the country based on targeted growth on an analytics dashboard visible on a large TV.

Azure Real-Time Data Handling



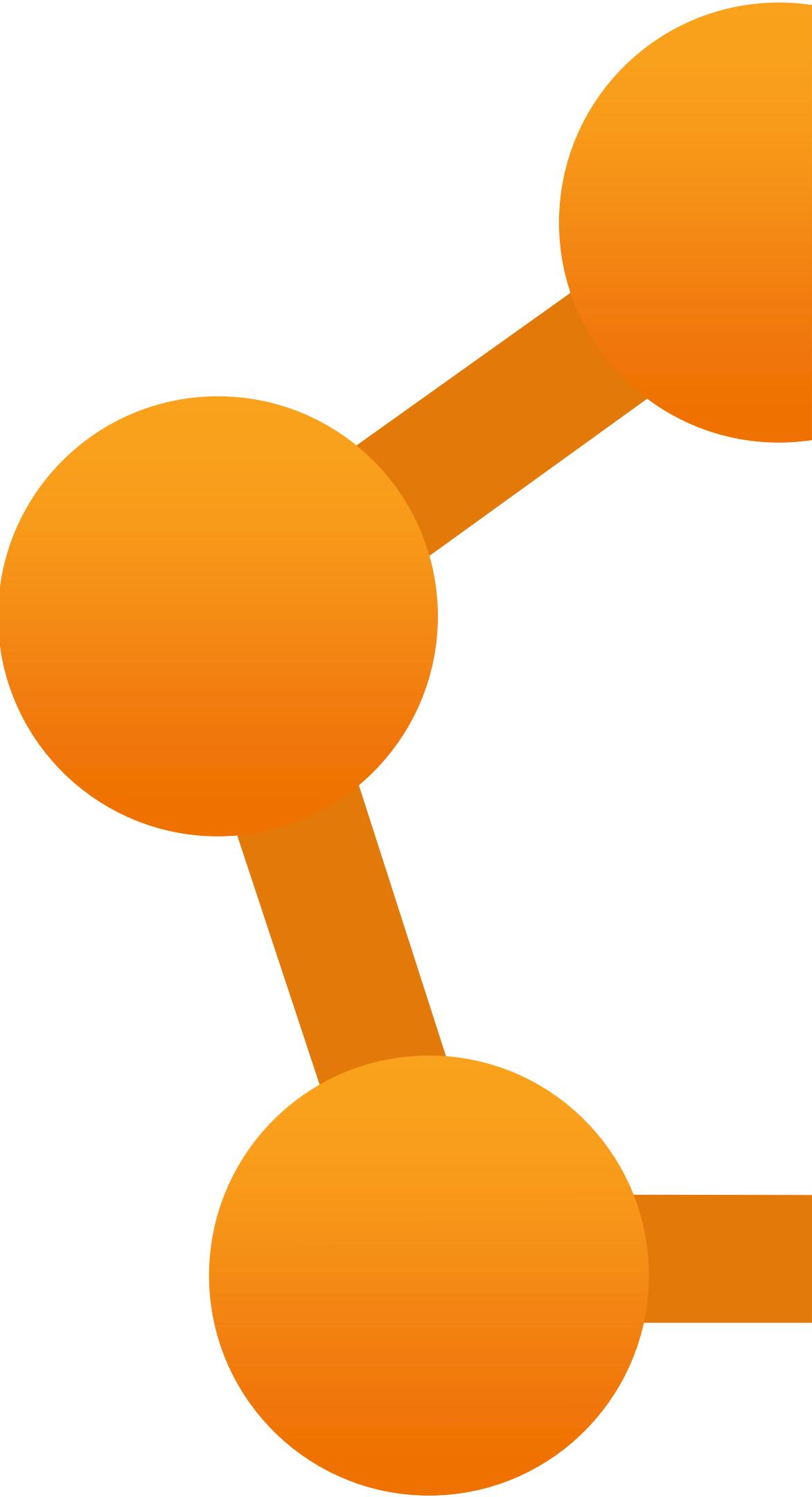


[https://github.com/
CloudFormations/
Training.MSFabRTI](https://github.com/CloudFormations/Training.MSFabRTI)



Tooling

Cloud Formations



**Data Activator**

Detect patterns and conditions in your Power BI reports and streaming data, and then take actions such as alert users or kick-off workflows.

Reflex (Preview)

Monitor datasets, queries, and event streams for patterns to trigger actions and alerts.

Reflex sample (Preview)

Monitor datasets, queries, and event streams for patterns to trigger actions and alerts with sample data.

Data Engineering

Create a lakehouse and operationalize your workflow to build, transform, and share your data estate.

Lakehouse

Store big data for cleaning, querying, reporting, and sharing.

Notebook

Explore data and build machine learning solutions with Apache Spark applications.

Environment

Set up shared libraries, Spark compute settings, and resources for notebooks and Spark job definitions.

Spark Job Definition

Define, schedule, and manage your Apache Spark jobs for big data processing.

API for GraphQL™ (Preview)

Create an API for GraphQL to easily connect your applications to Fabric data sources.

Data Factory

Empower your organization to get value from data faster than ever.

Dataflow Gen2

Prep, clean, and transform data.

Data pipeline

Ingest data at scale and schedule data workflows.

Data workflow (Preview)

Simplifies the creation and management of Data workflows (powered by Apache Airflow) on which you can operate end-to-end data pipelines at scale.

Data Science

Use machine learning to detect trends, identify outliers, and predict values from your data. [Learn more](#)

ML model

Use machine learning models to predict outcomes and detect anomalies in data.

Experiment

Create, run, and track development of multiple models for validating hypotheses.

Notebook

Explore data and build machine learning solutions with Apache Spark applications.

Environment

Set up shared libraries, Spark compute settings, and resources for notebooks and Spark job definitions.

Data Warehouse

Provide strategic insights from multiple sources into your entire business. [Learn more](#)

Warehouse

Provide strategic insights from multiple sources into your entire business.

Mirrored Azure SQL Database (p...)

Easily replicate data from an existing source into an analytics-friendly format.

Mirrored Snowflake (p...)

Easily replicate data from an existing source into an analytics-friendly format.

Mirrored Azure Cosmos DB (p...)

Easily replicate data from an existing source into an analytics-friendly format.

Industry Solutions

Use out-of-the-box industry data solutions and resources.

Microsoft Fabric

Sustainability solutions (Preview)

Unify and prepare corporate environmental, social, and governance (ESG) data for regulatory disclosures, actionable insights, and analytics.

Retail solutions (Preview)

With Microsoft Retail data solutions, you can manage retail data at scale to improve customer experience and drive operational efficiency across the organization.

Healthcare solutions (Preview)

Use advanced AI analytics to help close care gaps, generate new insights, enhance patient care, and improve outcomes.

Power BI

Use data to find insights, track progress, and make decisions faster. [Learn more](#)

Report

Create an interactive presentation of your data.

Paginated report

Display tabular data in a report that's easy to print and share.

Scorecard

Define, track, and share key metrics for your organization.

Dashboard

Build a single-page data story.

Streaming dataset

Build visuals from real-time data.



The Fabric Icon Game

can you name them all???



Microsoft Fabric



Power BI

0





OneLake



0



Data Activator

0



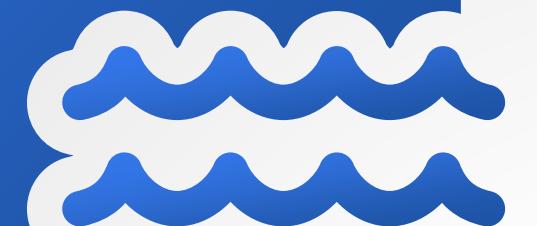
Reflex

0

Data Warehouse



Lakehouse



0



Real-time Analytics



KQL Database



0



0



Event House

0



Notebook

0



KQL Queryset



0





Reflex

0

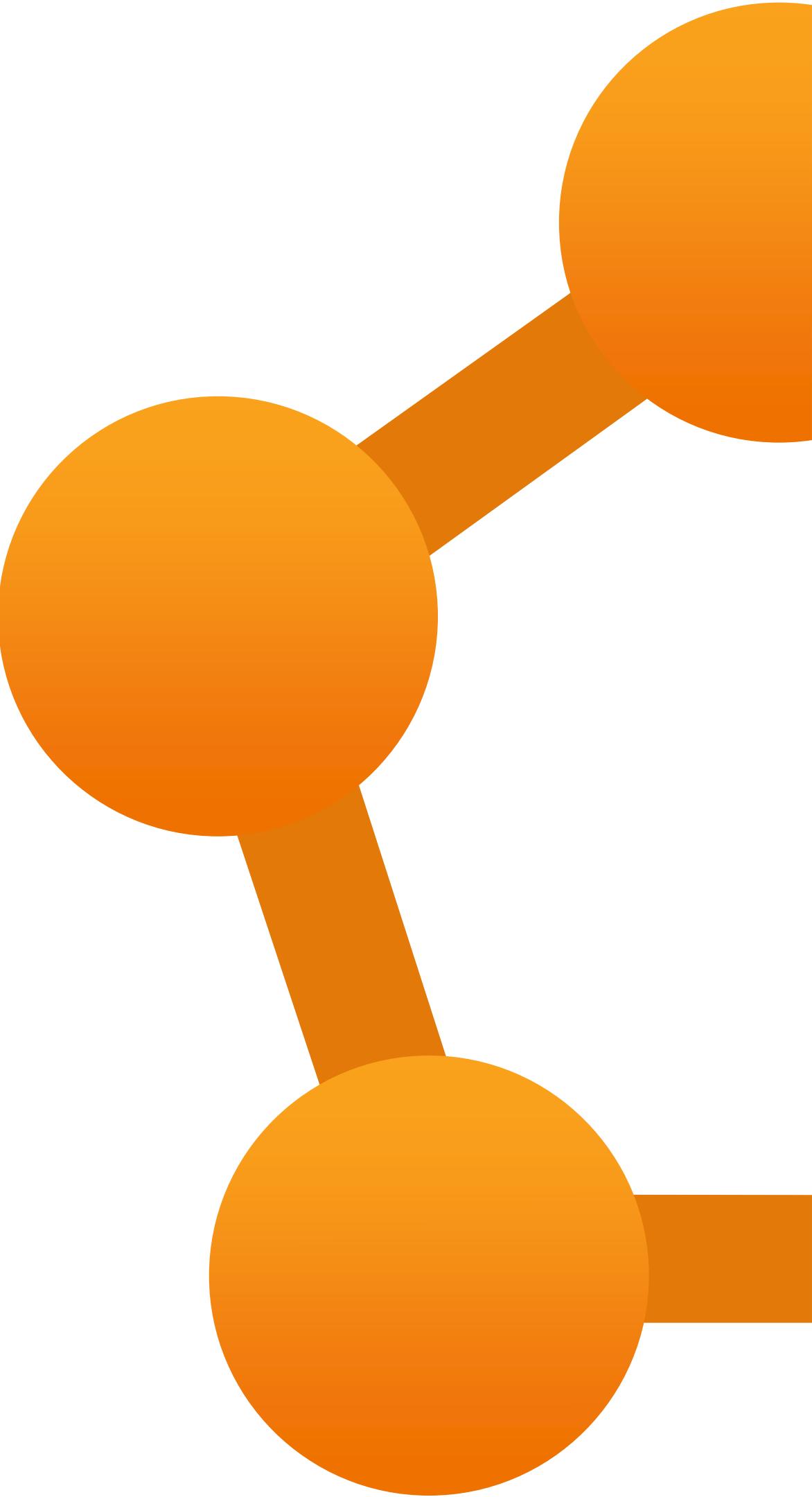


Real-time Hub



Tooling

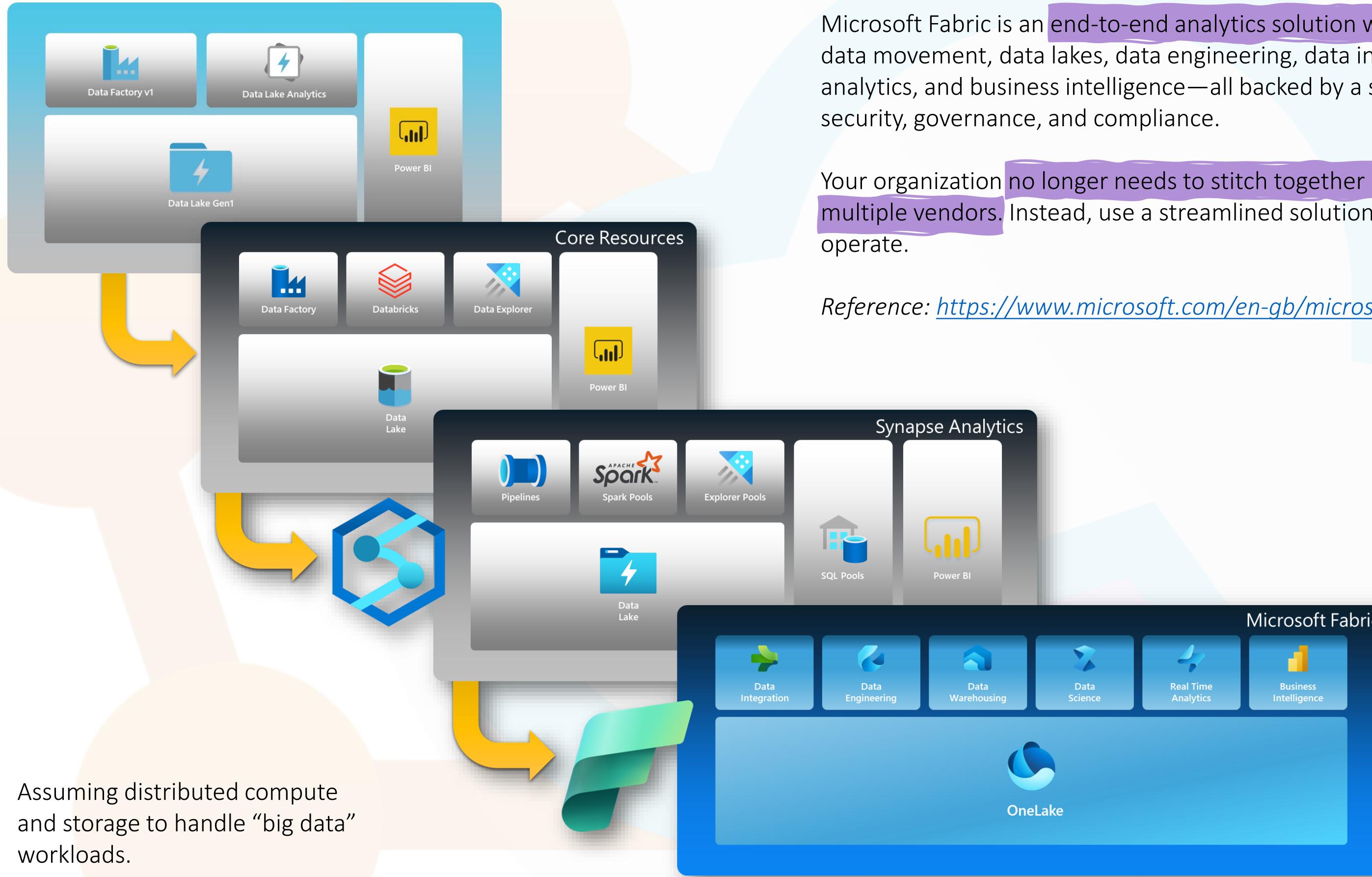
Cloud Formations





What is Microsoft Fabric? – Vision and Stack Evolution

Cloud Formations - Knowledge Transfer & Training



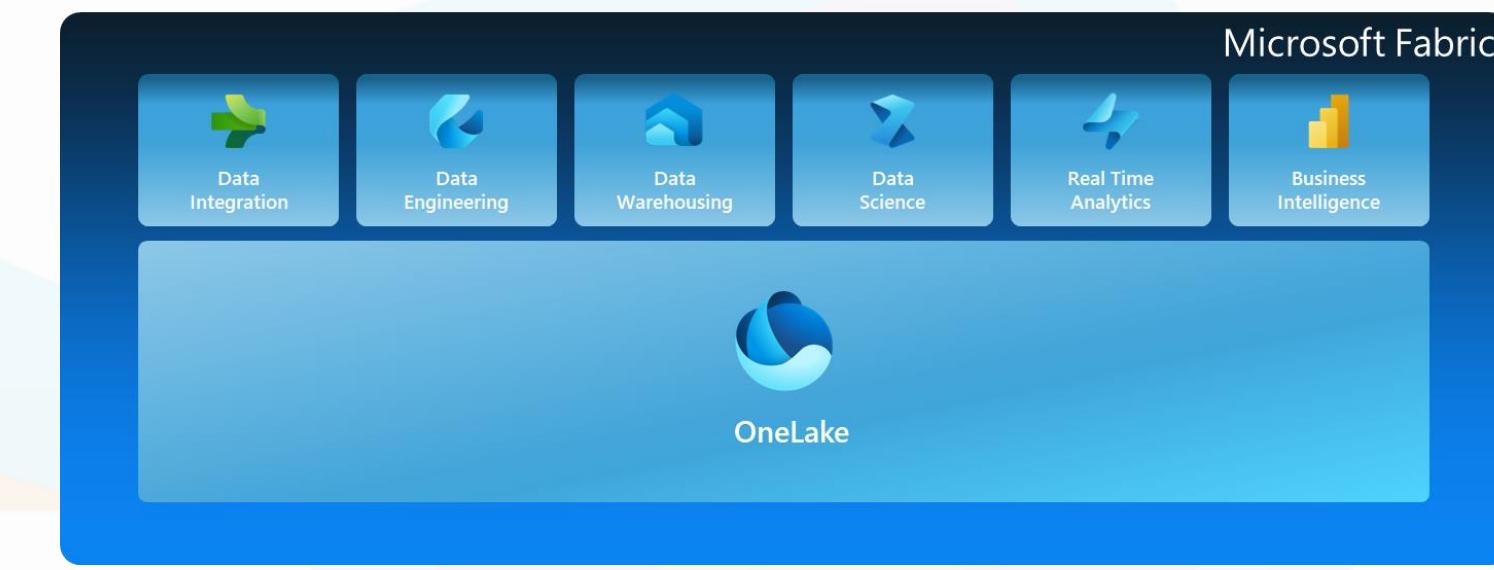
Microsoft Fabric is an **end-to-end analytics solution with full-service capabilities** including data movement, data lakes, data engineering, data integration, data science, real-time analytics, and business intelligence—all backed by a shared platform providing robust data security, governance, and compliance.

Your organization **no longer needs to stitch together individual analytics services from multiple vendors**. Instead, use a streamlined solution that's easy to connect, onboard, and operate.

Reference: <https://www.microsoft.com/en-gb/microsoft-fabric>



What is Microsoft Fabric?





What is Microsoft Fabric? - Experiences vs Technical Capabilities

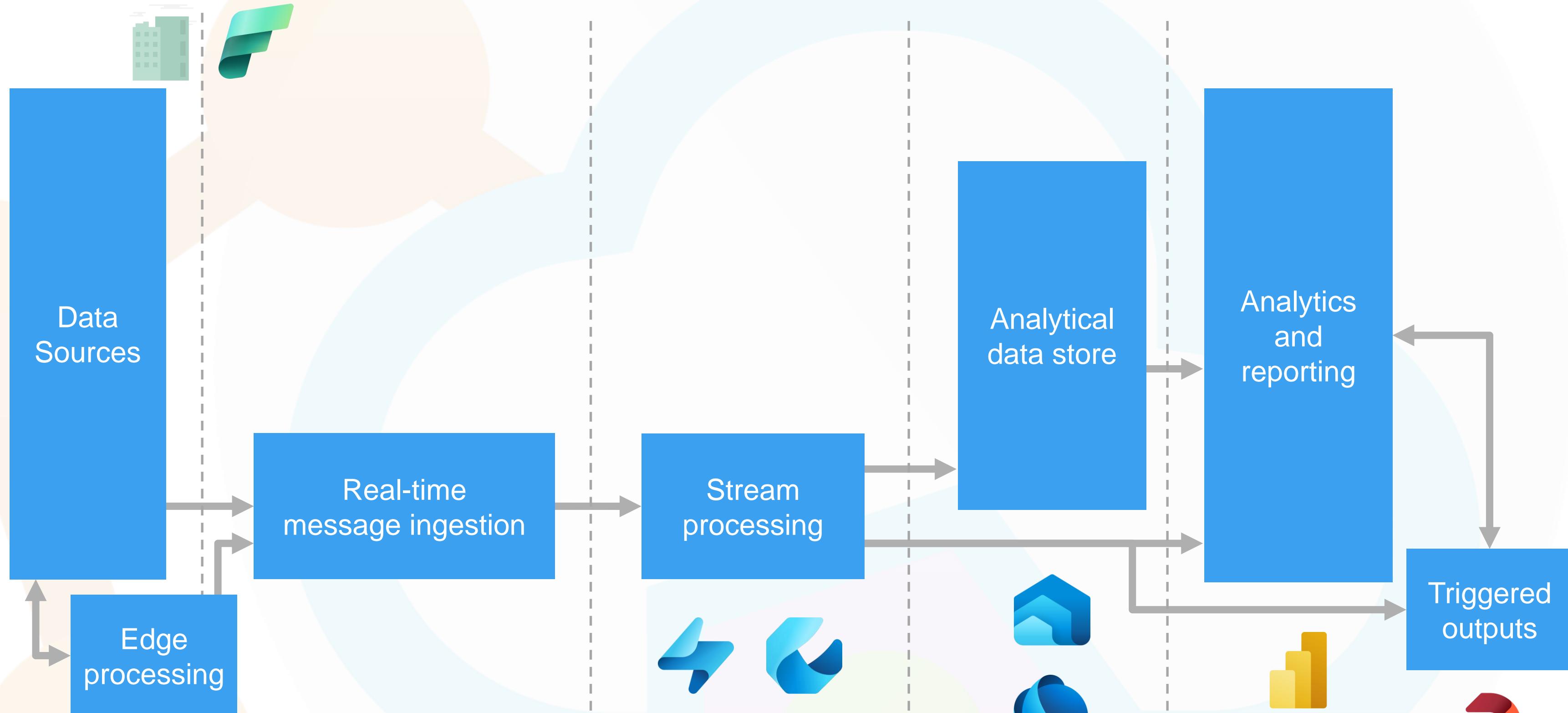
Cloud Formations - Knowledge Transfer & Training

	Data Integration	- Workload management and orchestration with dependency chain handling and scheduling. <i>Think... Azure Data Factory</i> 
	Data Engineering	- Low code and full code development in Python, Scala, R, SQL executed using Spark clusters. <i>Think... Azure Databricks</i> 
	Data Warehouse	- Schema driven relational entities coded using T-SQL covering DML and DDL functionality. <i>Think... Azure Synapse Analytics – SQL Pools.</i> 
	Data Science	- Predictive analytics and experimentation on data to expose insights and drive outcomes. <i>Think... Azure Machine Learning.</i> 
	Real-time Intelligence	- Time series data exploration over inbound telemetry and messages coded using KQL . <i>Think... Azure Data Explorer.</i> 
	Business Intelligence	- Dashboards and metrics created to for the business to consume data, coded using DAX and M . <i>Think... Power BI.</i> 
	Data Activator	- Actions triggered by defined changes in modelled datasets. <i>Think... Azure Alerts</i>  * Closest equivalent capability.
	One Lake	- Distributed data storage optimised for analytics and structured as Delta Lake tables. <i>Think... Azure Data Lake Gen2</i>   DELTA LAKE™

Fabric Tooling



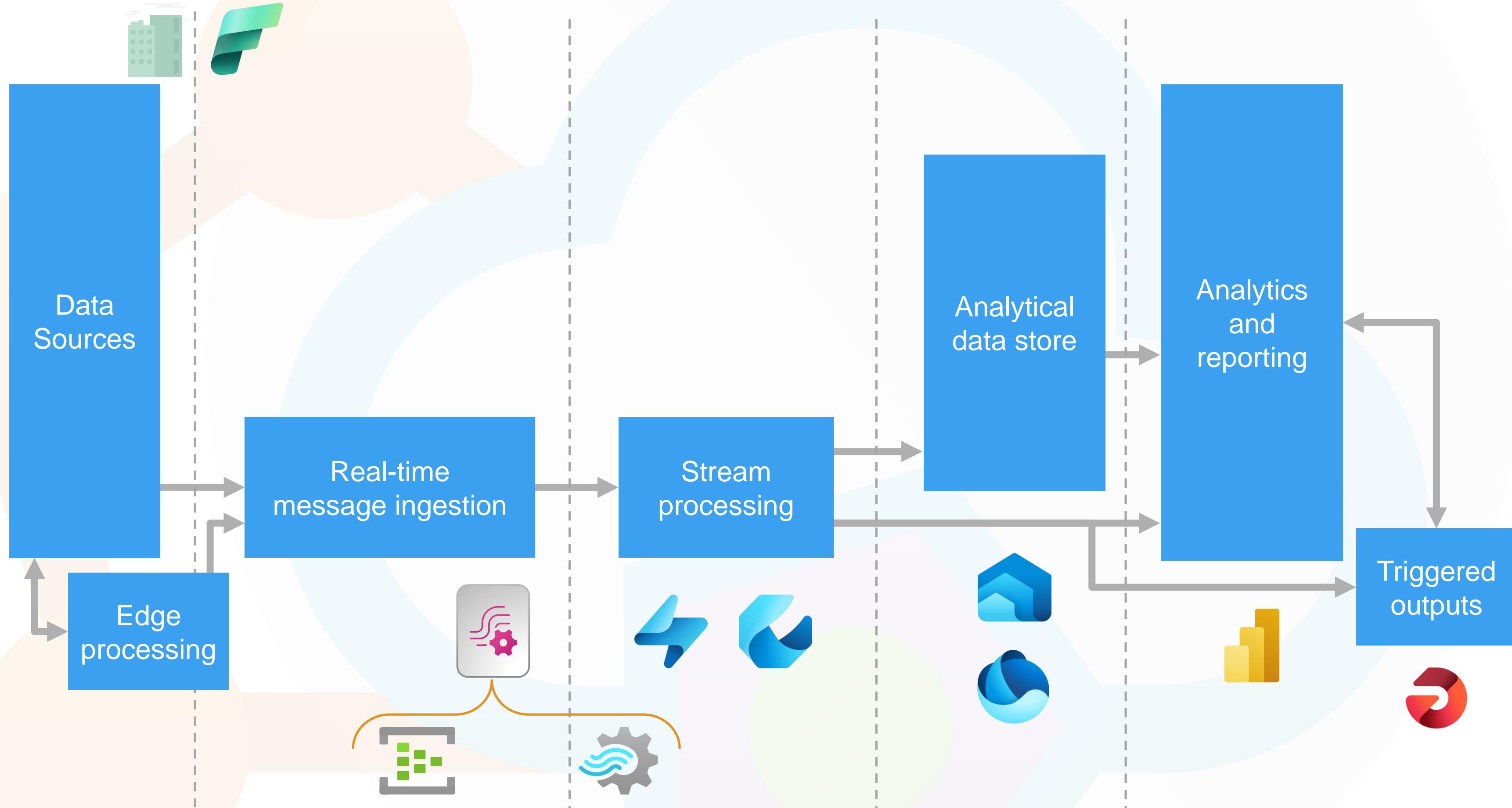
Cloud Formations - Knowledge Transfer & Training



Fabric Tooling – Event Stream



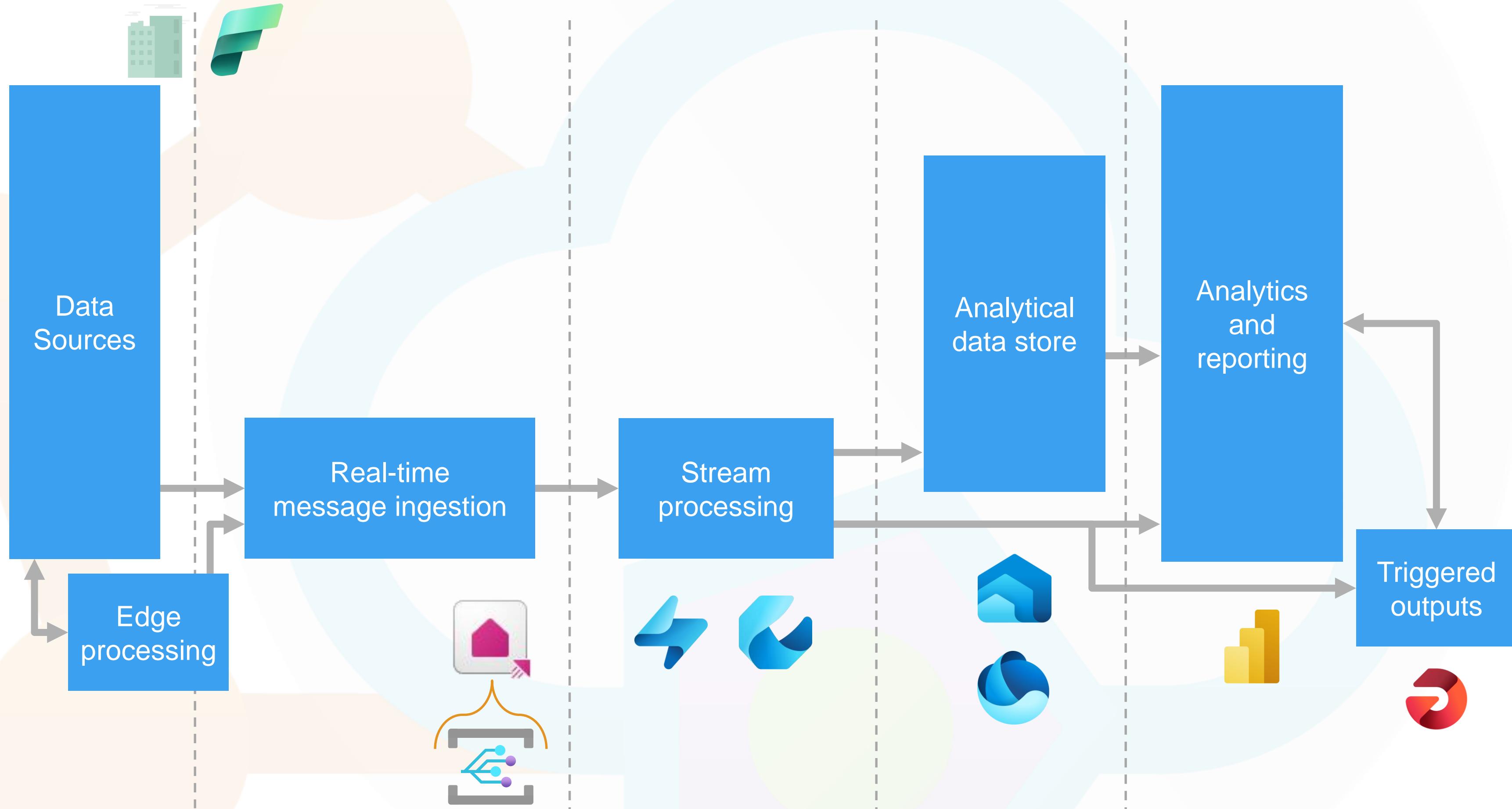
Cloud Formations - Knowledge Transfer & Training



Fabric Tooling – Event Hub



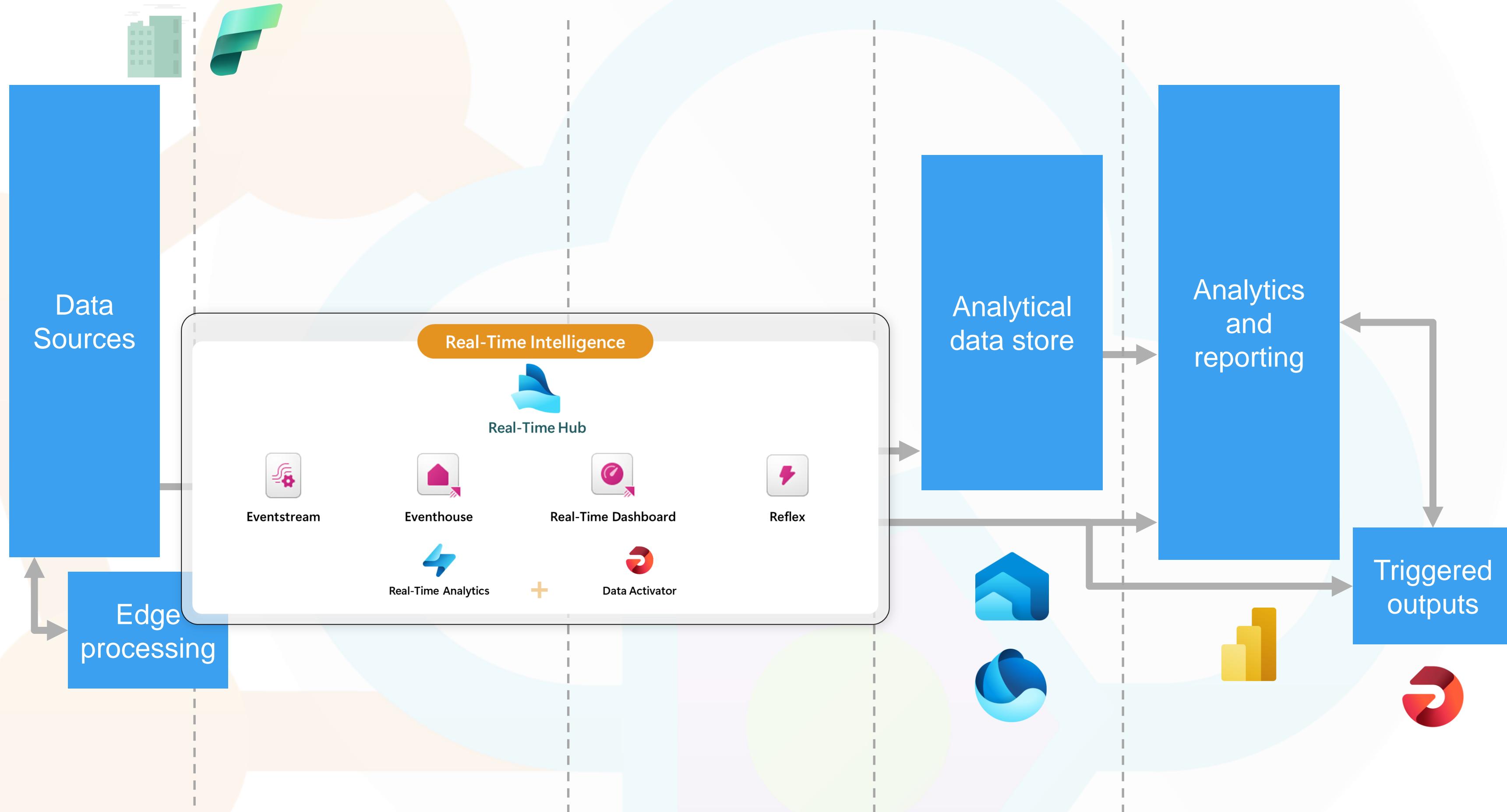
Cloud Formations - Knowledge Transfer & Training



Fabric Tooling – Event Stream



Cloud Formations - Knowledge Transfer & Training

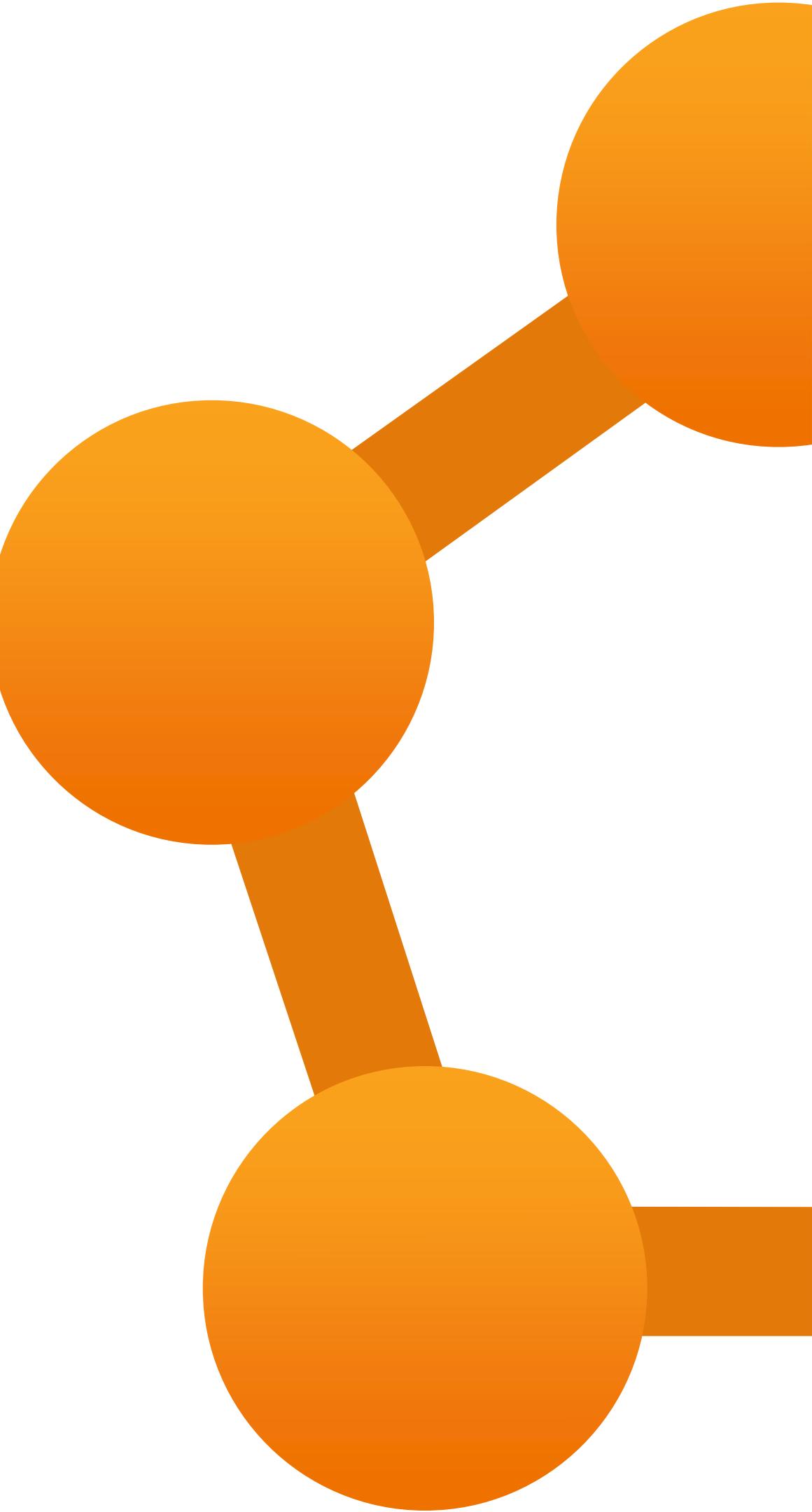


$\lambda \ K$

Lambda & Kappa

Architectures – *Part 2*

Cloud Formations



Lambda & Kappa Architectures vs Technology



Cloud Formations - Knowledge Transfer & Training

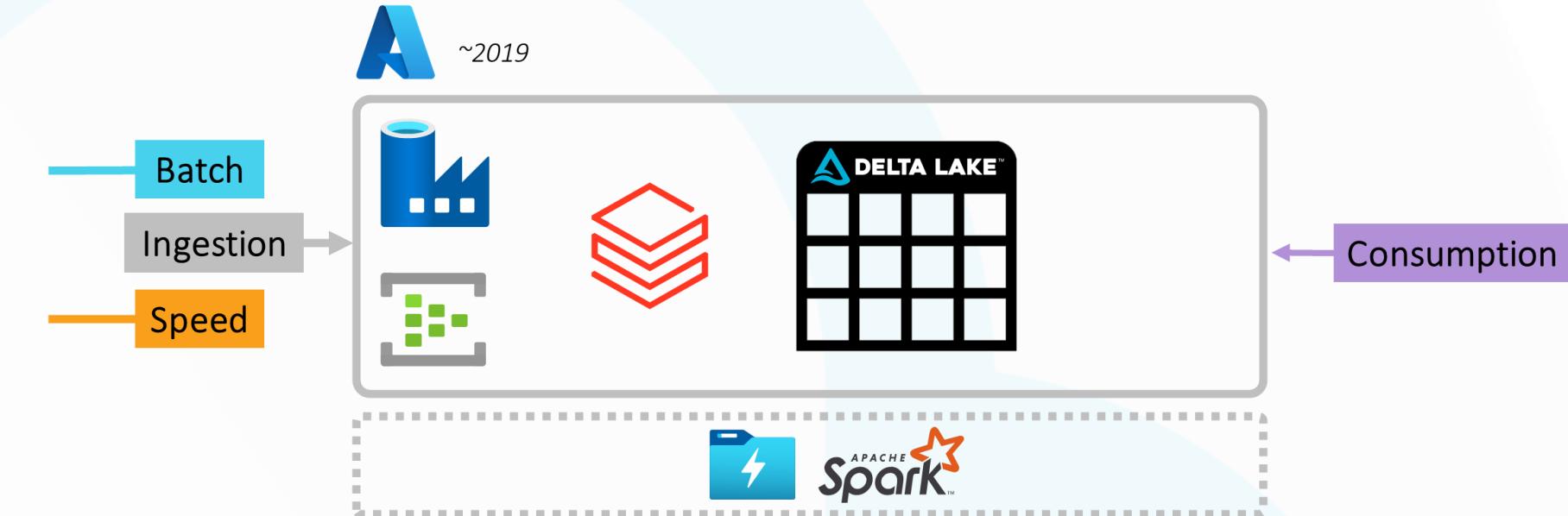
Lambda

~2015

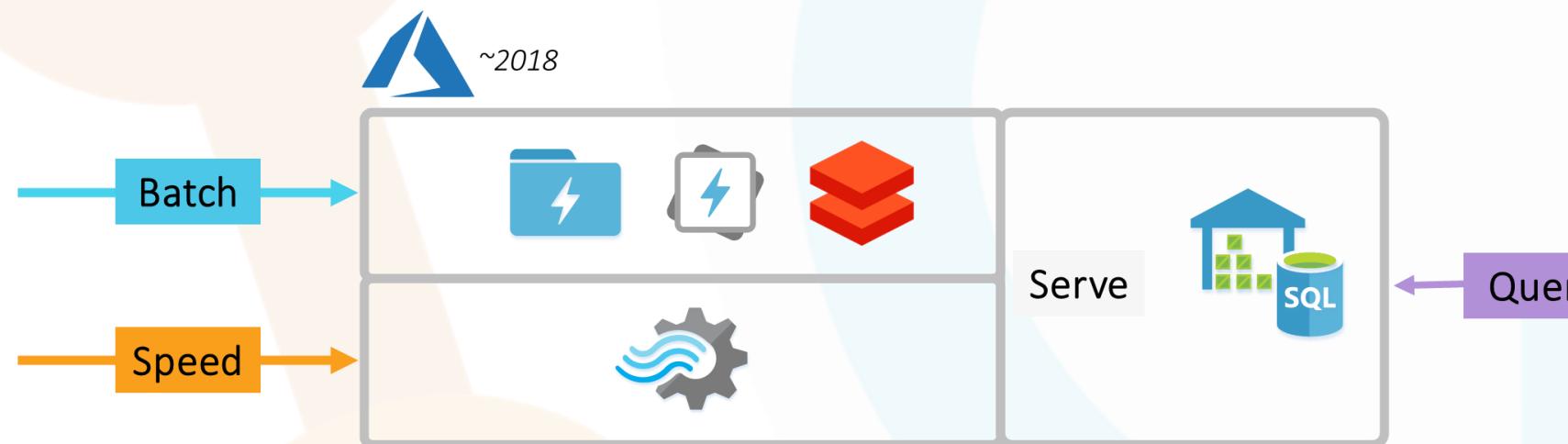


Kappa

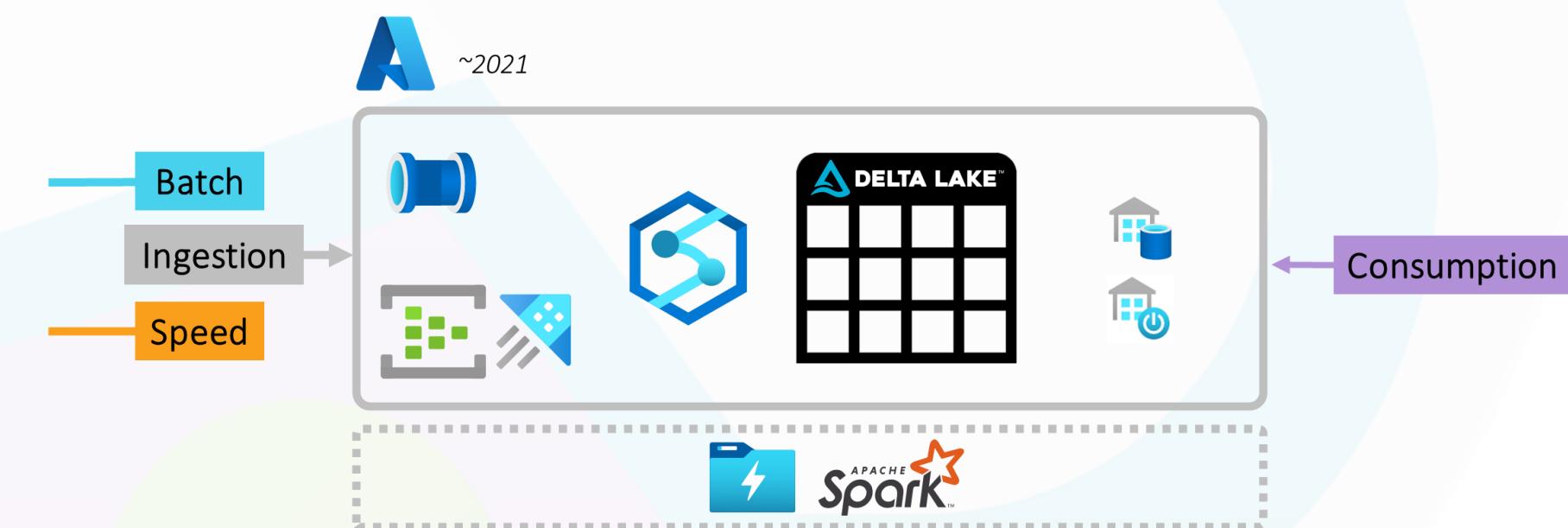
~2019



~2018



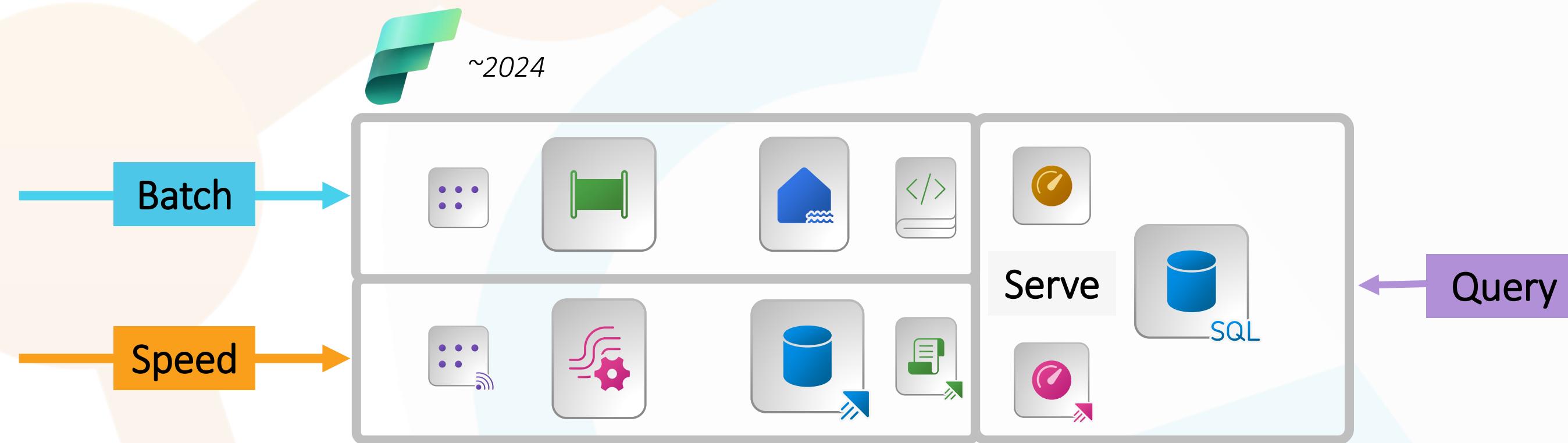
~2021





Microsoft Fabric vs a Kappa Architecture

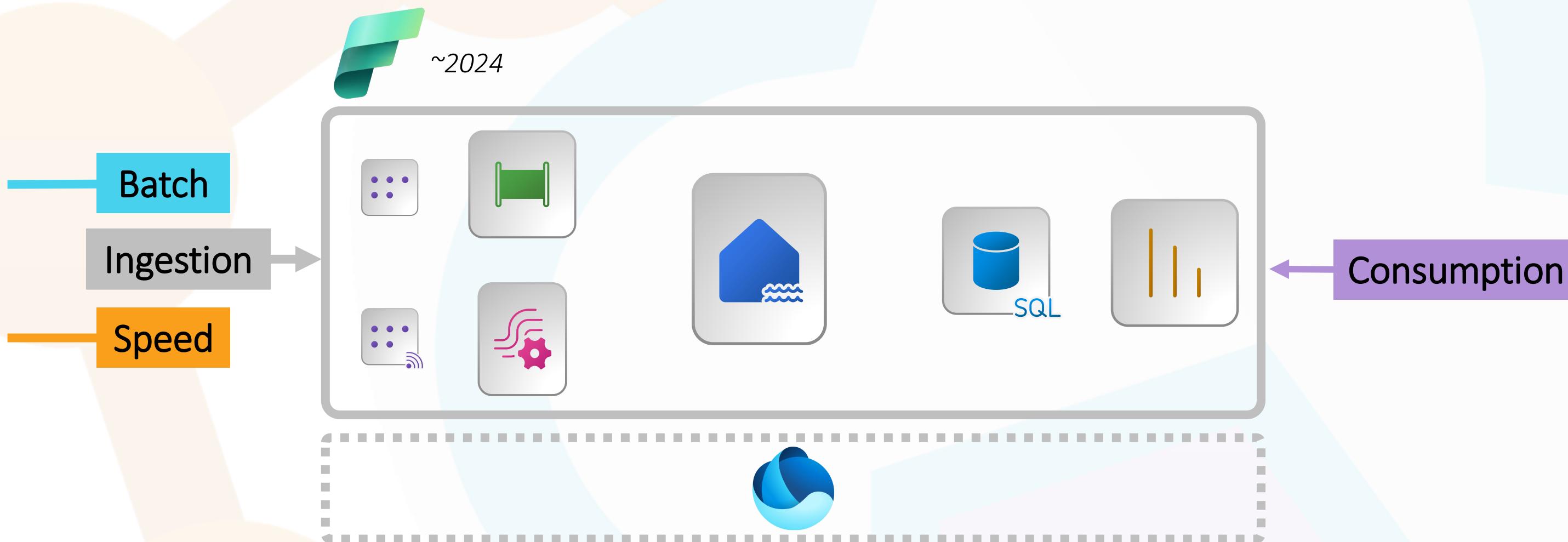
Cloud Formations - Knowledge Transfer & Training





Microsoft Fabric vs a Kappa Architecture

Cloud Formations - Knowledge Transfer & Training



Lambda & Kappa Architectures vs Technology



Cloud Formations - Knowledge Transfer & Training

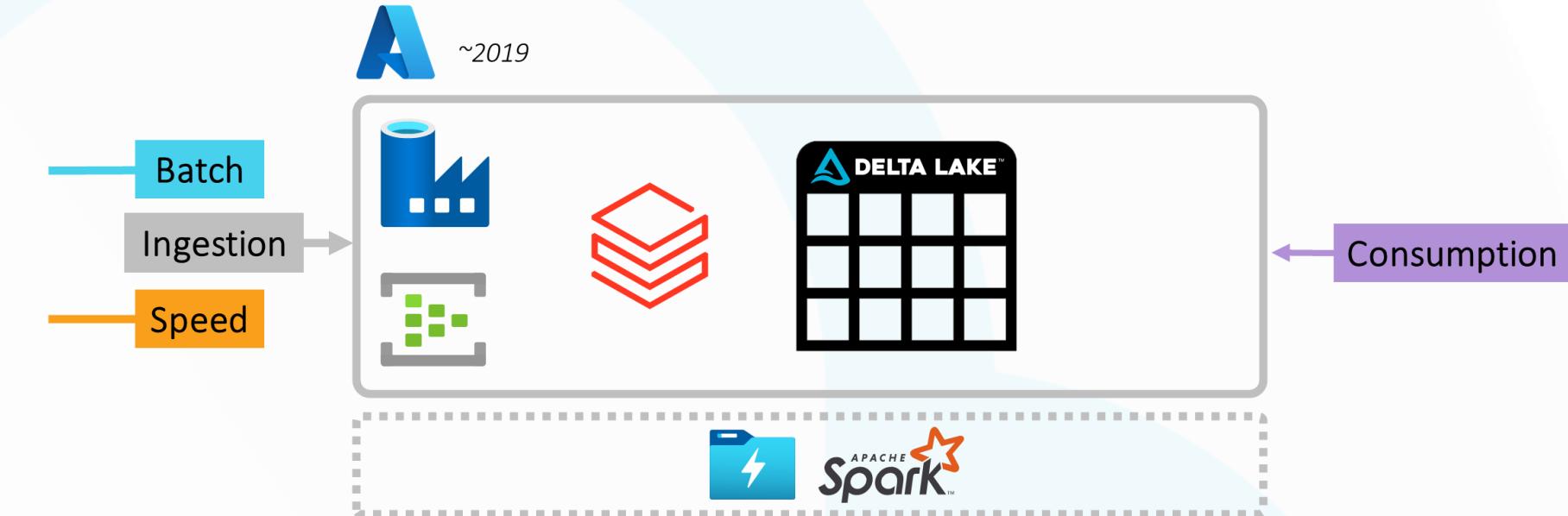
Lambda

~2015

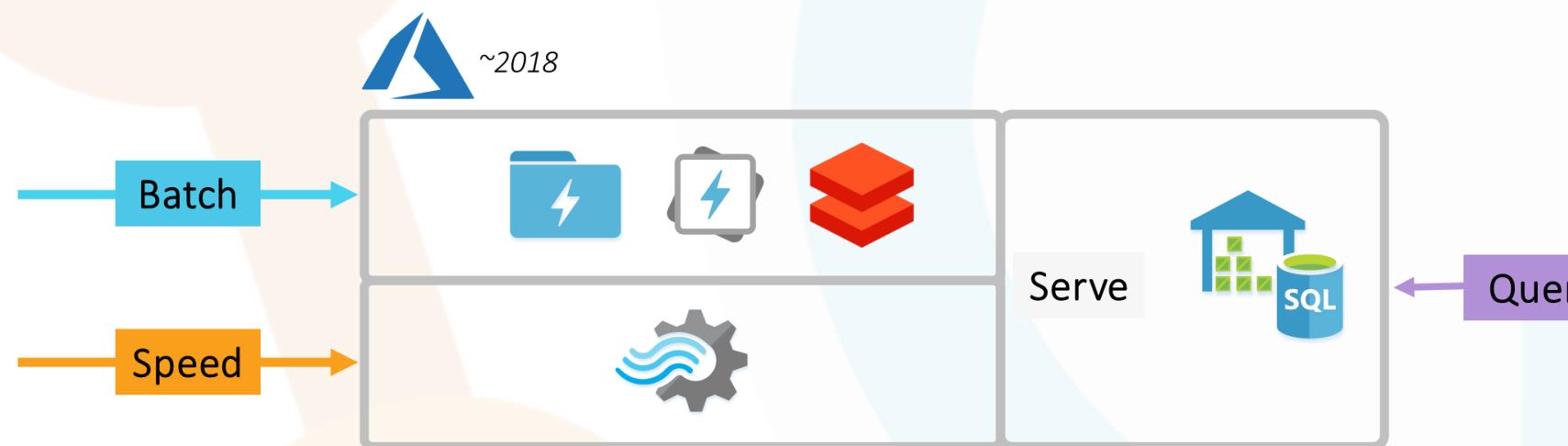


Kappa

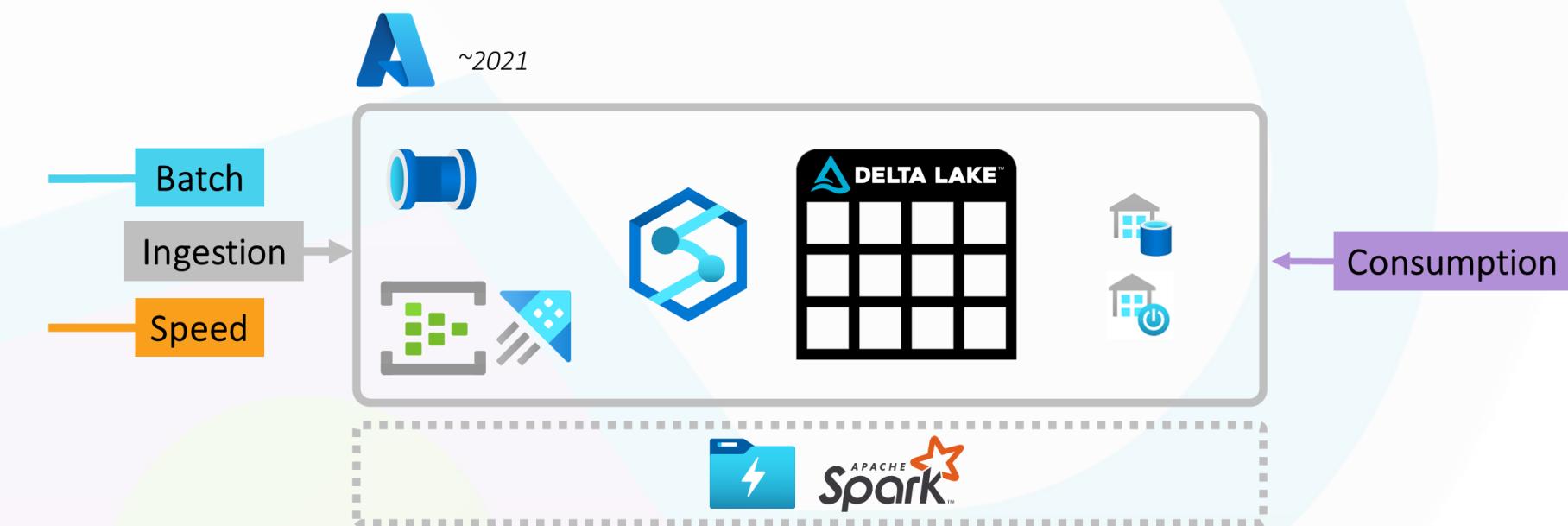
~2019



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~2021

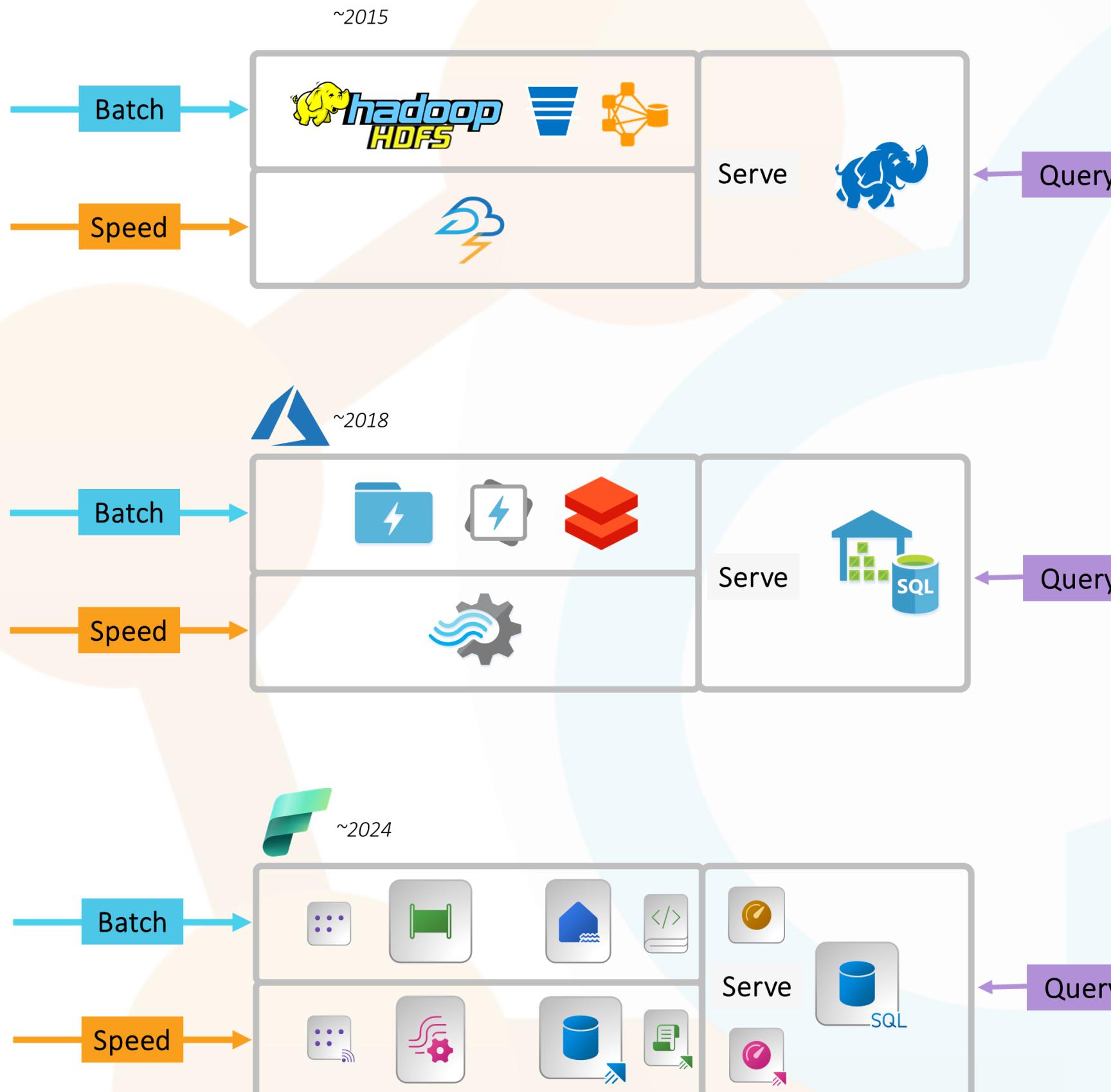


Lambda & Kappa Architectures vs Technology

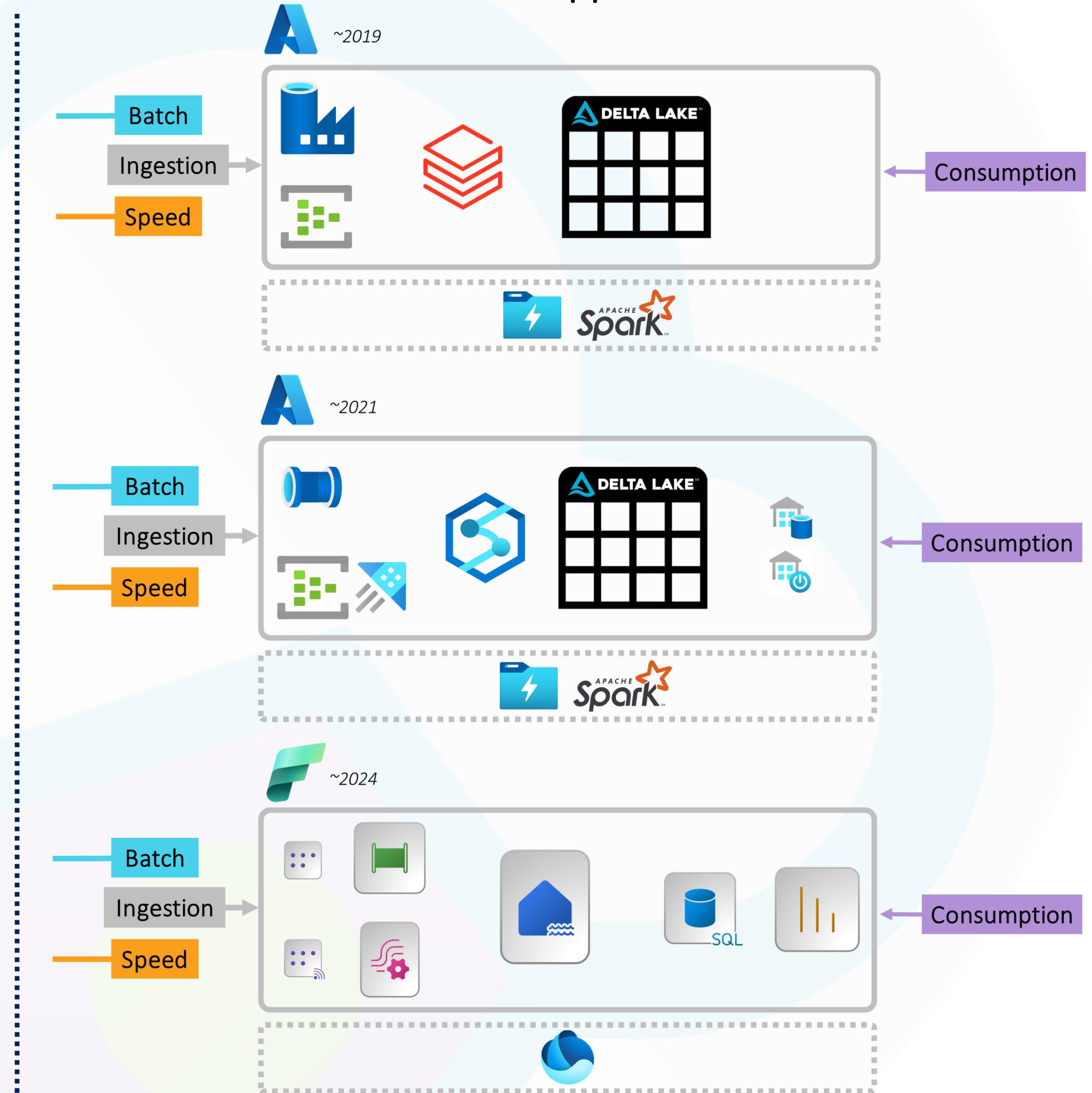


Cloud Formations - Knowledge Transfer & Training

Lambda



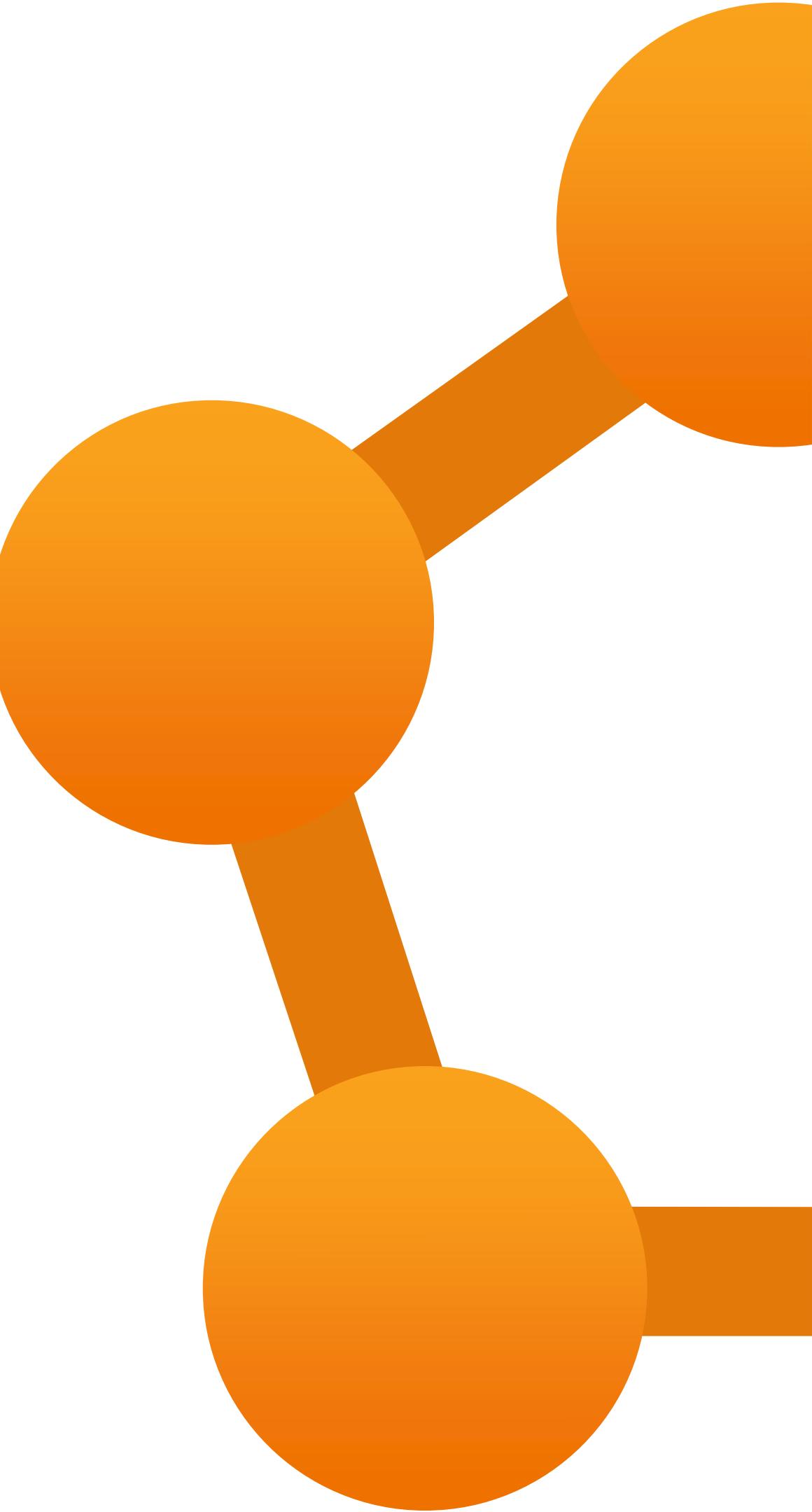
Kappa



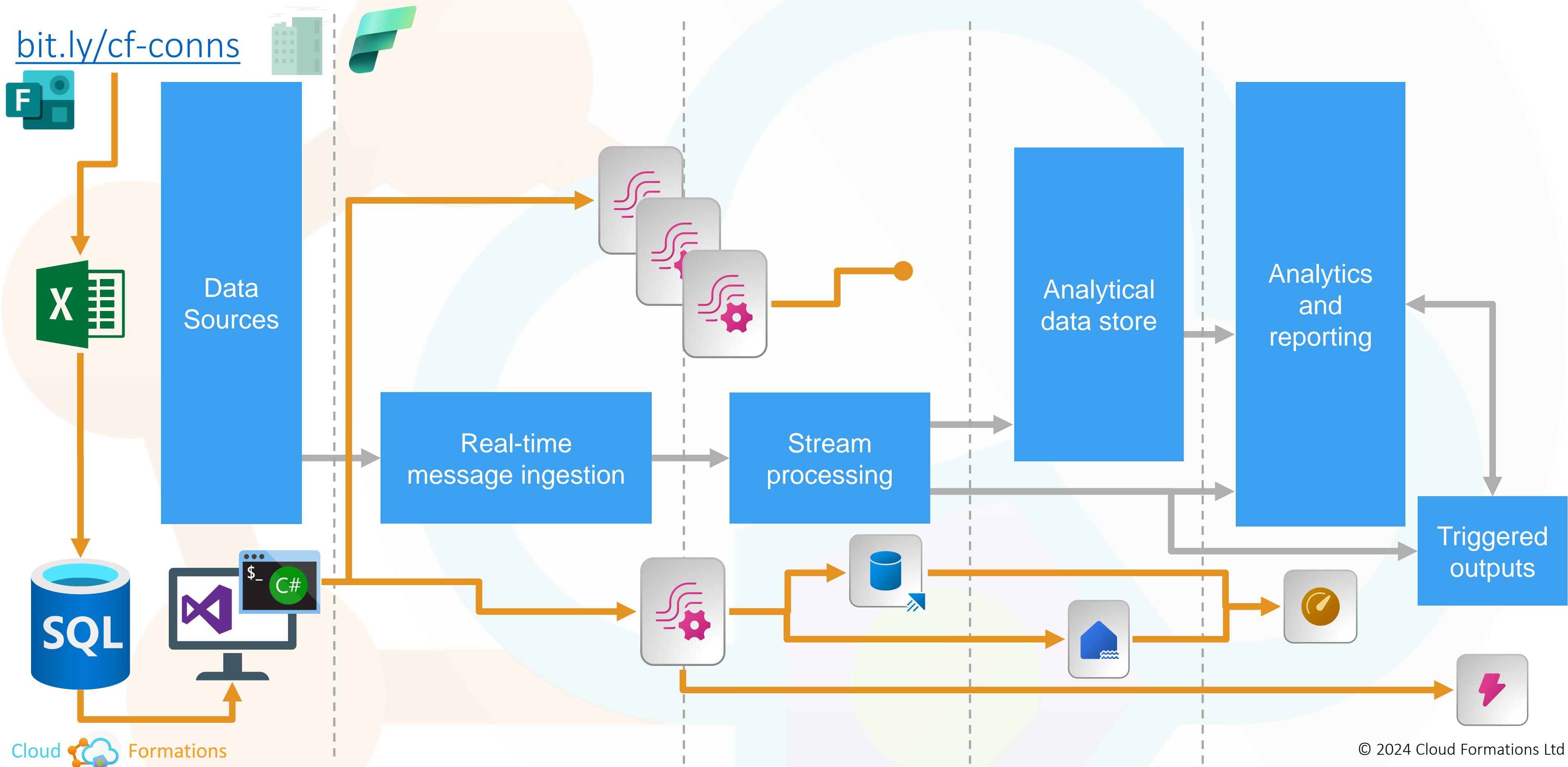
Let's Build Something!

Data Stream 2

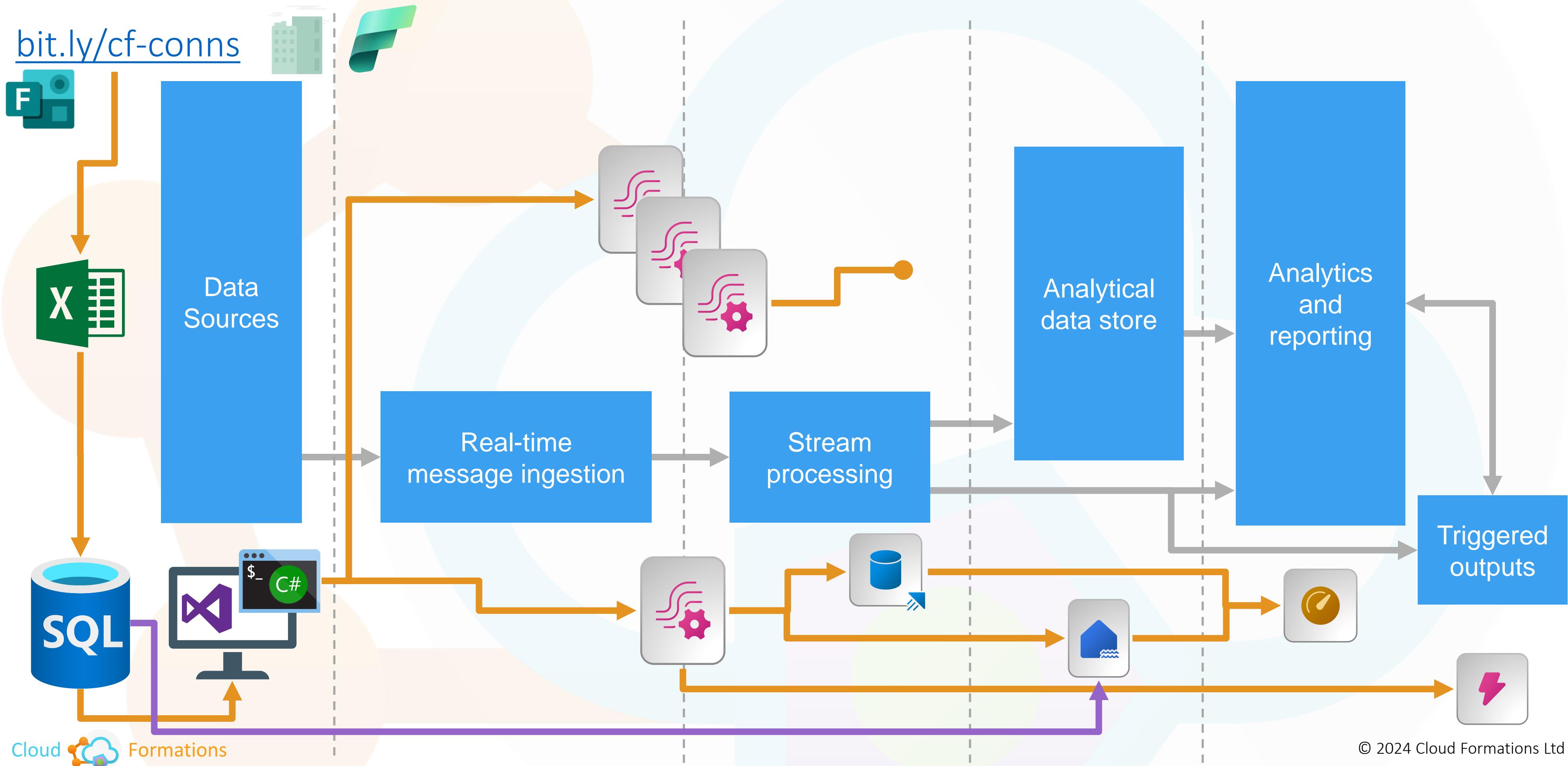
Cloud Formations

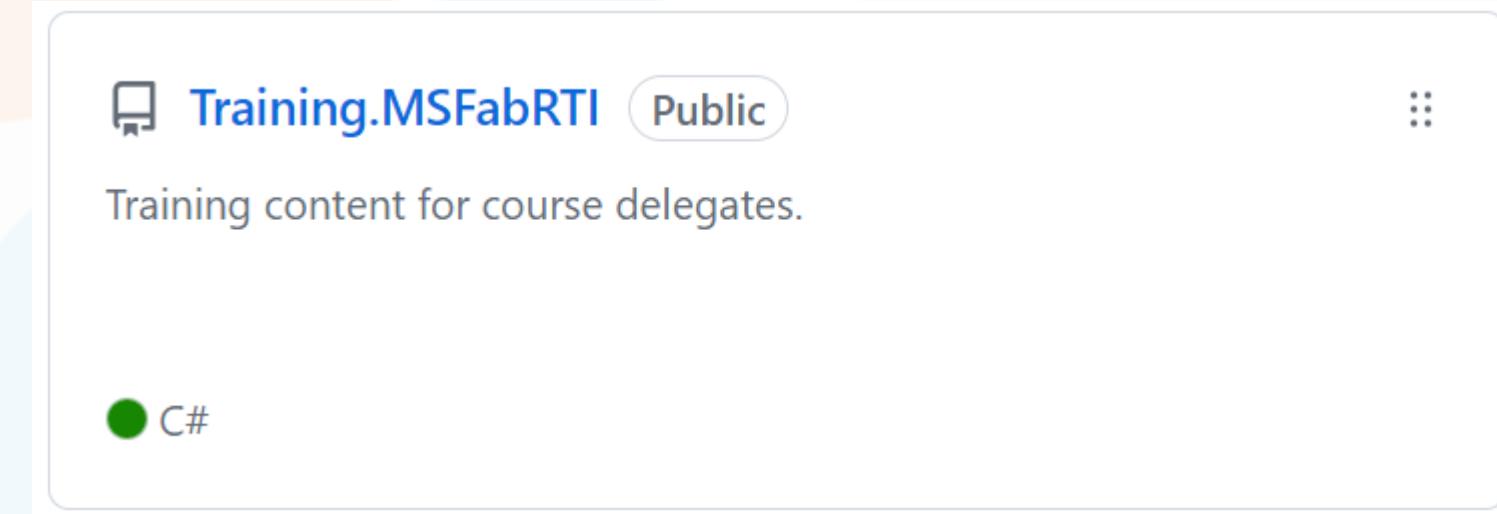


Fabric Real-Time Data Handling



Fabric Real-Time Data Handling (Mirroring)

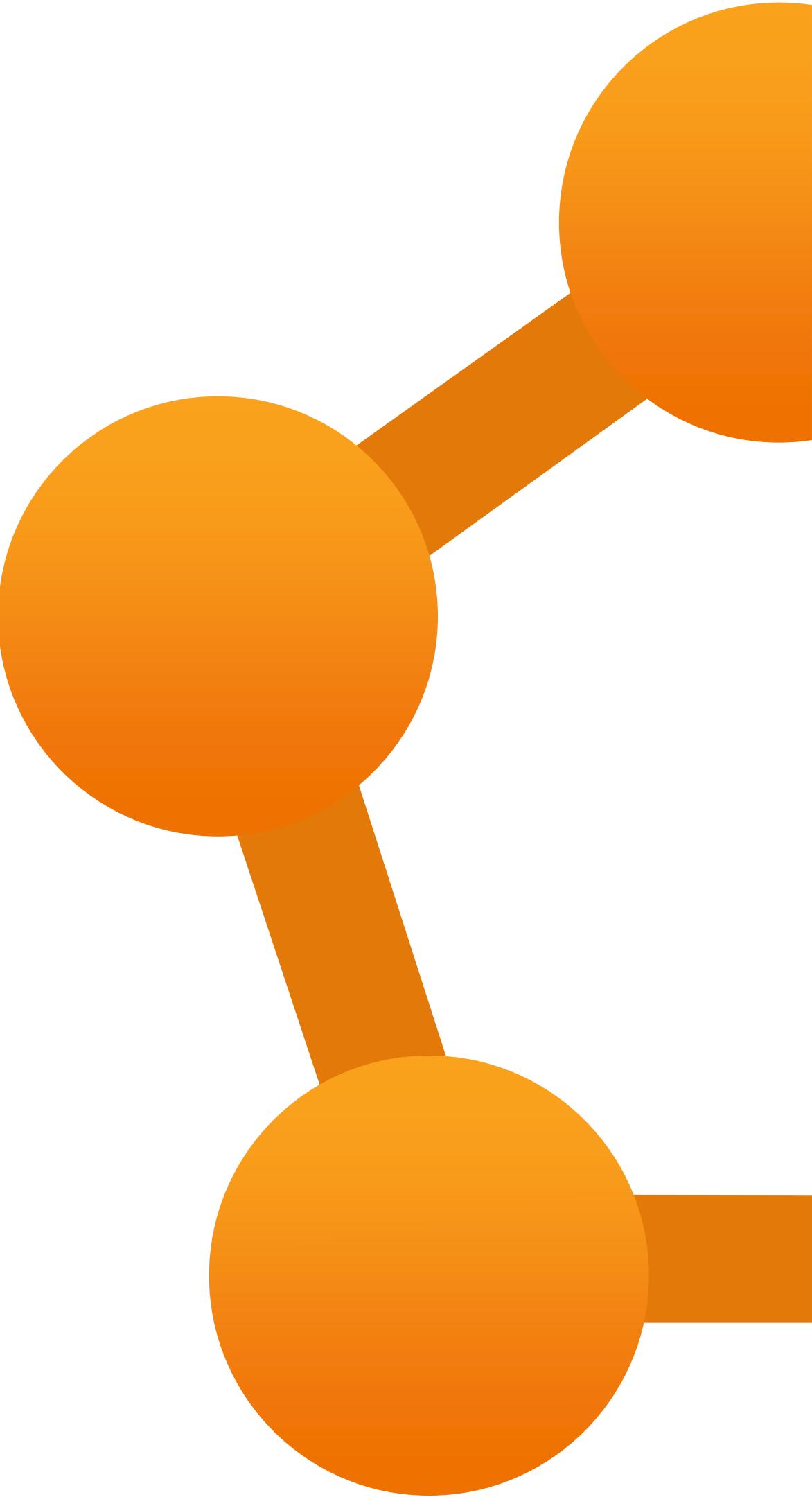




[https://github.com/
CloudFormations/
Training.MSFabRTI](https://github.com/CloudFormations/Training.MSFabRTI)

Conclusions

Cloud Formations



Glossary

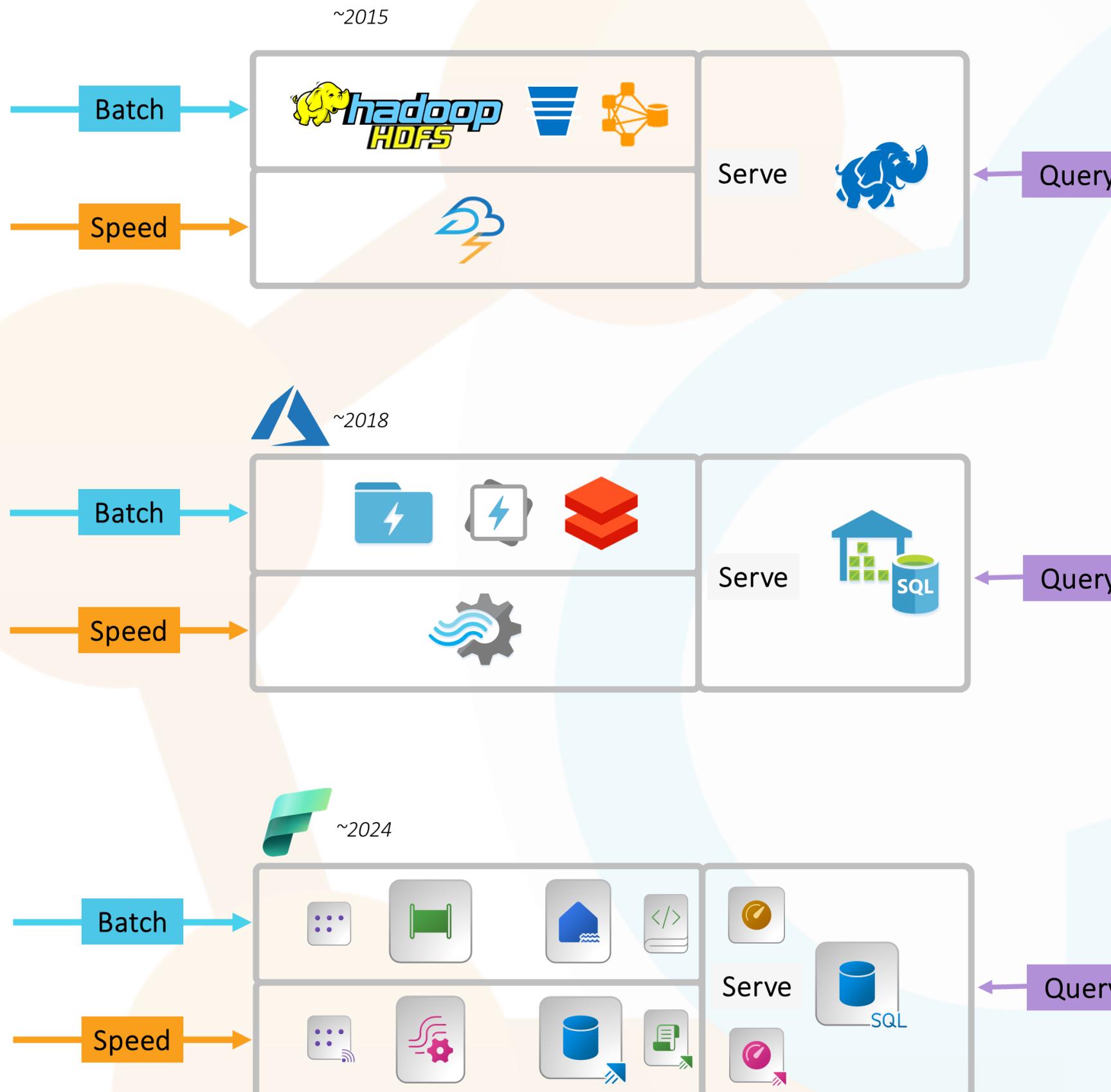
Term	Definition
Big Data	Any data that you cannot process in the time that you have/want using the technology you have.
Real-time Data	Delivering data from the producer to consumer as fast as possible using the technology you have.
Near Real-time Data	Delivering data from the producer to consumer within 1 minute of it being created.
Data Stream	Data that is constantly flowing from producer to consumer in near real-time.

Lambda & Kappa Architectures vs Technology

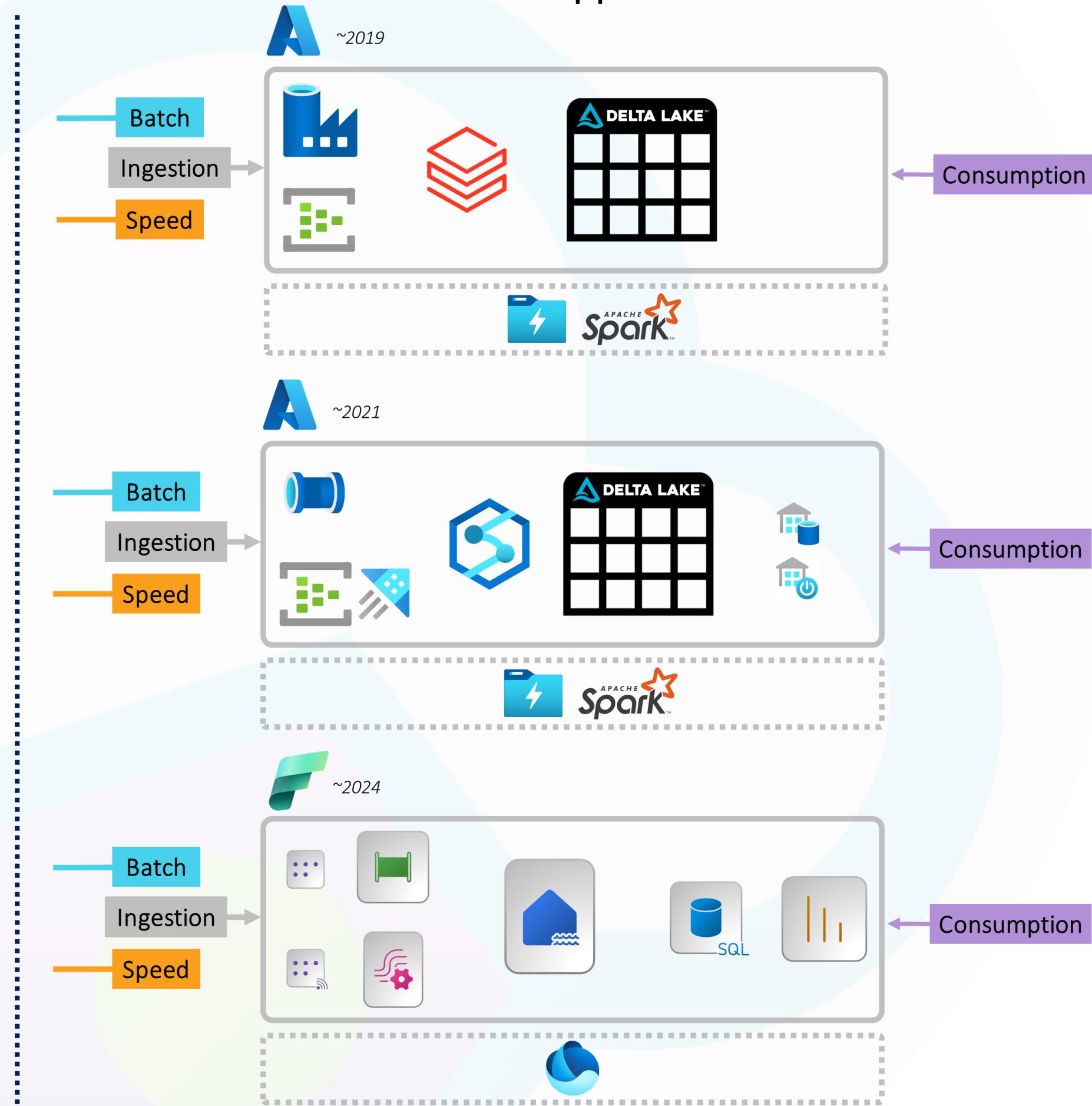


Cloud Formations - Knowledge Transfer & Training

Lambda



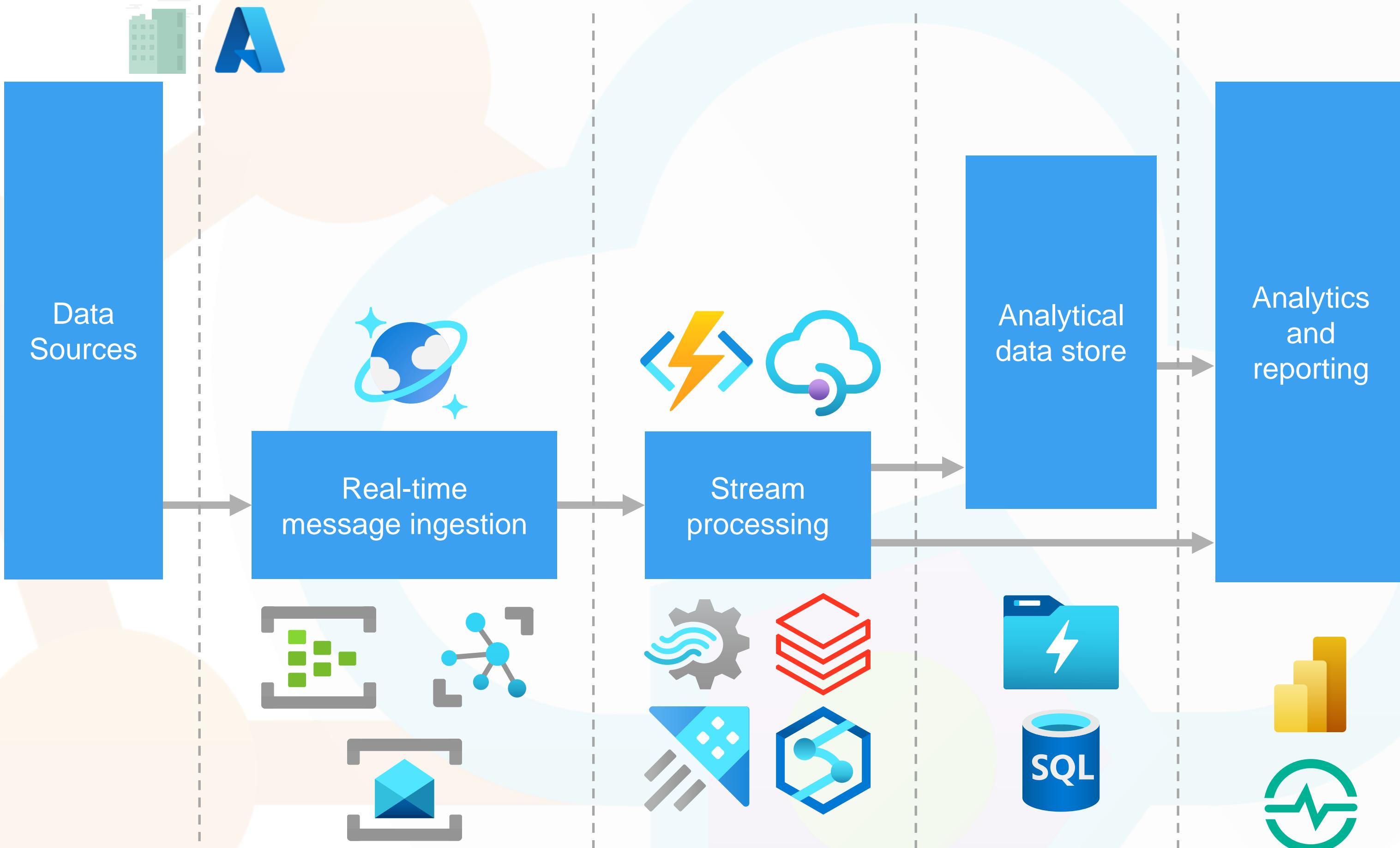
Kappa



Azure Tooling – My Favourites



Cloud Formations - Knowledge Transfer & Training



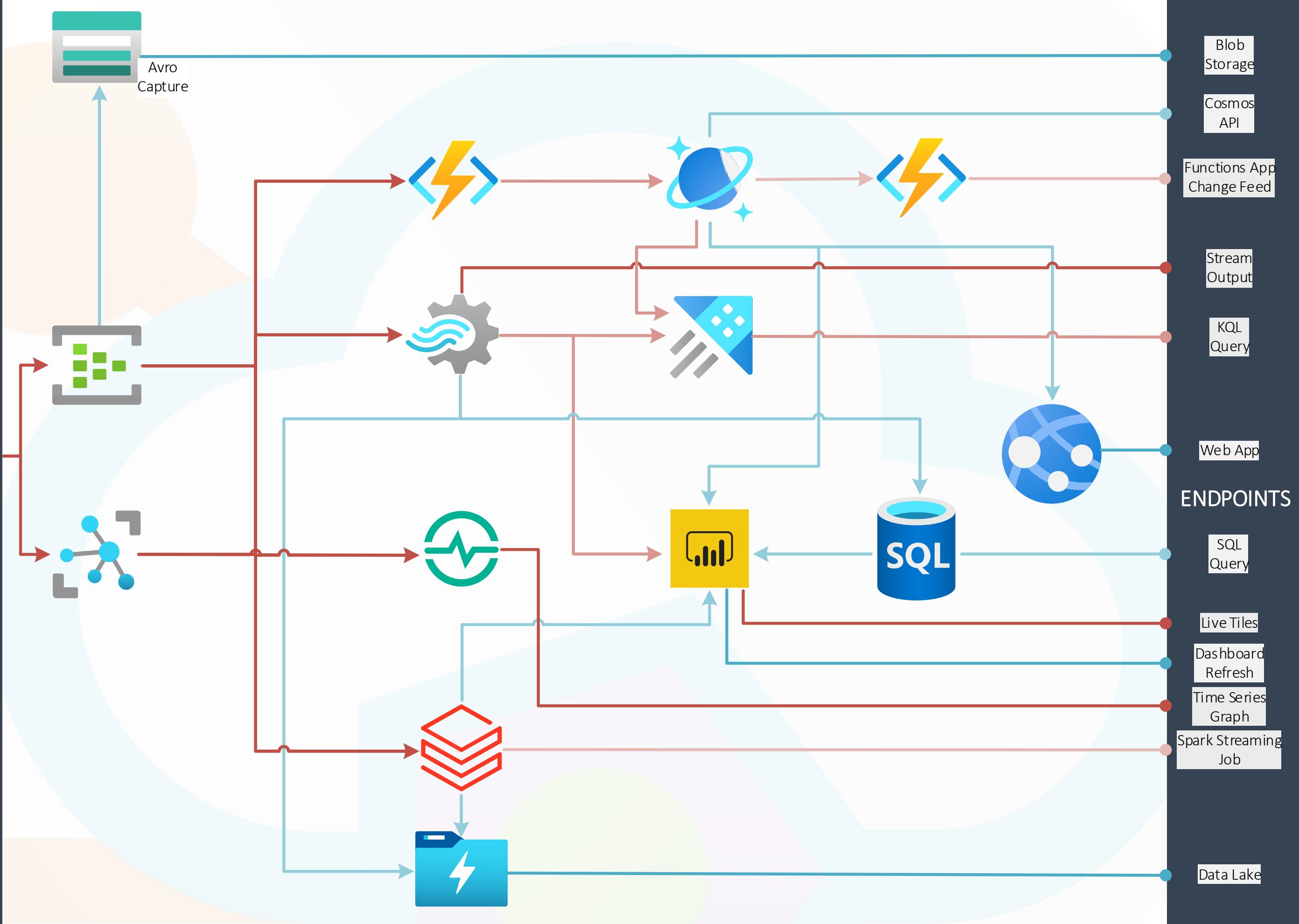
All The Options

Data Cool Down

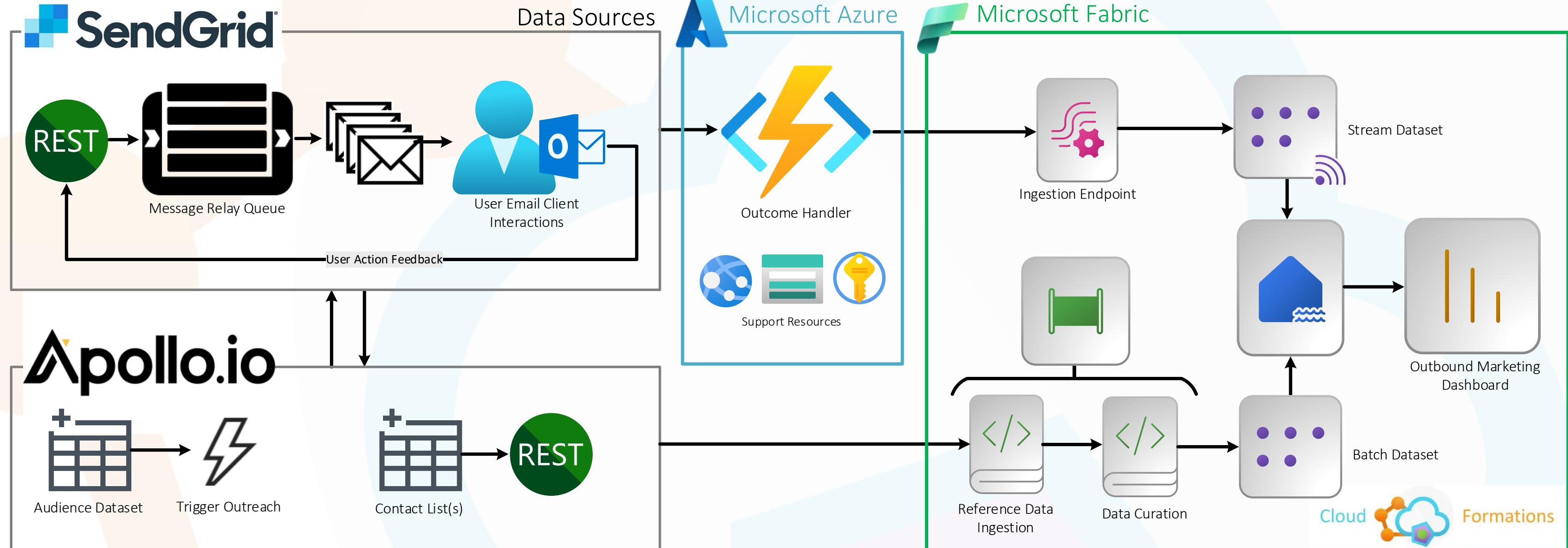
(Process Latency)

- Hot Path
- Cold Path

DATA SOURCES



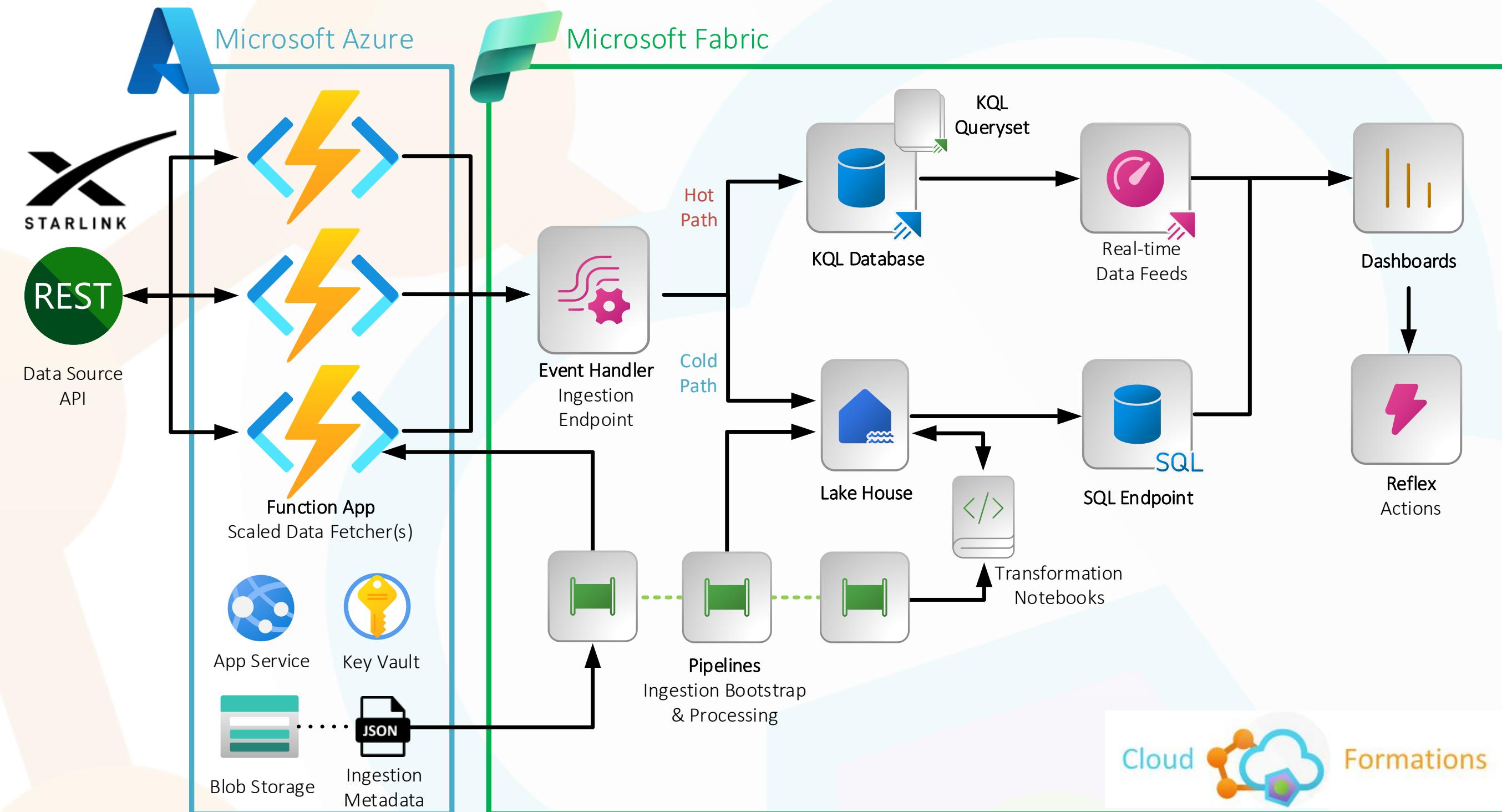
Case Study 1



Near real-time streaming of marketing outreach data into Power BI dashboards to provide up to the minute analytics on the performance of campaigns to inform future content and audience enrolment.



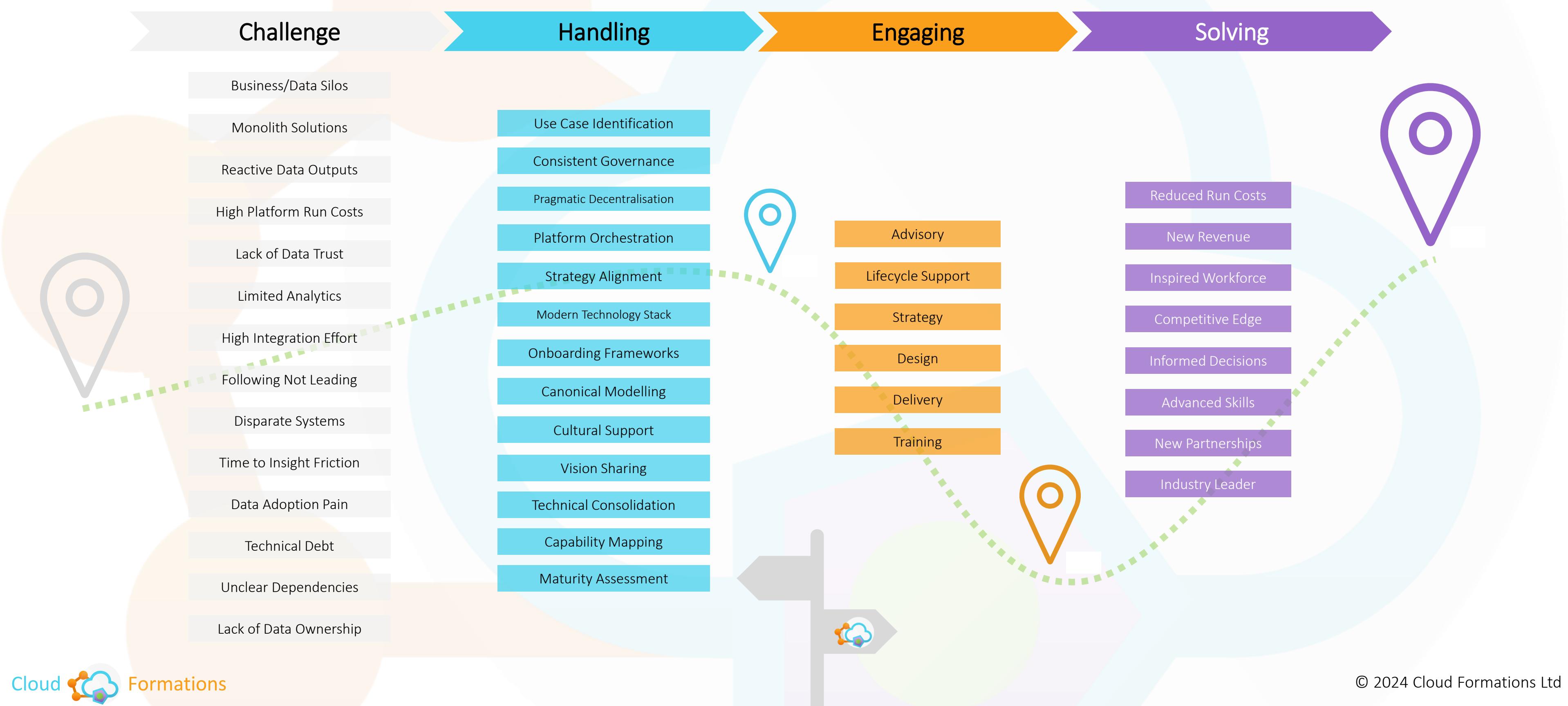
Case Study 2



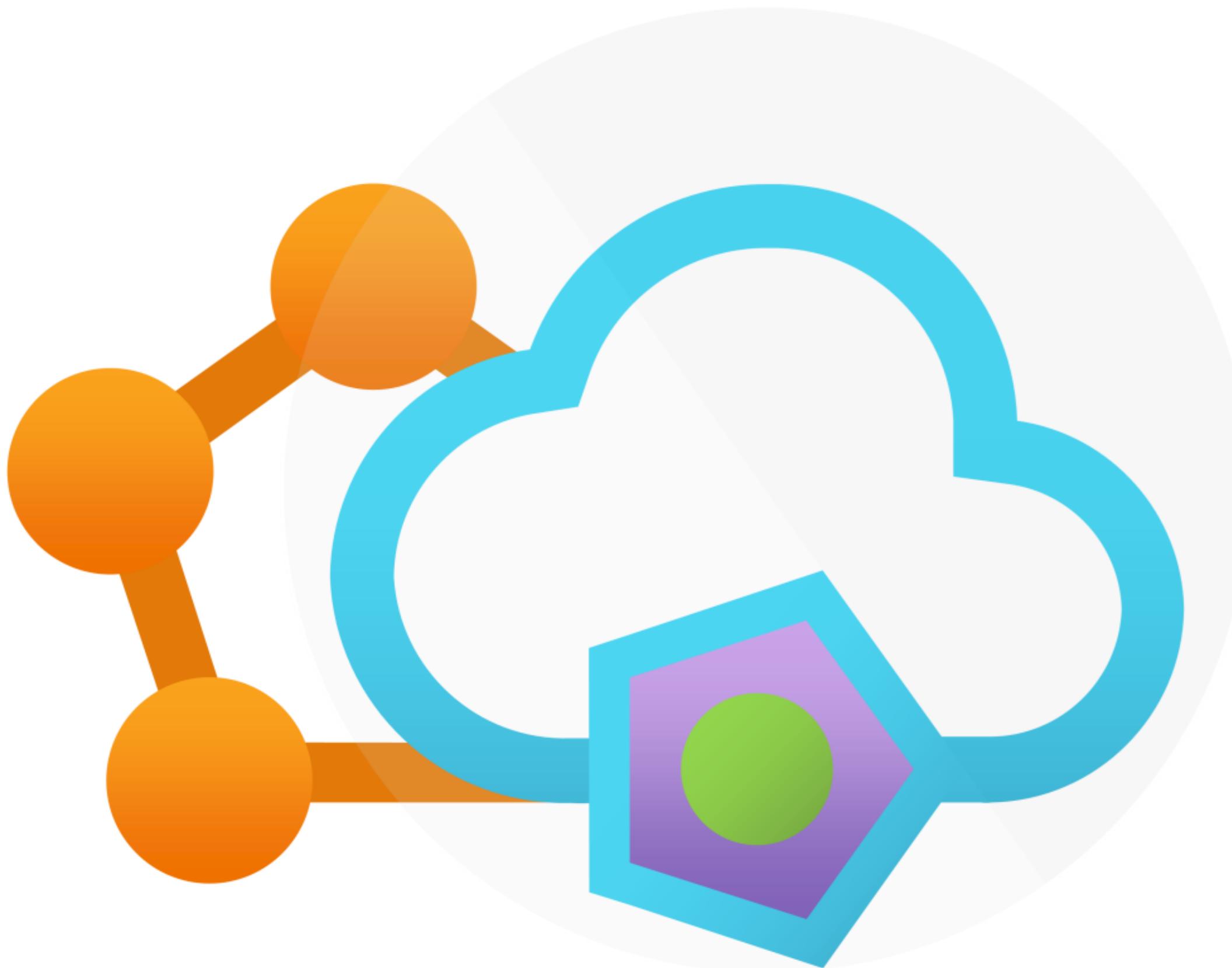
The greenfield implementation follows a microservices approach to data handling, leveraging Azure Functions Apps to ingest telemetry from the Starlink API at scale and metadata driven, feeding into a Microsoft Fabric Event Stream. Bootstrapped by Integration Pipelines, data feeds into Realtime Analytics Kusto Databases and Lakehouse structures for reporting using Power BI Dashboards.

Common Data Problems

Identifying Pathways to Value and Data Insights



Thank You



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 [@mrpaulandrew](https://twitter.com/mrpaulandrew)



Cloud Formations