# Azure Stream Analytics

## Beyond IoT Real-time Data Ingestion

Paul Andrew

Microsoft Most Valuable Professional

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# Azure Stream Analytics

**Real-time data problems**

**What is ASA and why use it**

**Production Considerations**

**Lambda  Architecture**

# Azure Stream Analytics

**Real-time data problems**

What is ASA and why use it

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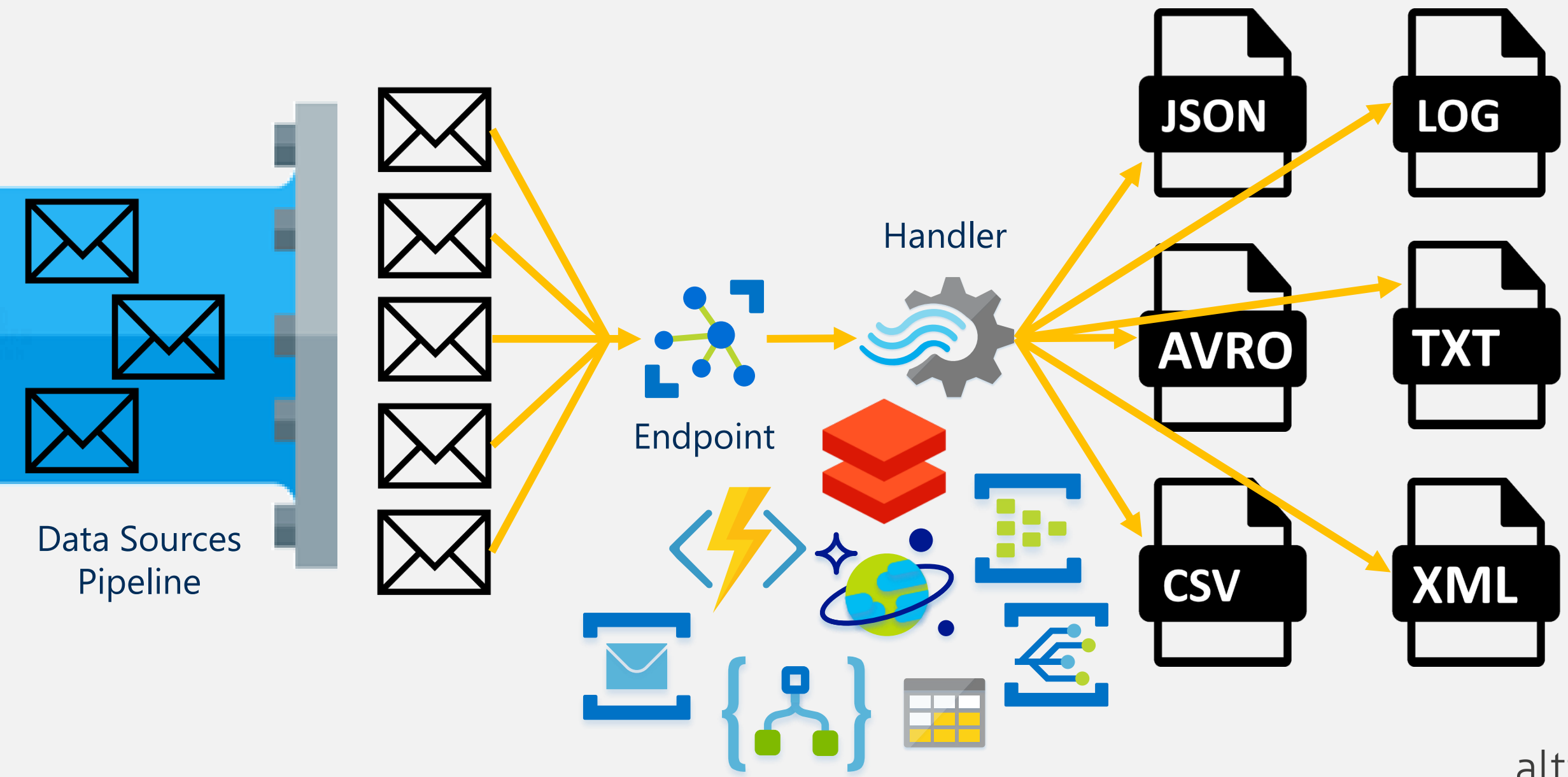
Lambda  Architecture

**Problem:** Real-time Data Feeds



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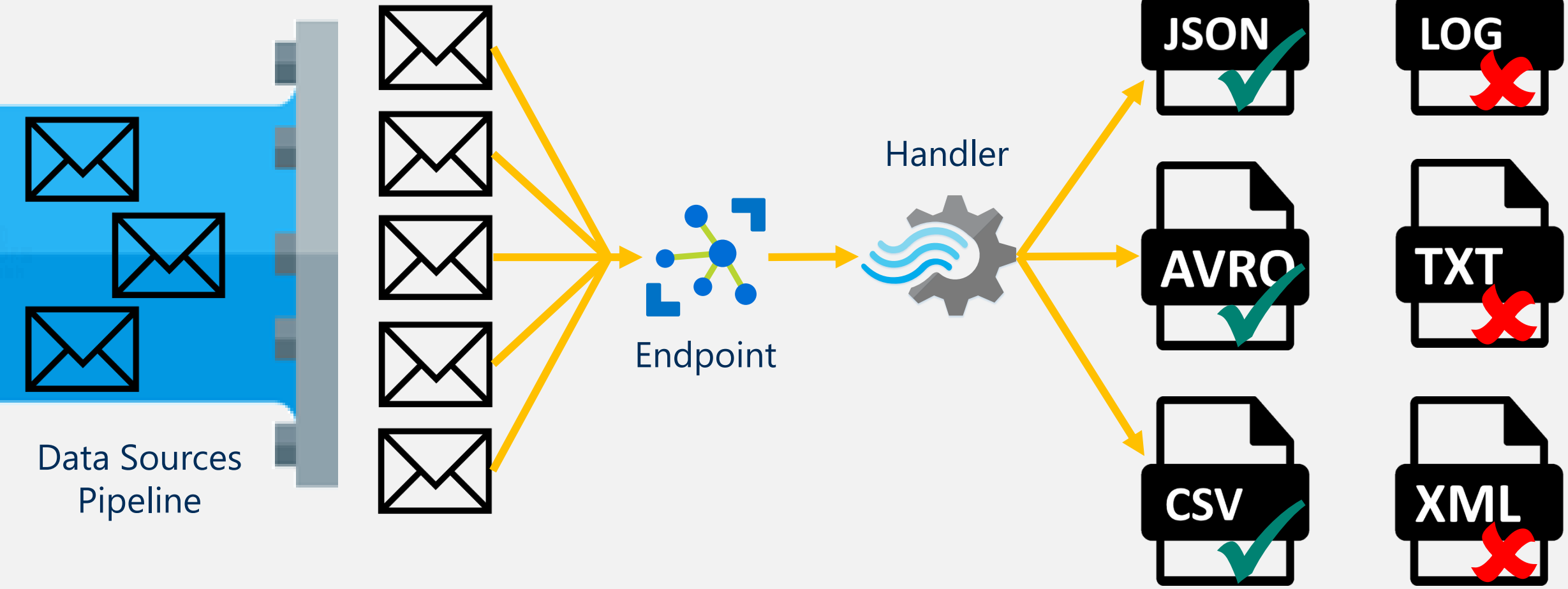

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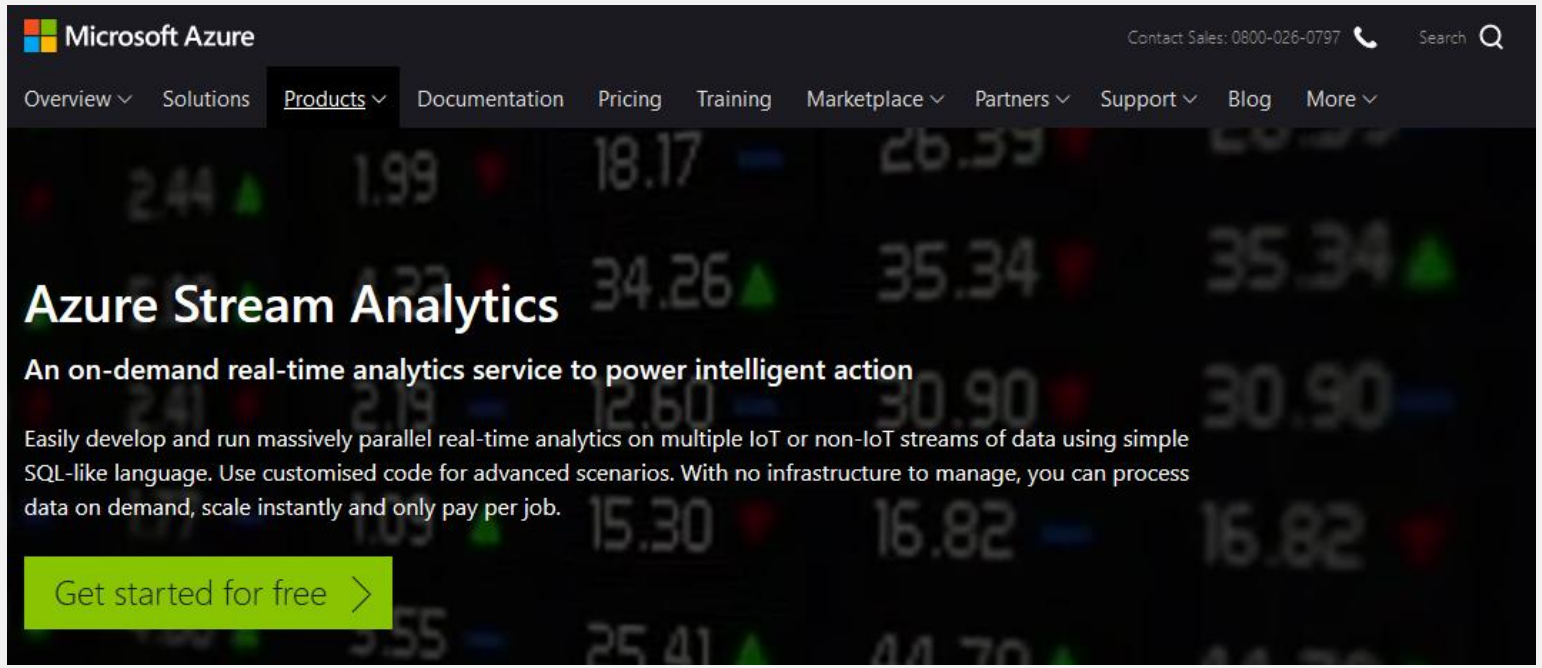


# Azure Stream Analytics

https://azure.microsoft.com/en-gb/services/stream-analytics/

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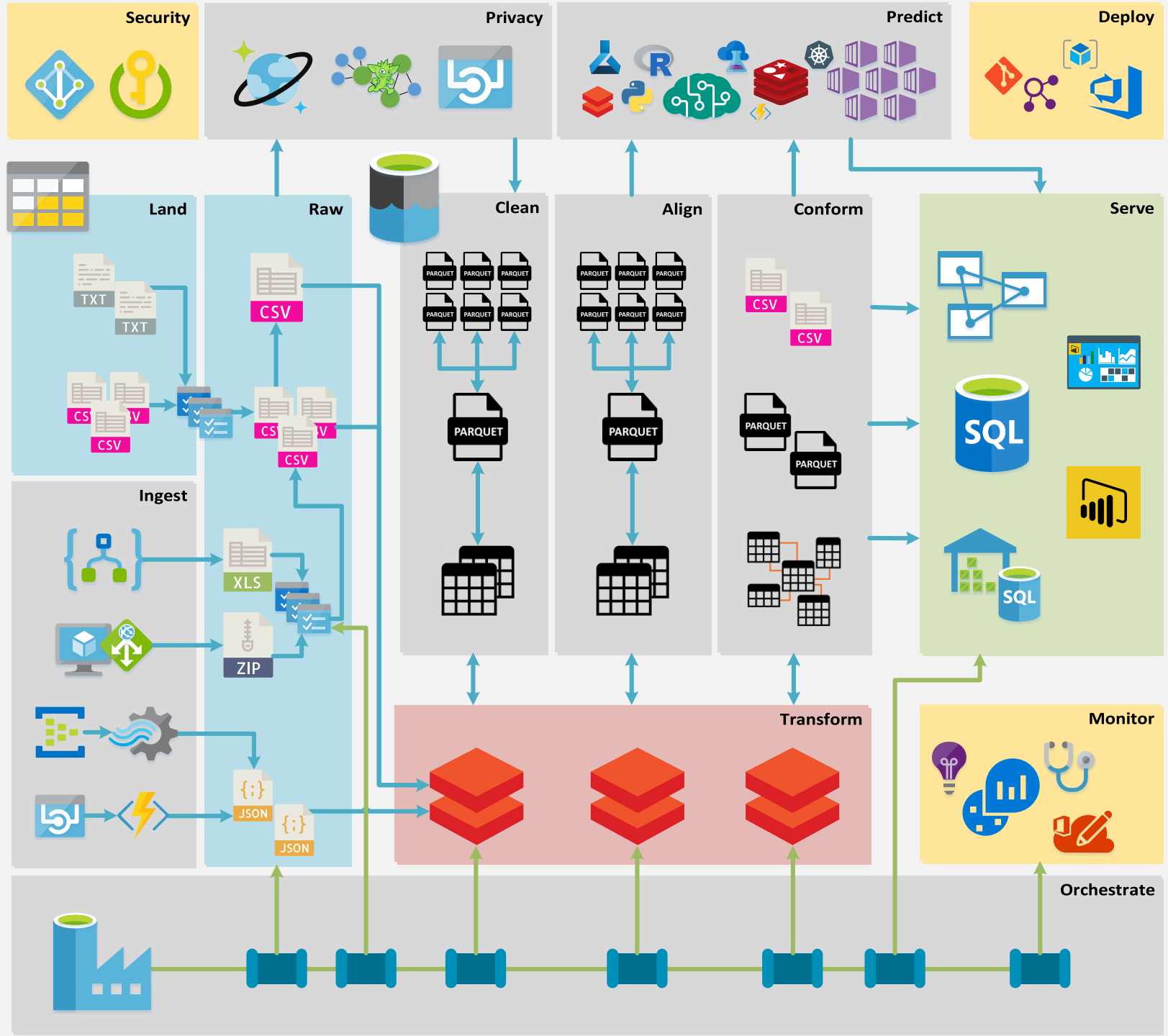


# What is ASA and why use it

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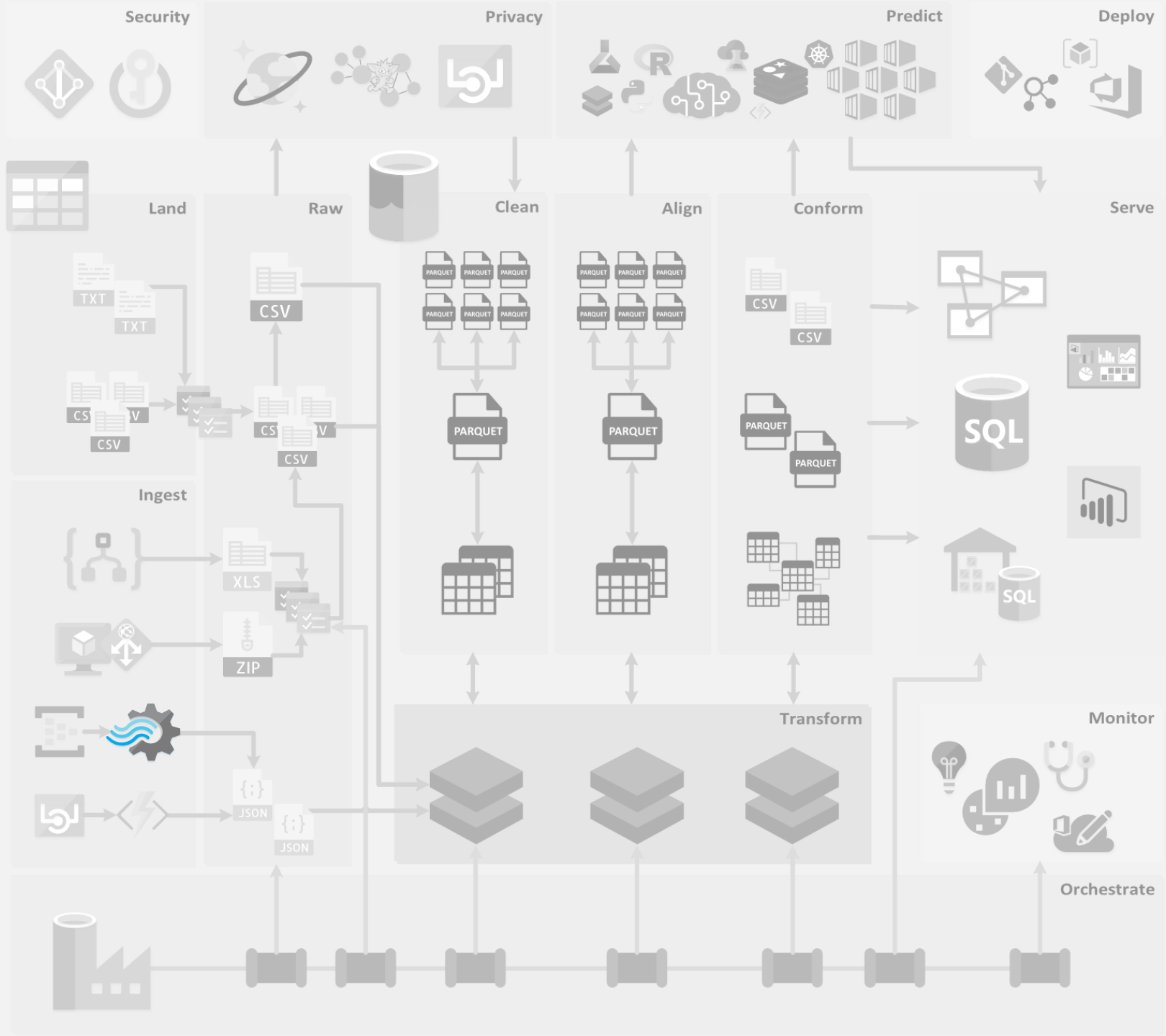


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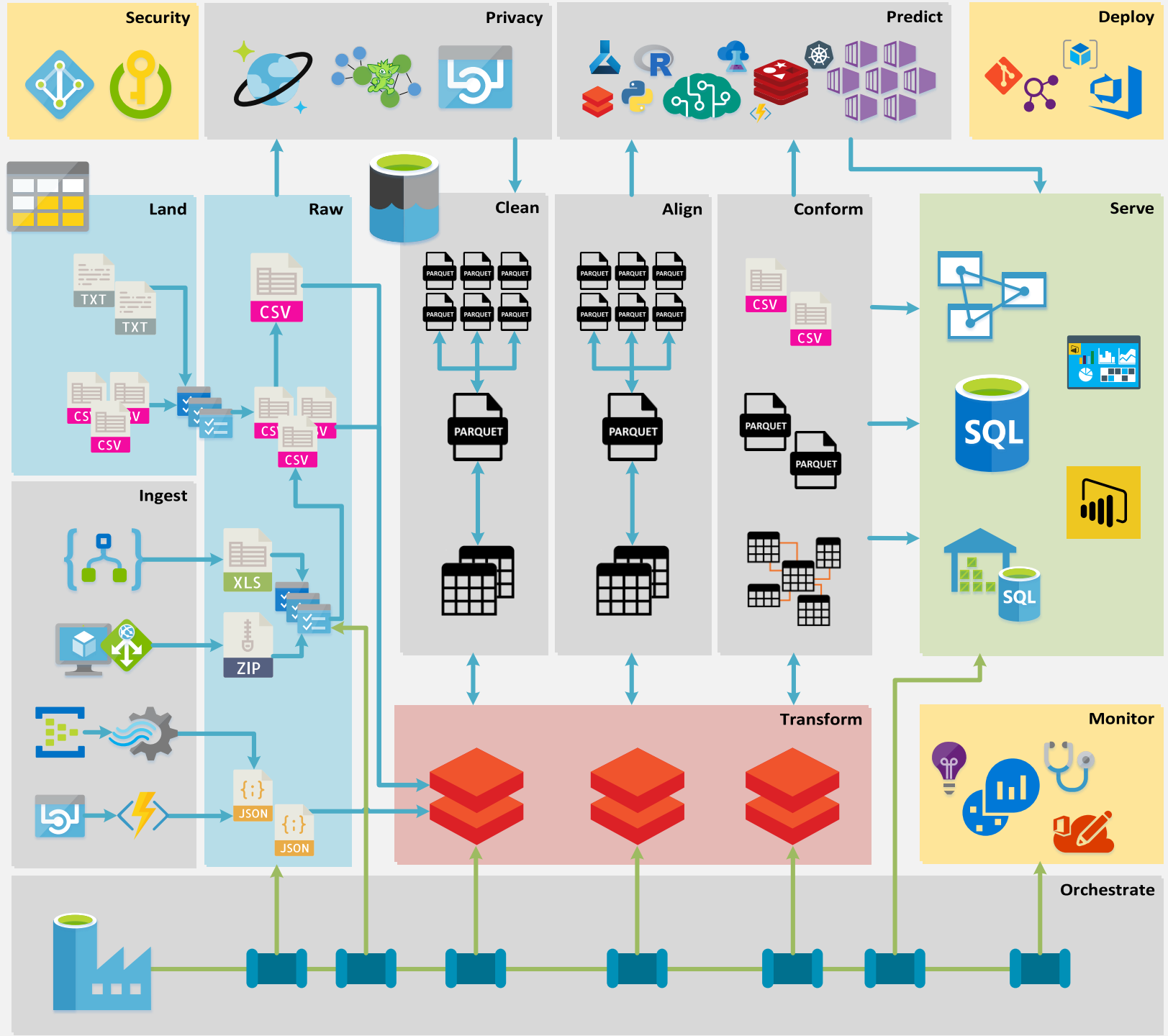


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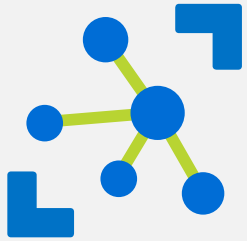
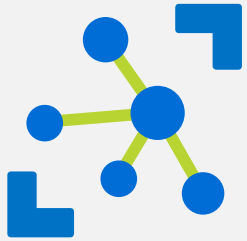


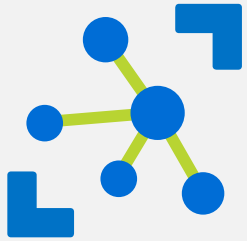
# Azure IoT Hub vs Azure Event Hub



| Feature | Azure IoT Hub | Azure Event Hub |
|---|---|---|
| Message Direction | 2 Way | 1 Way |
| Protocol Support | MQTT, AMQP, HTTP | AMQP, HTTP |
| Scaling | Configured | Automatic |
| Message Routing | Yes | No |
| Security | Device Level | Hub Level |
| Device State Support | Yes | No |
| Message Capturing | No | Yes |
| Multiple Namespaces | No | Yes |
| Tiers | F1/S1/S2/S3 | Basic/Standard |
| Service Endpoint | Yes | Yes (preview) |

https://docs.microsoft.com/en-us/azure/iot-hub/iot-hub-compare-event-hubs

# Azure IoT Hub vs Azure Event Hub



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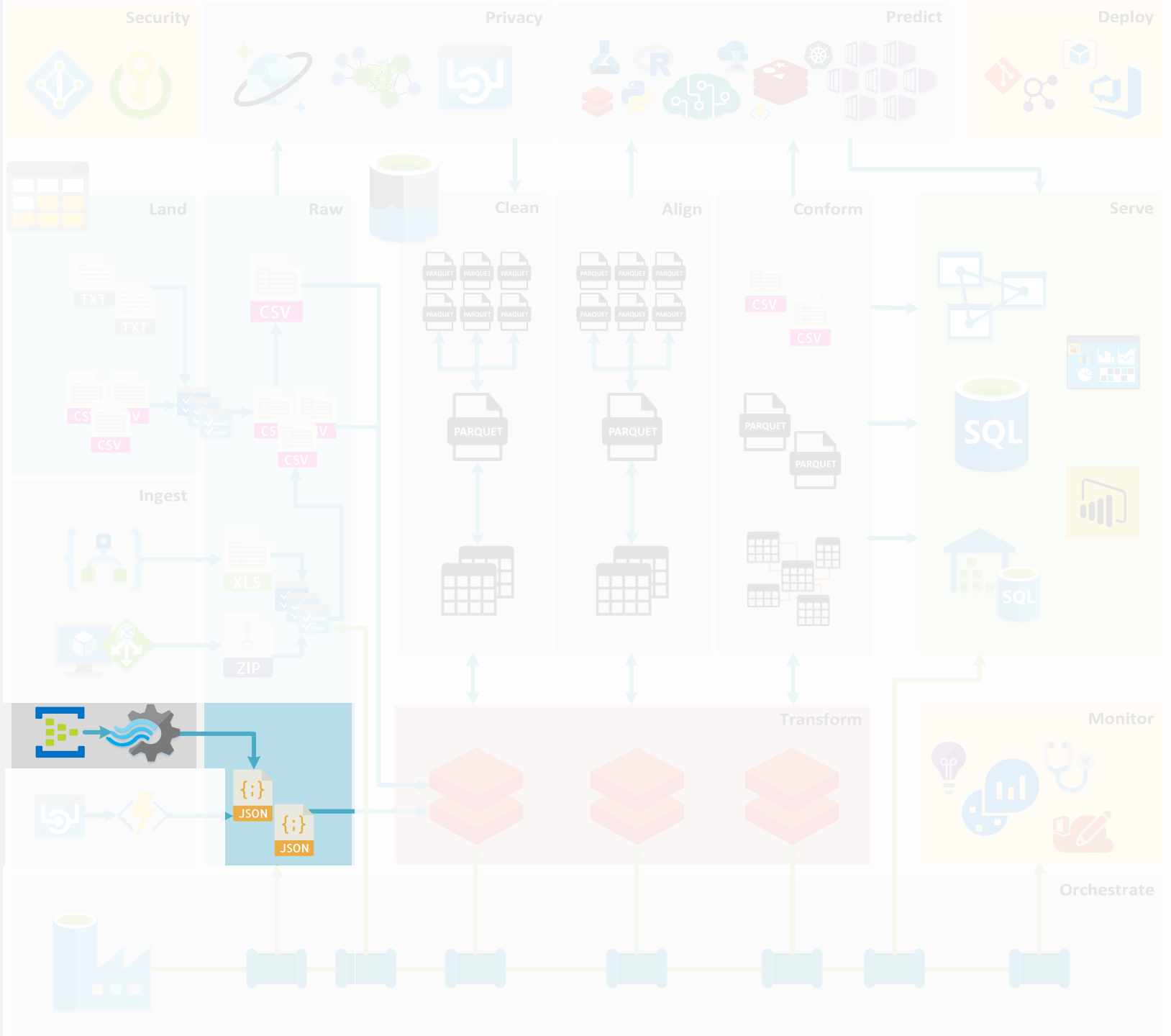


# What is ASA and why use it

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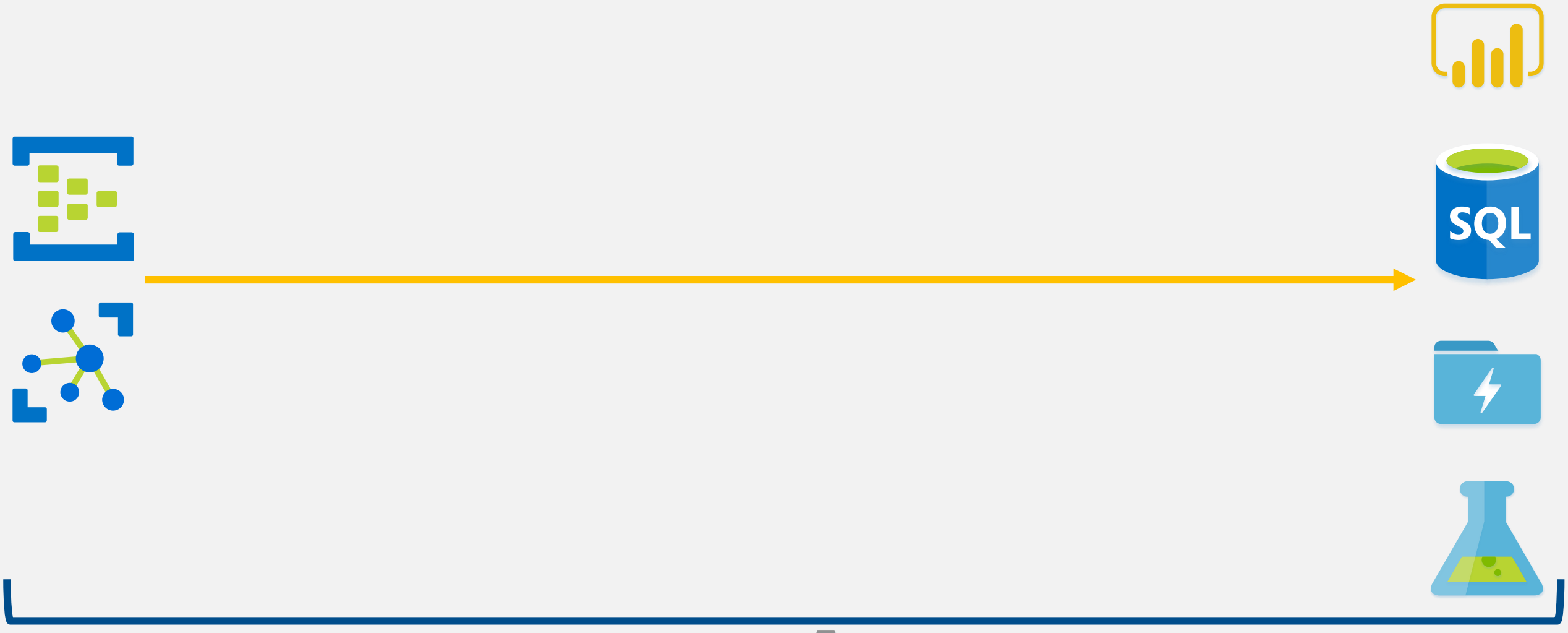
# Azure Stream Analytics



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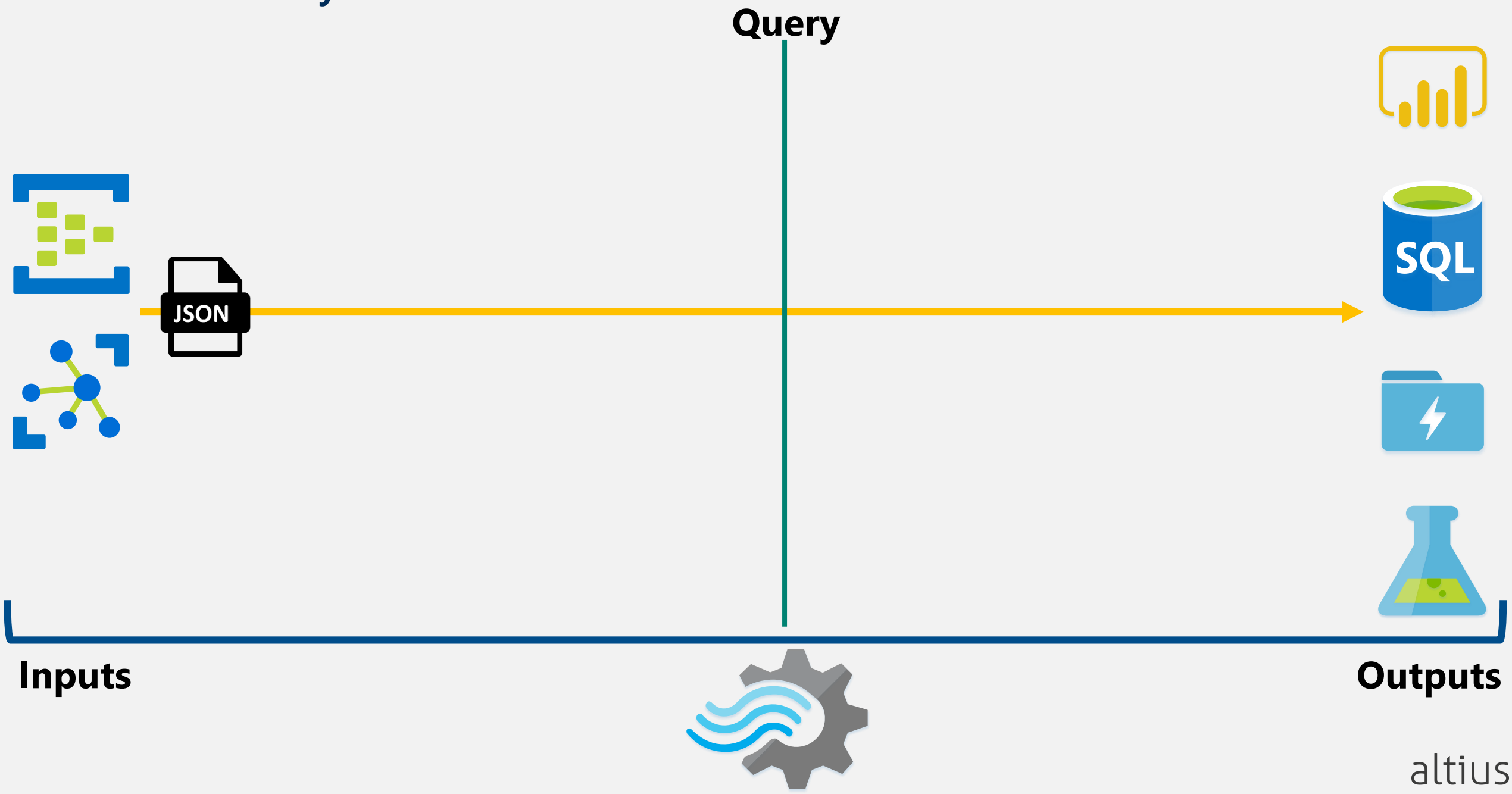

# Azure Stream Analytics

## 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**

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# 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)
```


*100MB Limit


**Inputs**

**Outputs**

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# Azure Stream Analytics

## Query



*100MB Limit

```
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**

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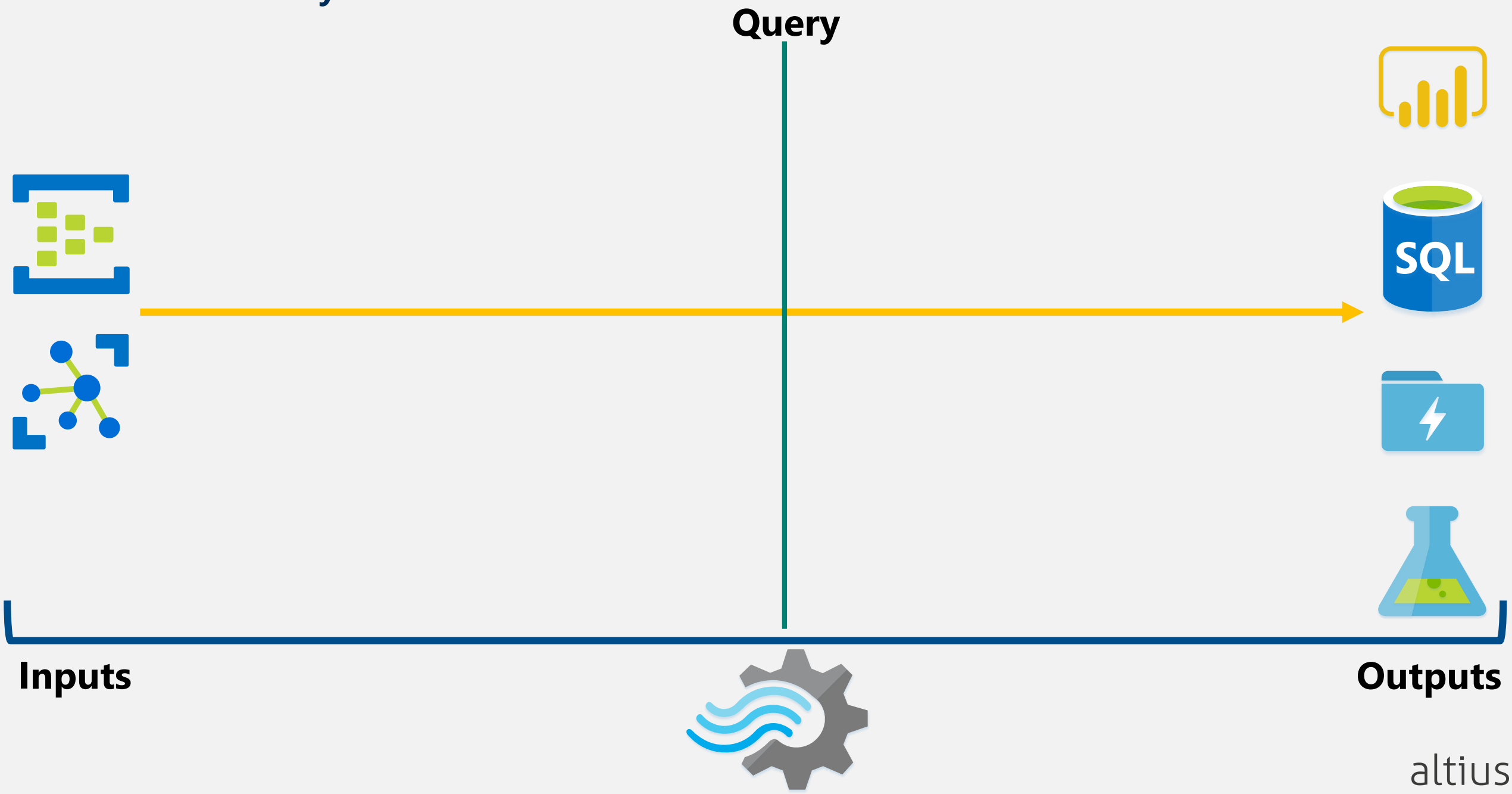
# Azure Stream Analytics



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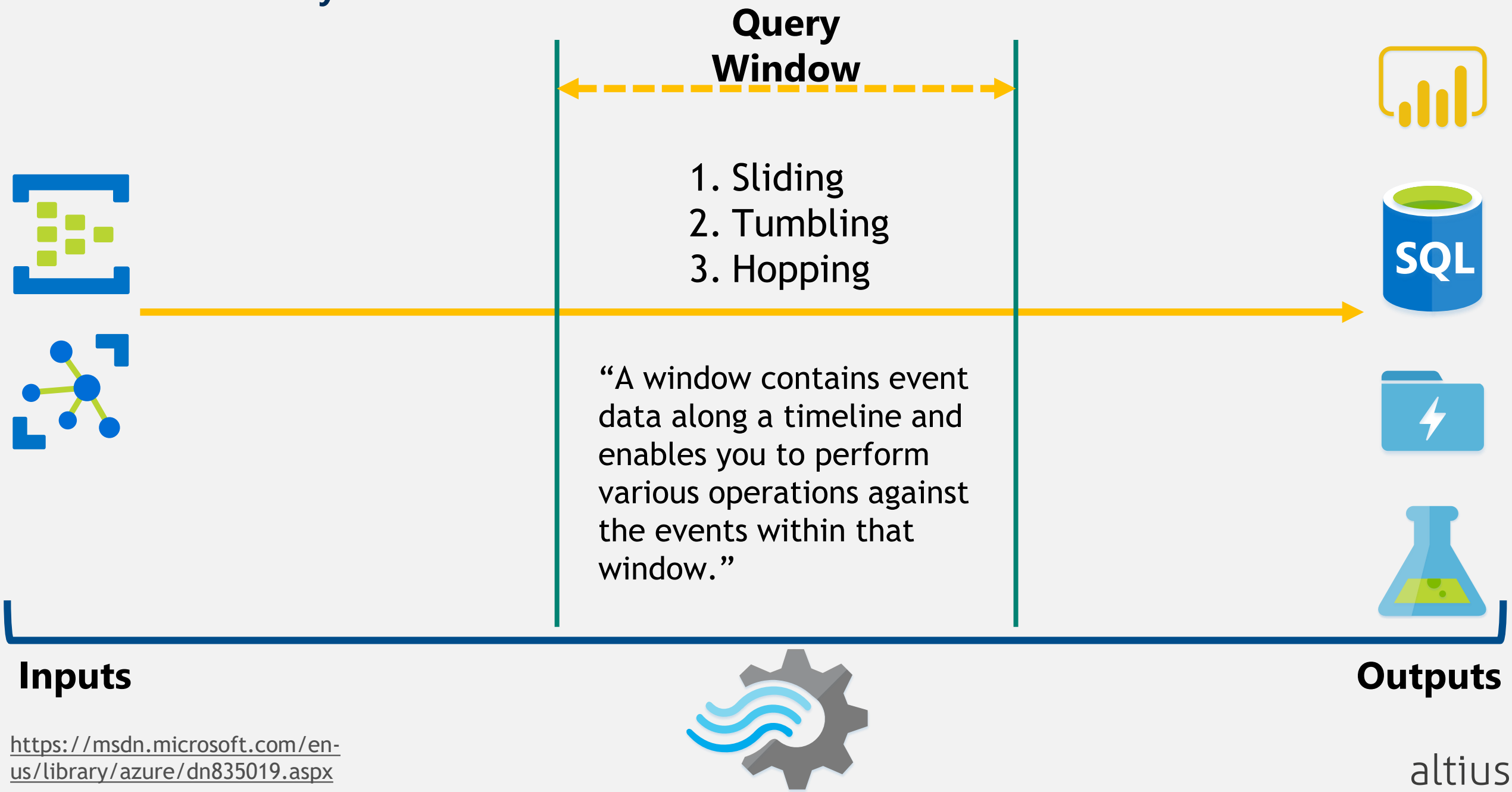


https://msdn.microsoft.com/en-us/library/azure/dn835019.aspx

# Azure Stream Analytics

## Sliding Window

```
SELECT
    MIN([value]) AS 'Min',
    MAX([value]) AS 'Max'
INTO
    SQLDBAvg
FROM
    IoTHub
TIMESTAMP BY
    timecreated
GROUP BY
    SlidingWindow(second, 5))
```


**Inputs**

**Outputs**

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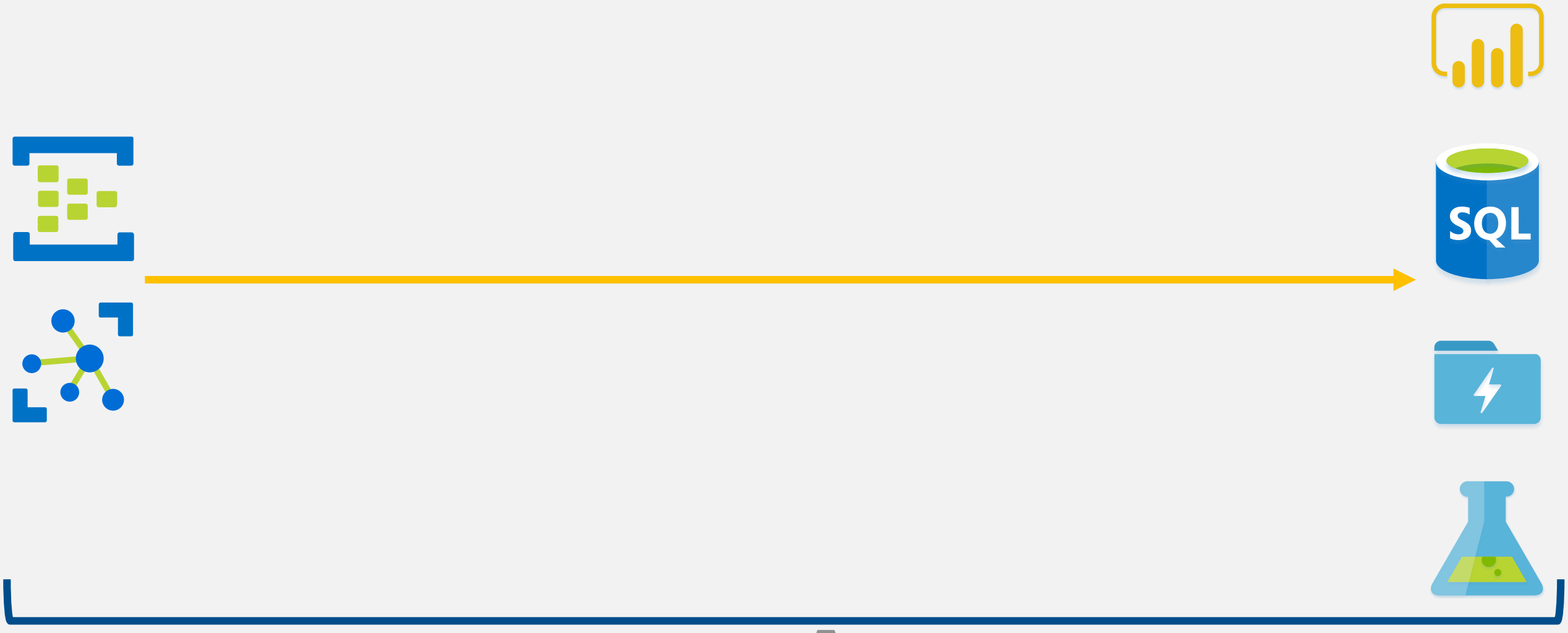
# Azure Stream Analytics



# Azure Stream Analytics

Tumbling Window

Tumbling Window

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Tumbling Window


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

**Inputs**

**Outputs**

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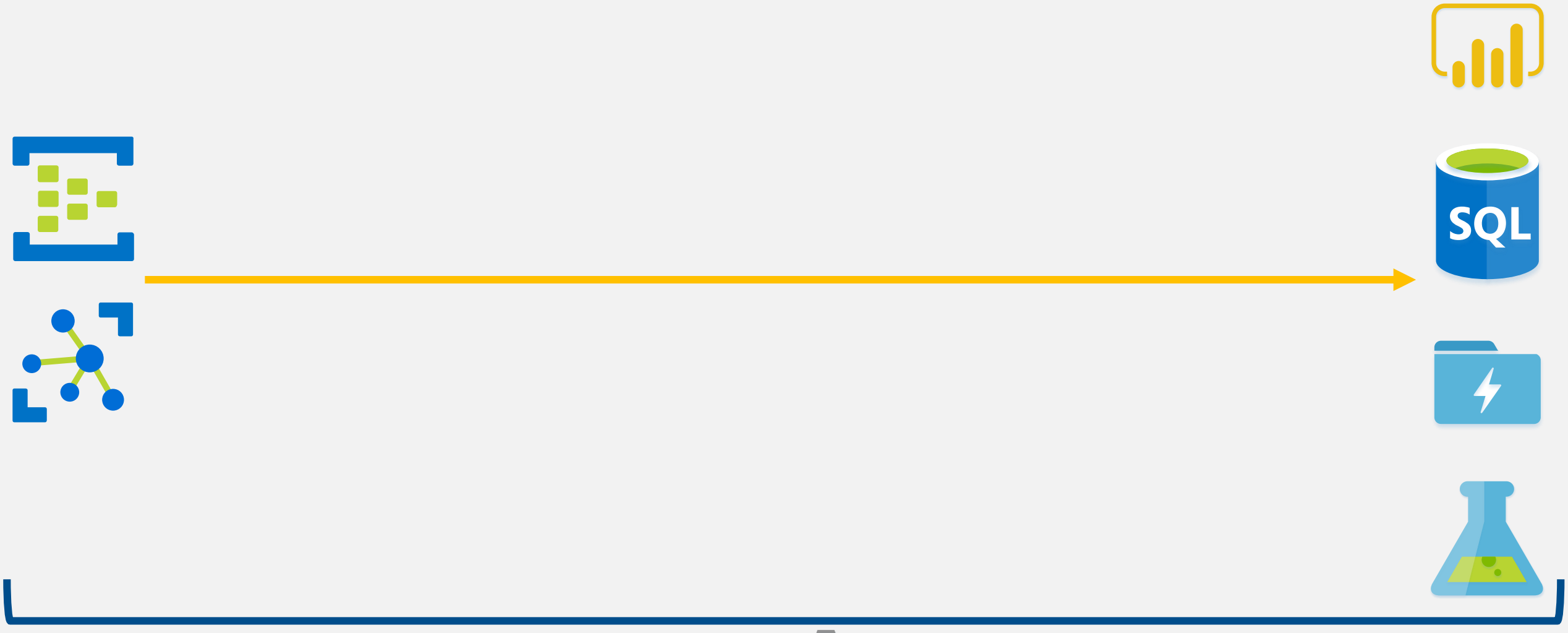
# Azure Stream Analytics



# Azure Stream Analytics

Hopping Window

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```
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**

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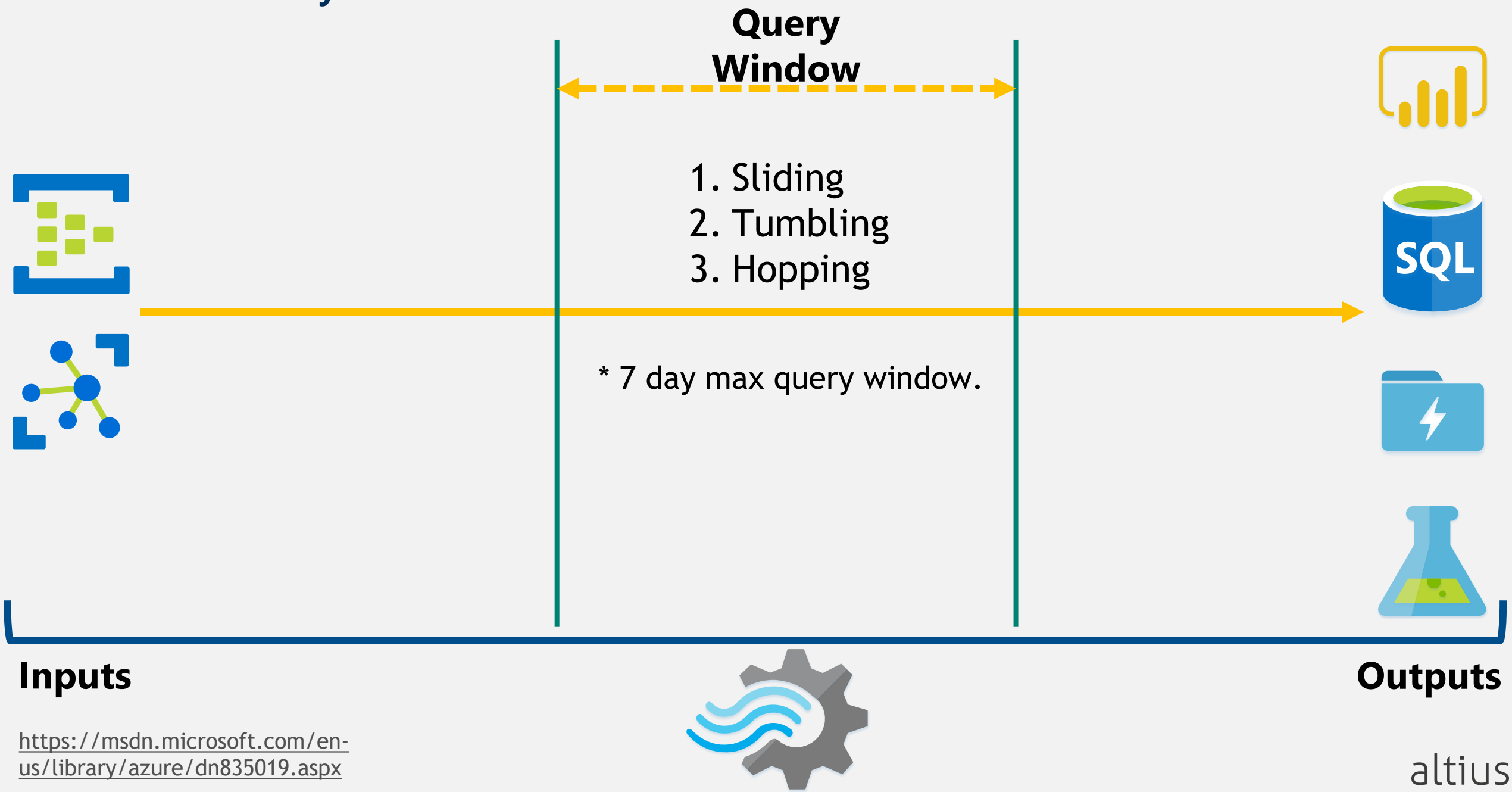
# Azure Stream Analytics

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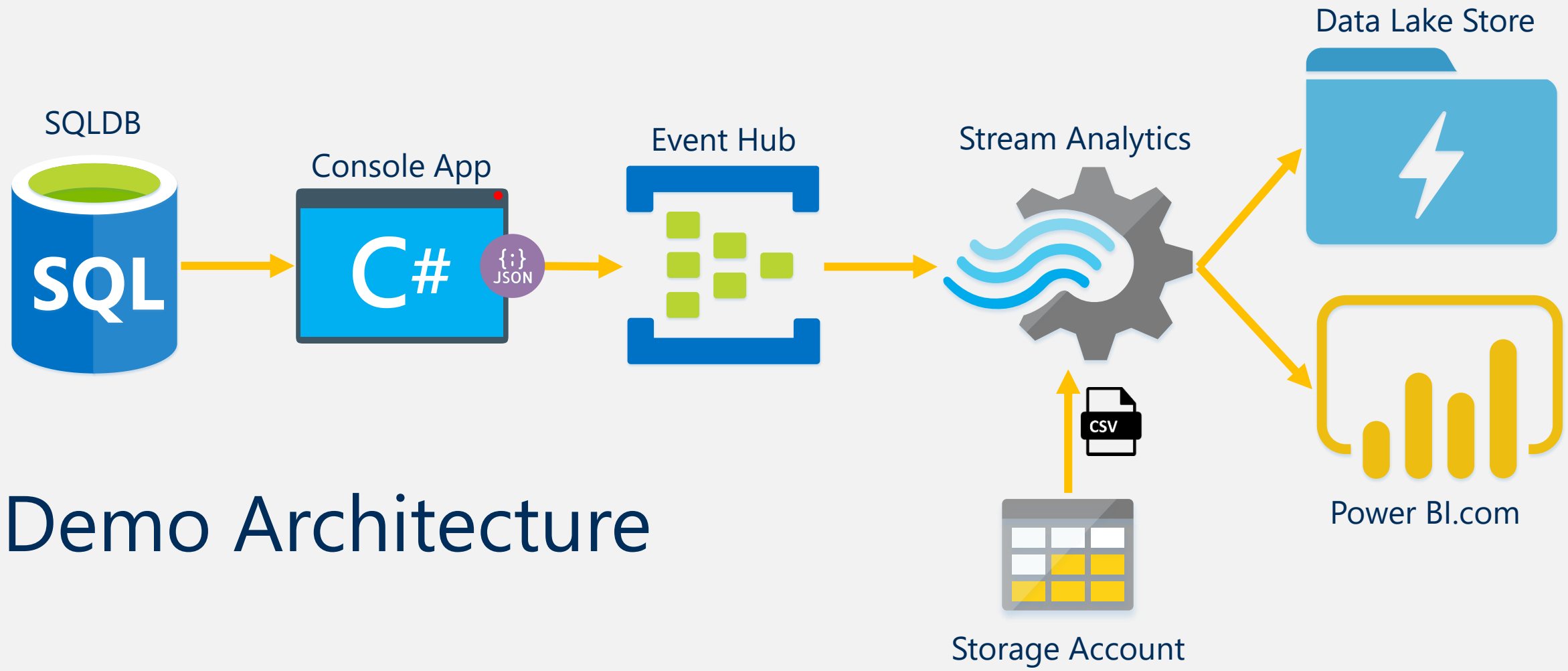
# Demo




# Demo Architecture

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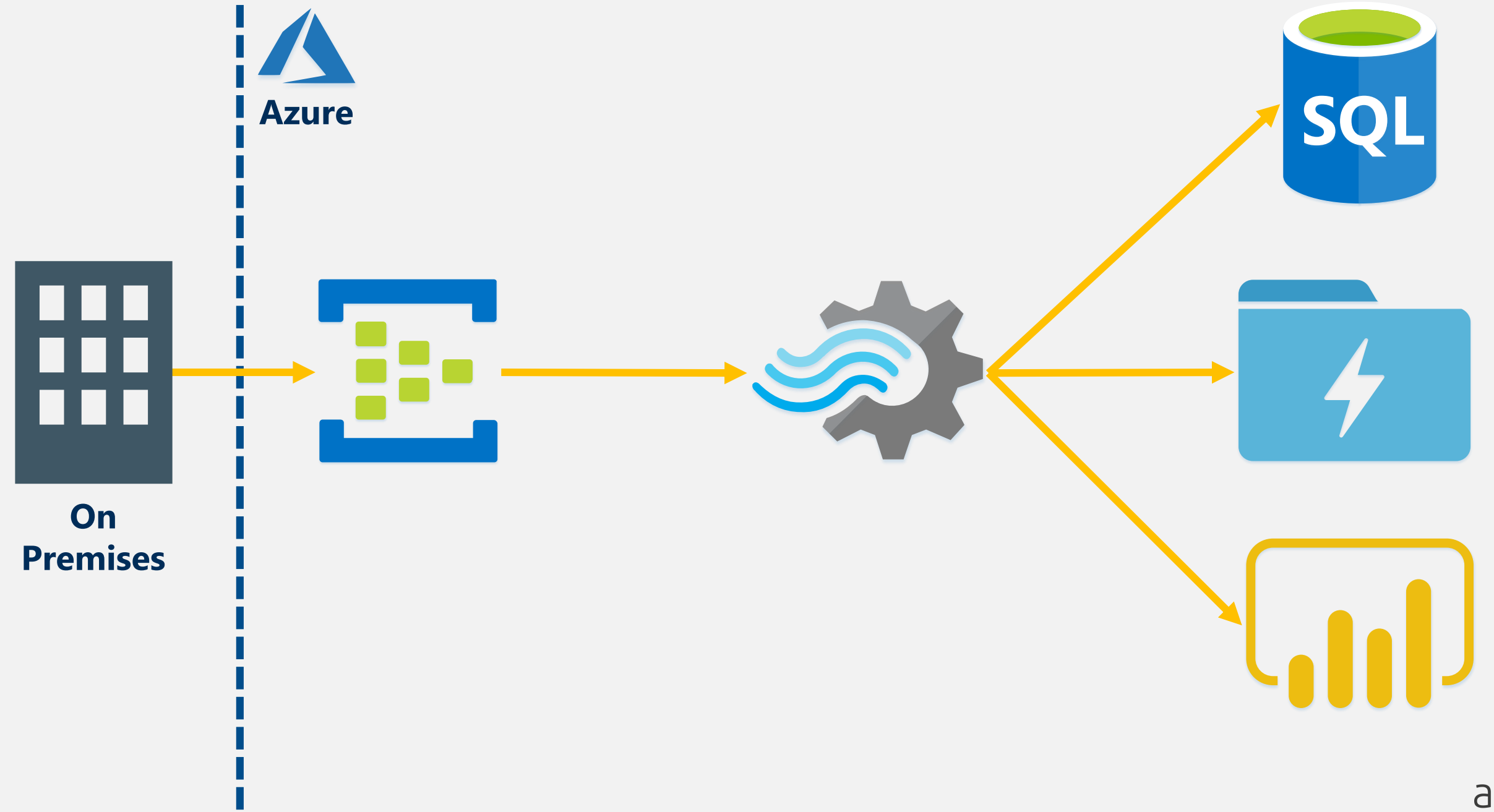
Real-time data problems

What is ASA and why use it

**Production Considerations**

Lambda Architecture

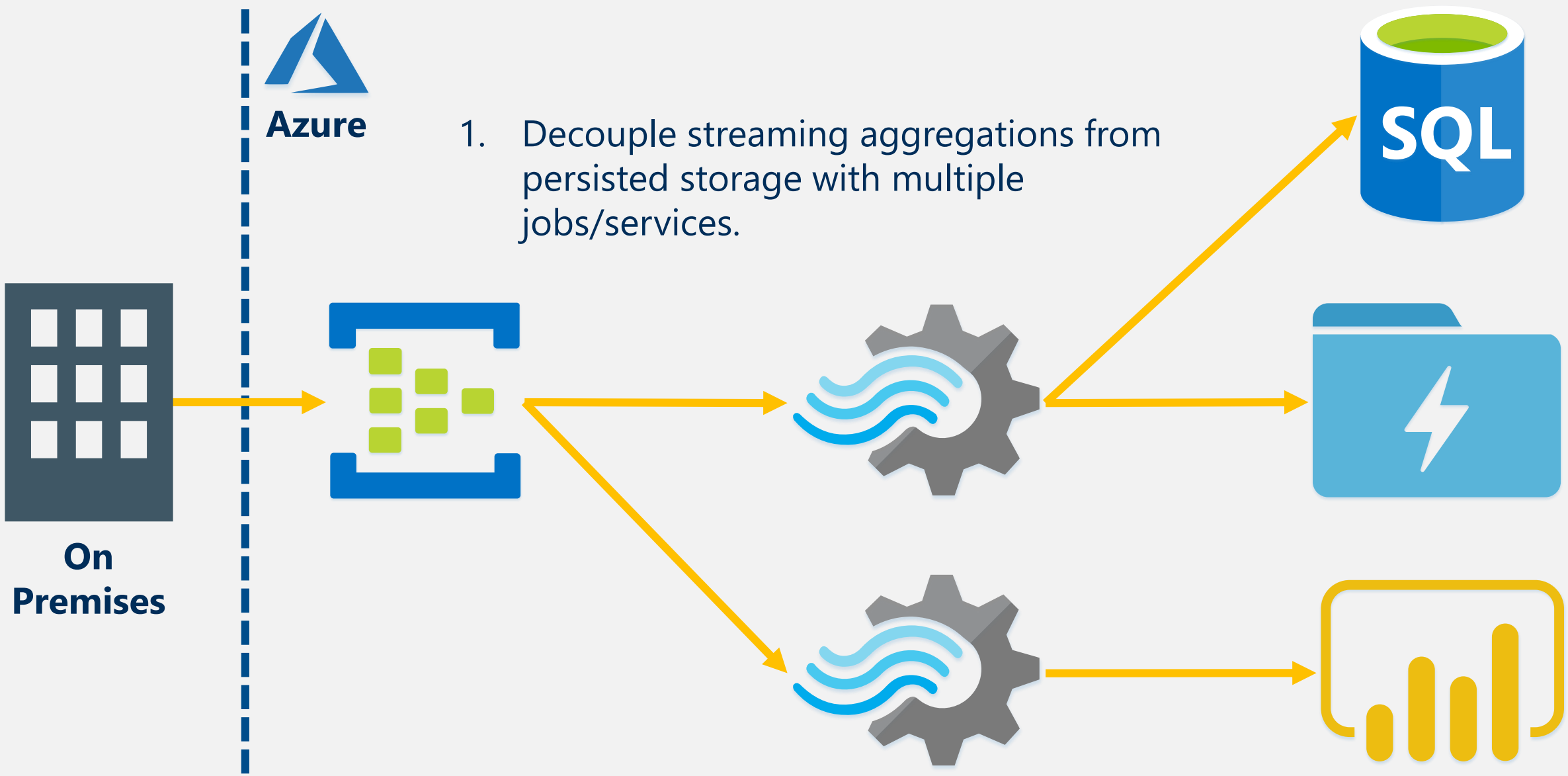
# Production Considerations



# Production Considerations

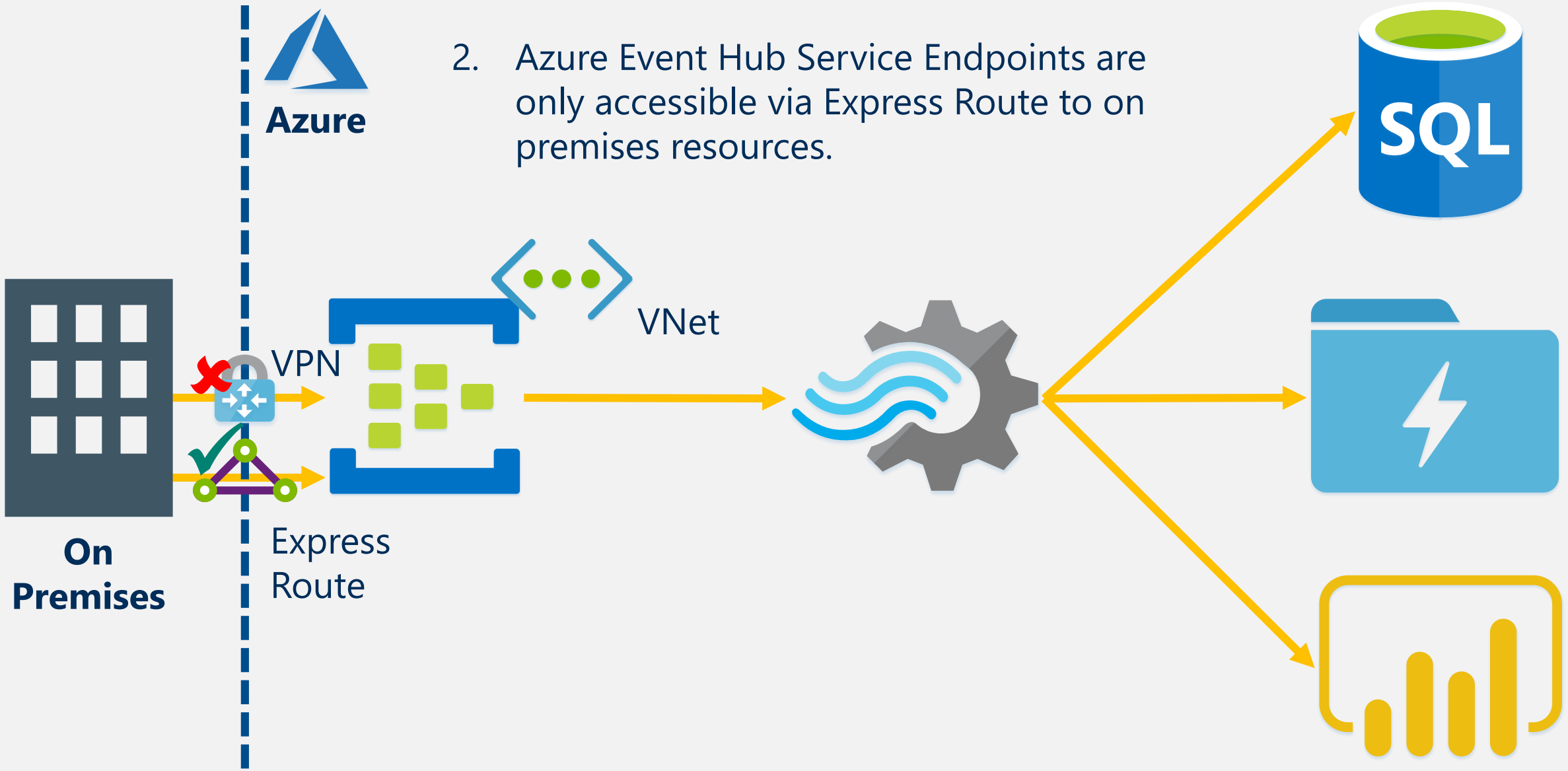
Azure

1. Decouple streaming aggregations from persisted storage with multiple jobs/services.



# Production Considerations

2. Azure Event Hub Service Endpoints are only accessible via Express Route to on premises resources.



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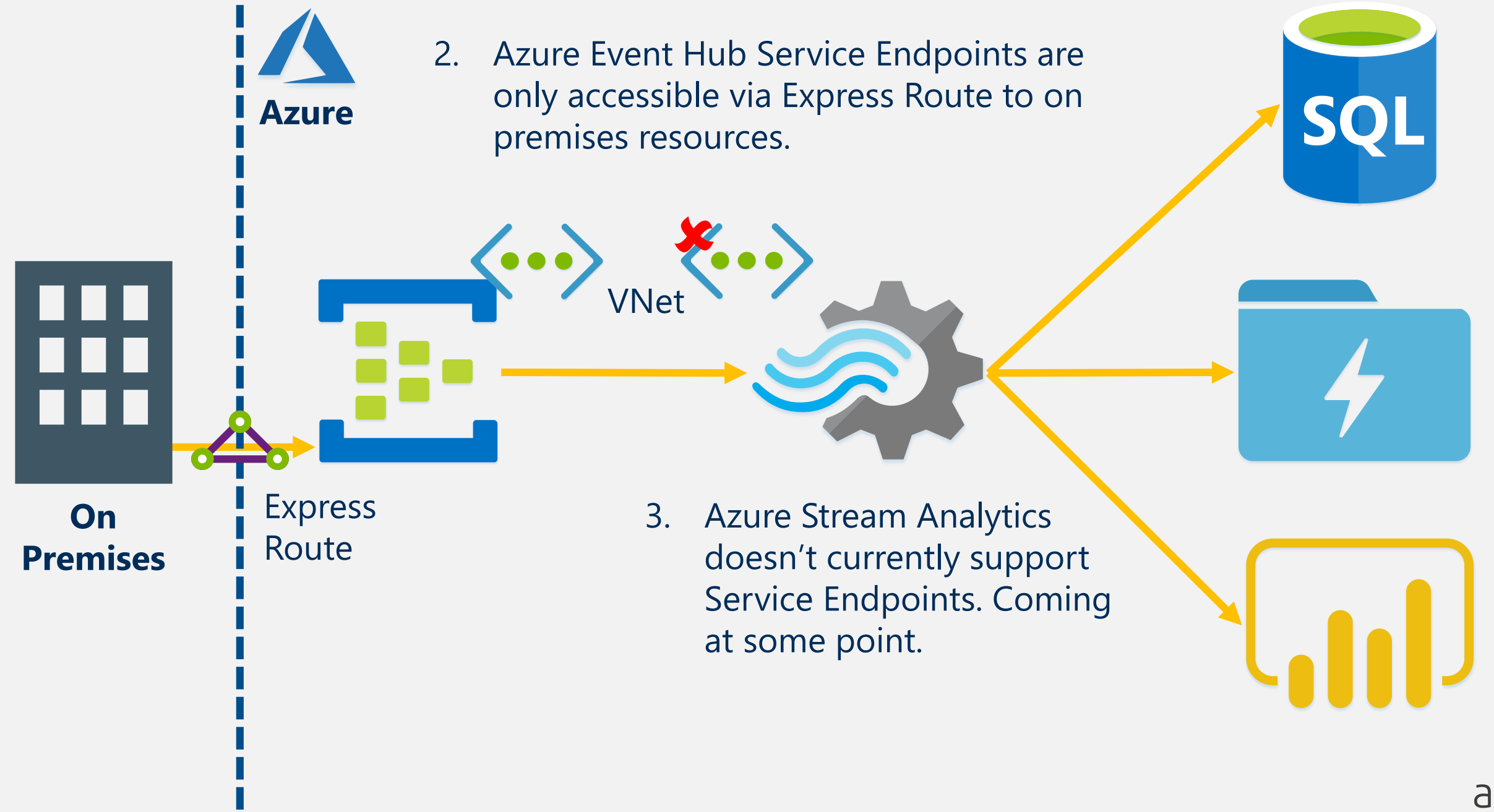

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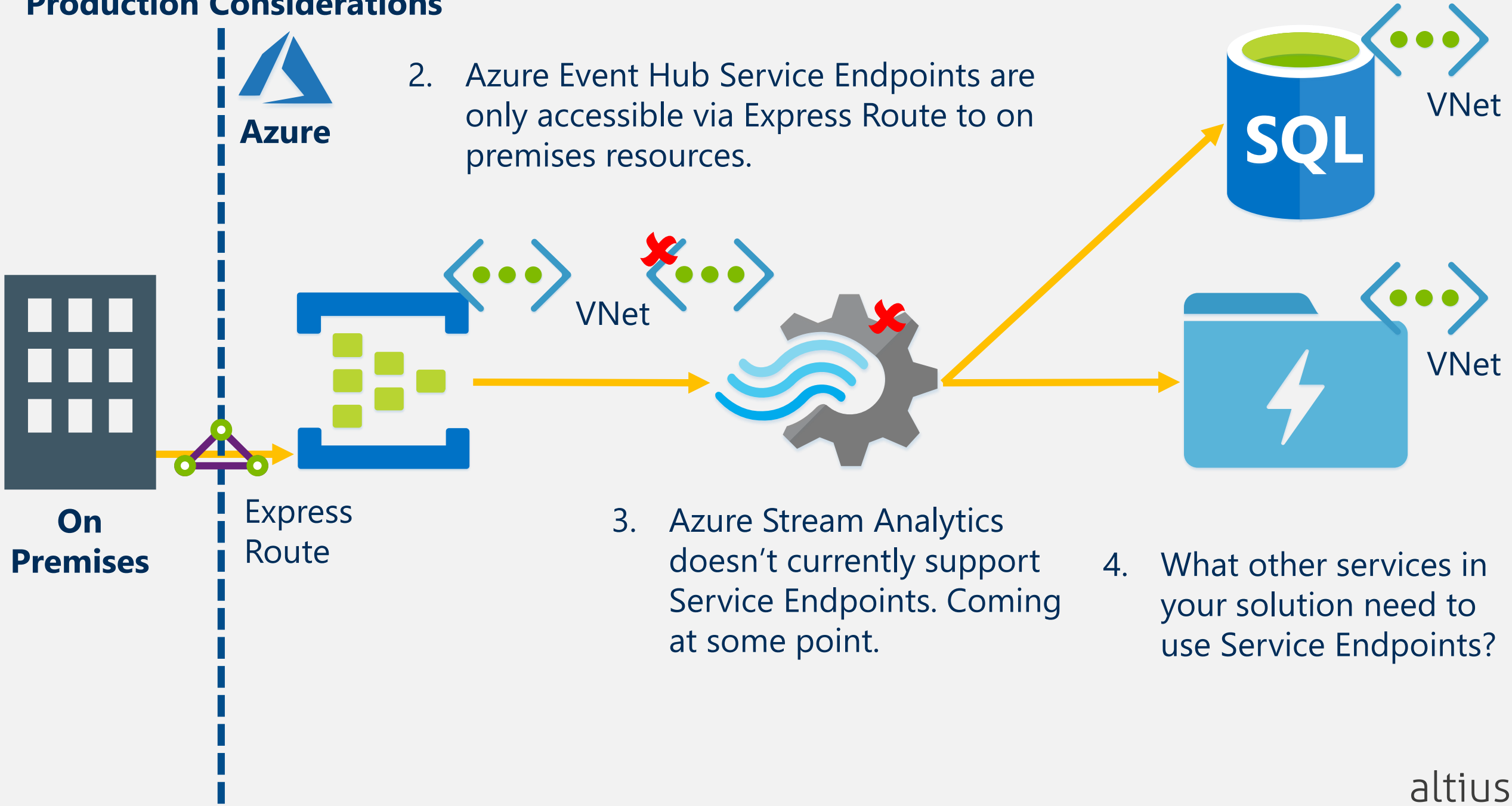

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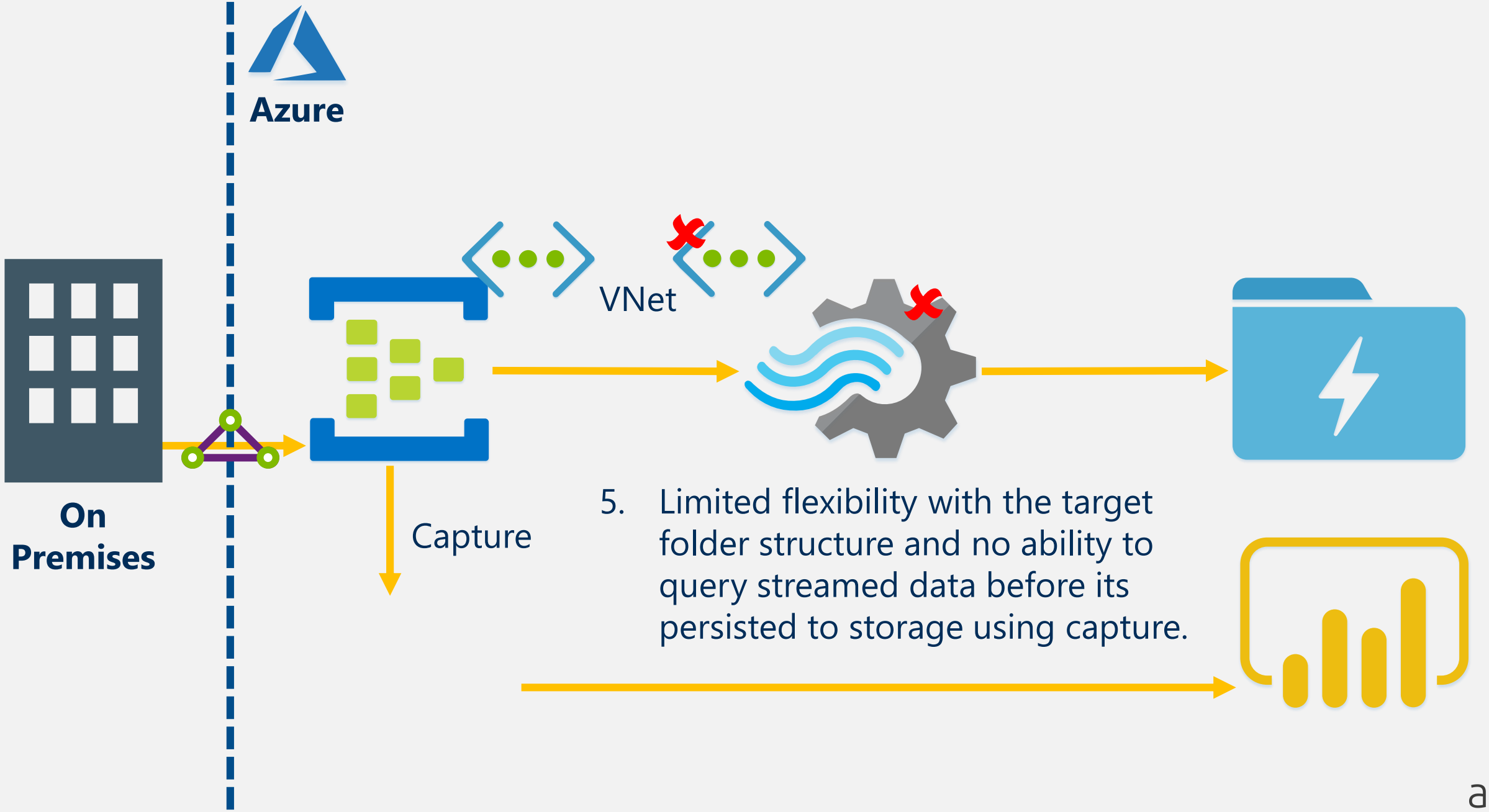
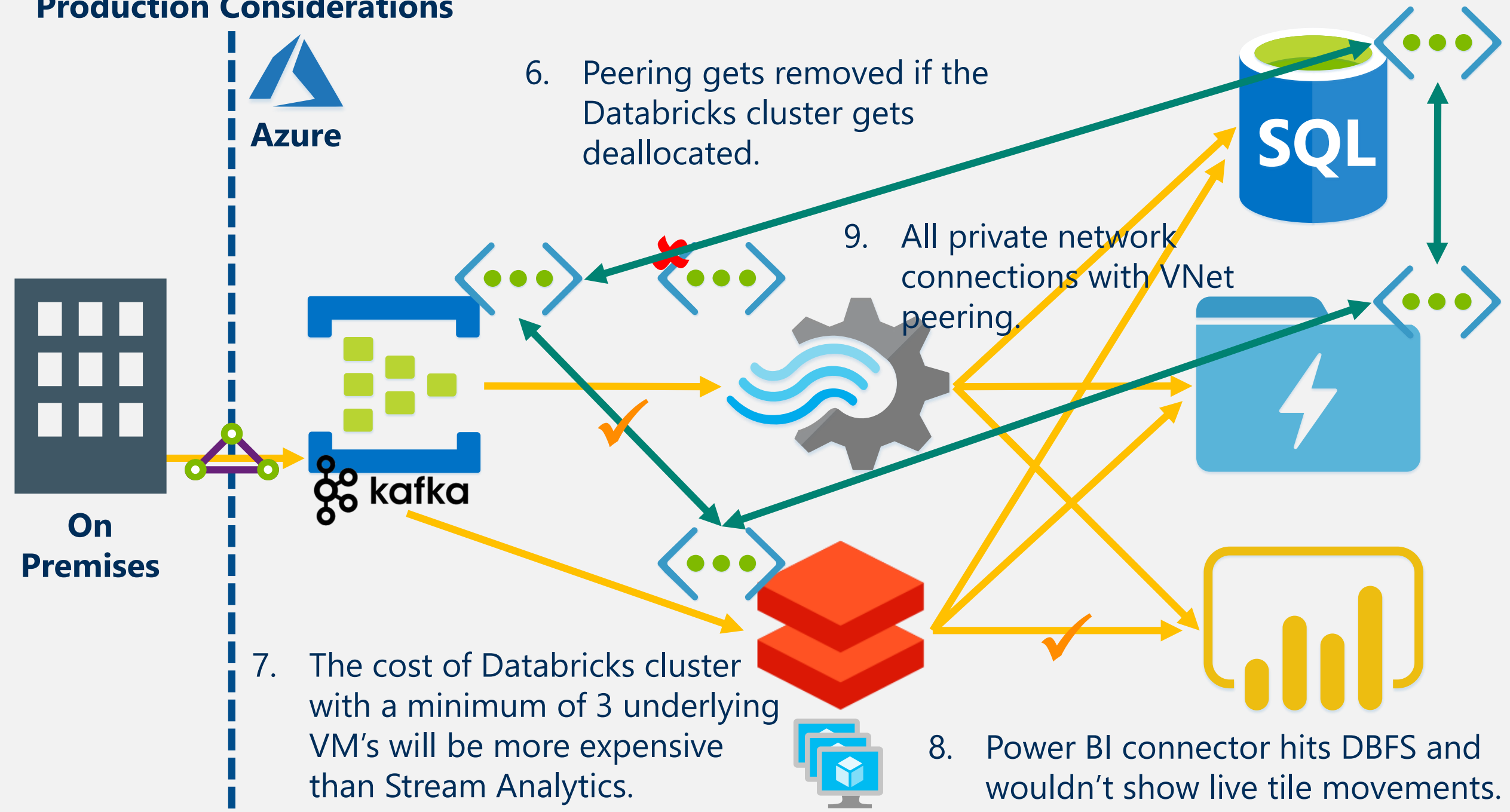



5. Limited flexibility with the target folder structure and no ability to query streamed data before its persisted to storage using capture.

# Production Considerations




6. Peering gets removed if the Databricks cluster gets deallocated.

9. All private network connections with VNet peering.

7. The cost of Databricks cluster with a minimum of 3 underlying VM's will be more expensive than Stream Analytics.

8. Power BI connector hits DBFS and wouldn't show live tile movements.

## Production Considerations Summary

1. Decouple streaming aggregations from persisted storage with multiple jobs/services.
2. Azure Event Hub Service Endpoints are only accessible via Express Route to on premises resources.
3. Azure Stream Analytics doesn't currently support Service Endpoints. Coming at some point.
4. What other services in your solution need to use Service Endpoints?
5. Limited flexibility with the target folder structure and no ability to query streamed data before its persisted to storage using capture.
6. Peering gets removed if the Databricks cluster gets deallocated.
7. The cost of Databricks cluster with a minimum of 3 underlying VM's will be more expensive than Stream Analytics.
8. Power BI connector hits DBFS and wouldn't show live tile movements.
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https://docs.microsoft.com/en-us/azure/event-hubs/event-hubs-service-endpoints

# Azure Stream Analytics

Real-time data problems

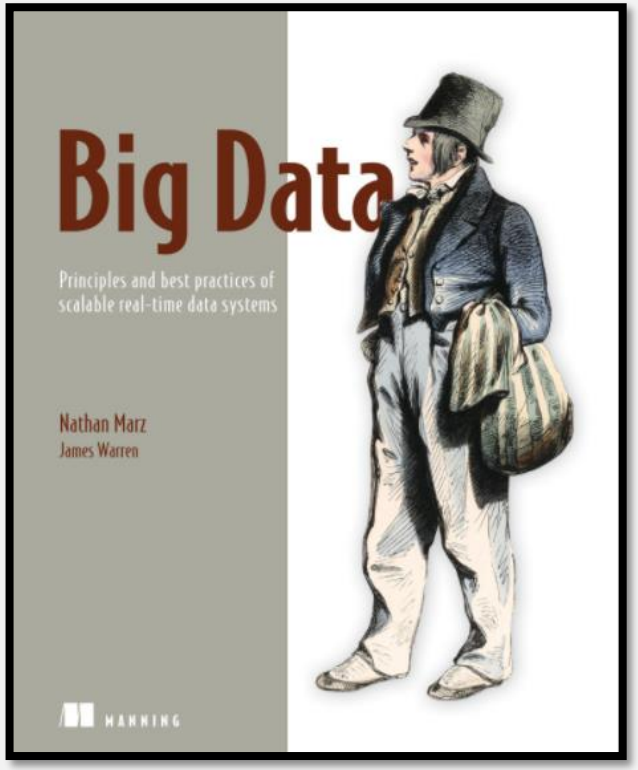
What is ASA and why use it

Production Considerations

**Lambda Architecture**

# Lambda Architecture

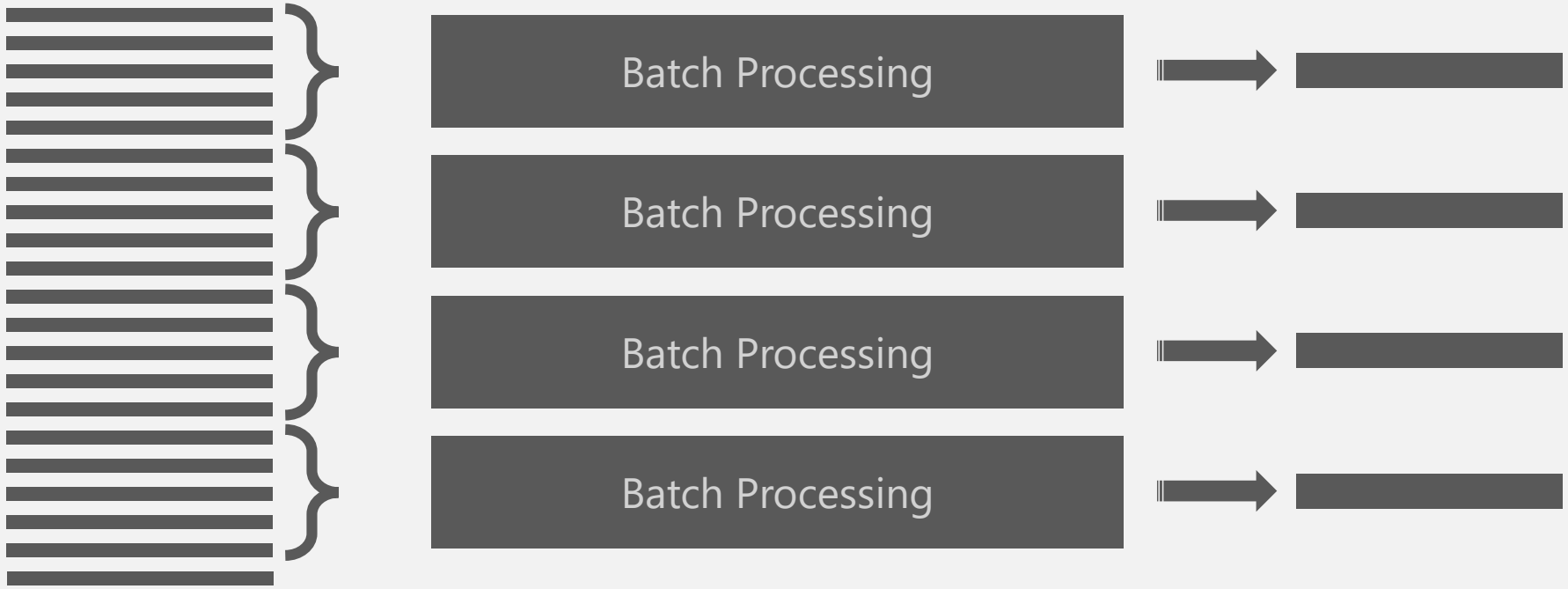
Use Batch and Stream technologies together to balance latency, throughput and fault-tolerance




Nathan Marz
& James Warren

* Pages 14 to 20

# **Problem:** Timely Data Insights



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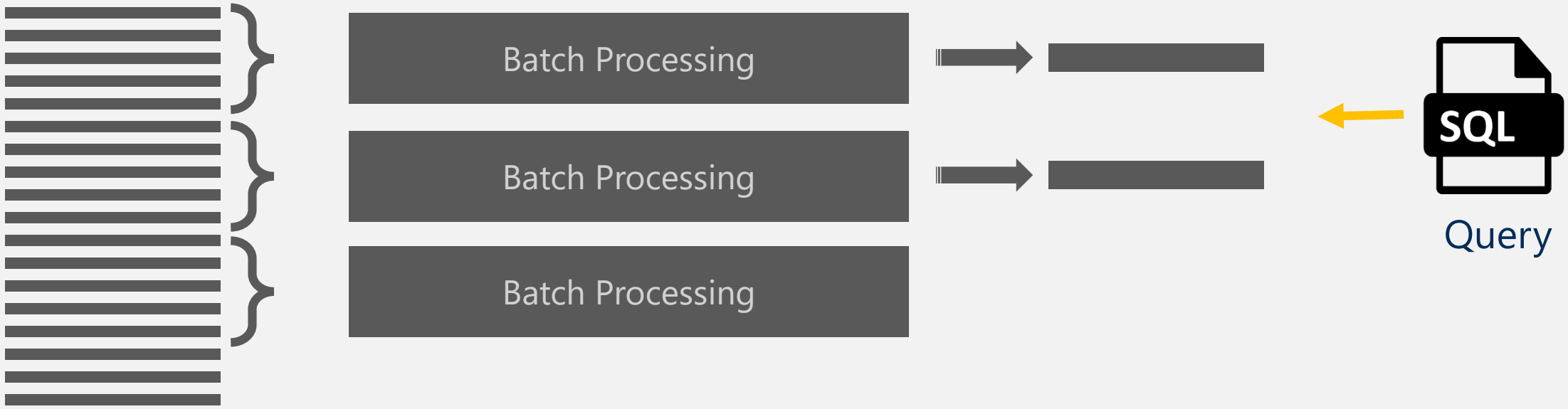
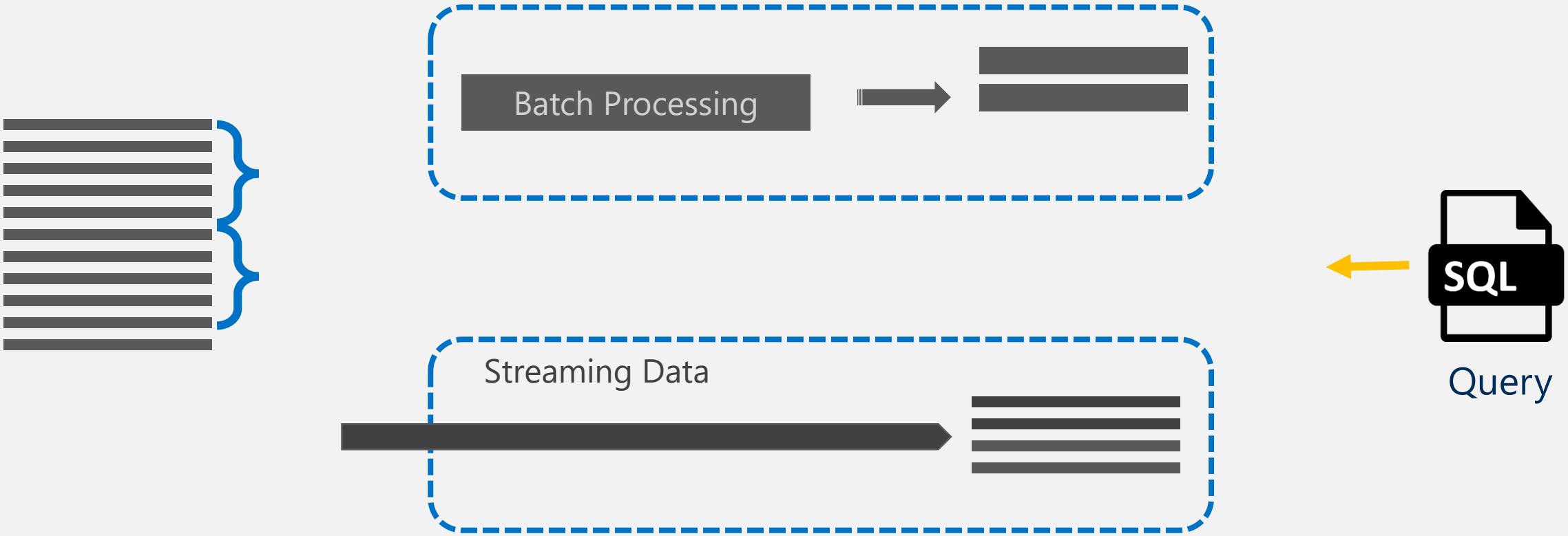
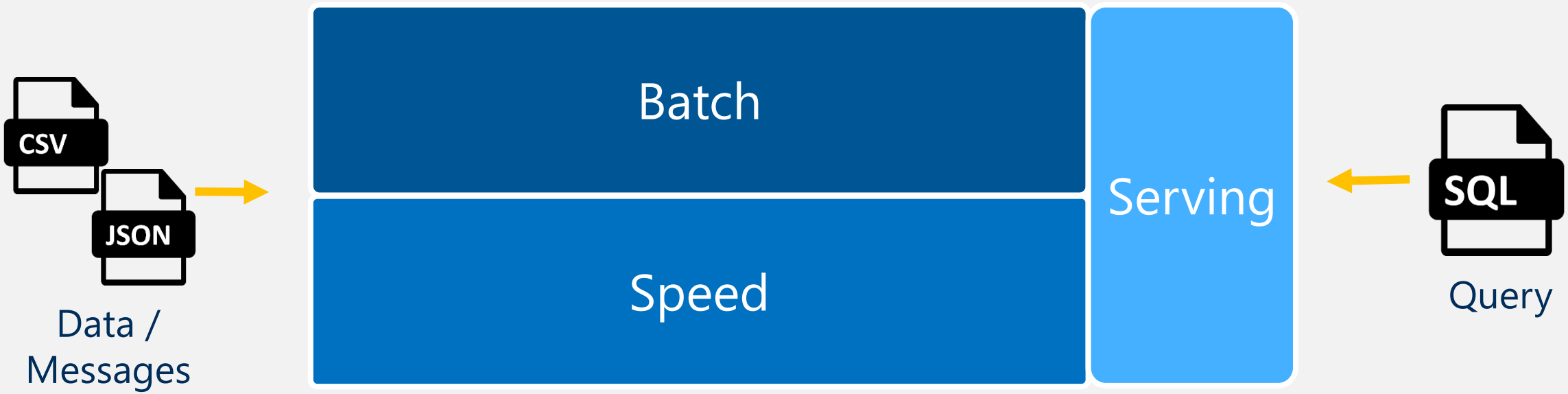


# Solution

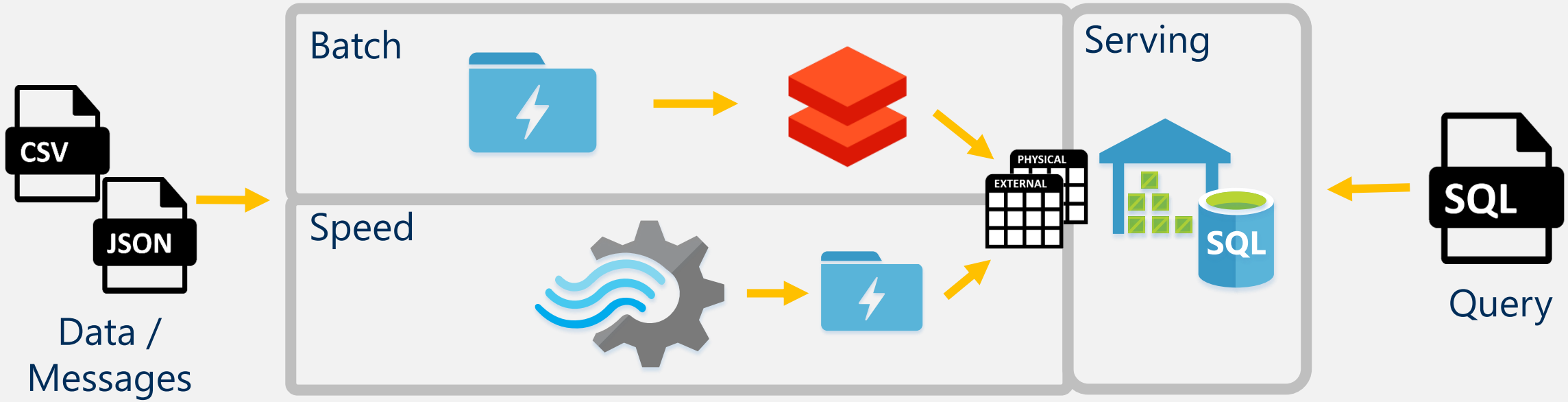


# Lambda Architecture



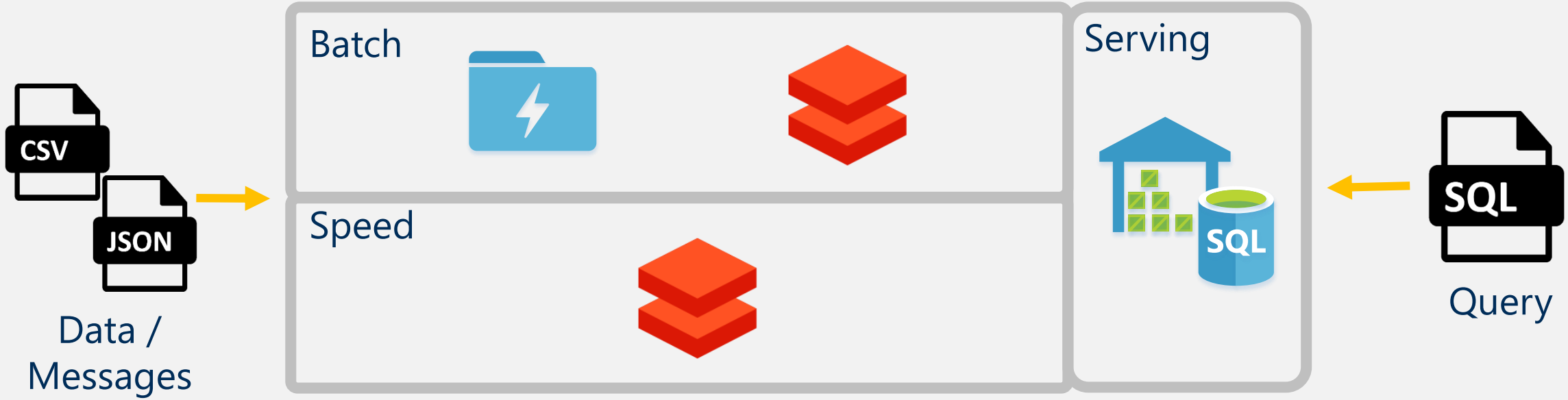
# The Marz Lambda Architecture

# Applying a Lambda Architecture in Azure

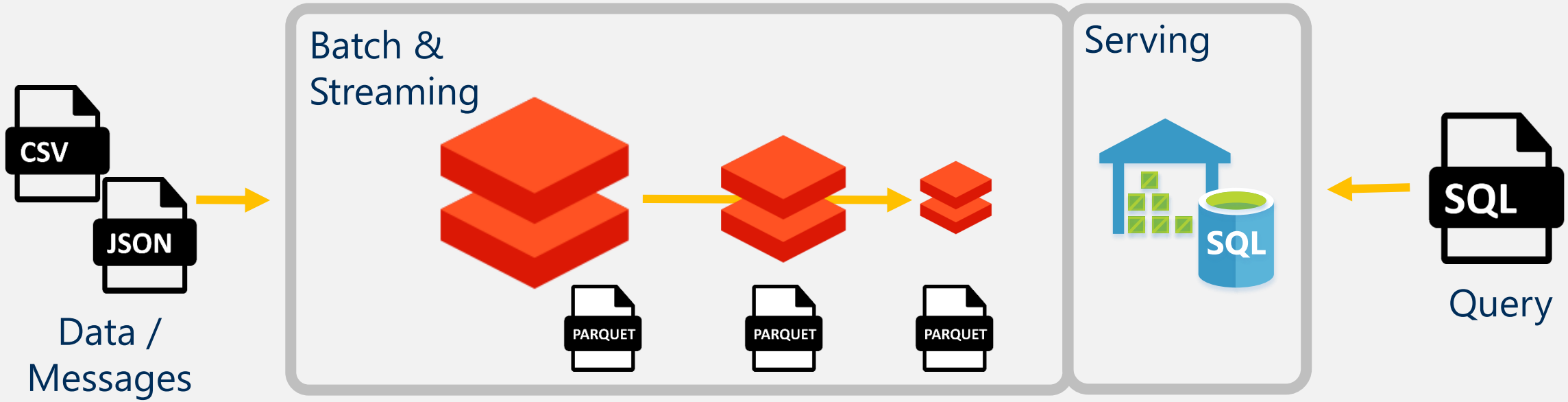



Simon Whiteley – PASS Summit 2018:
https://www.pass.org/summit/2018/Sessions/Details.aspx?name=modern-data-warehousing-the-lambda-approach-to-azure-bi

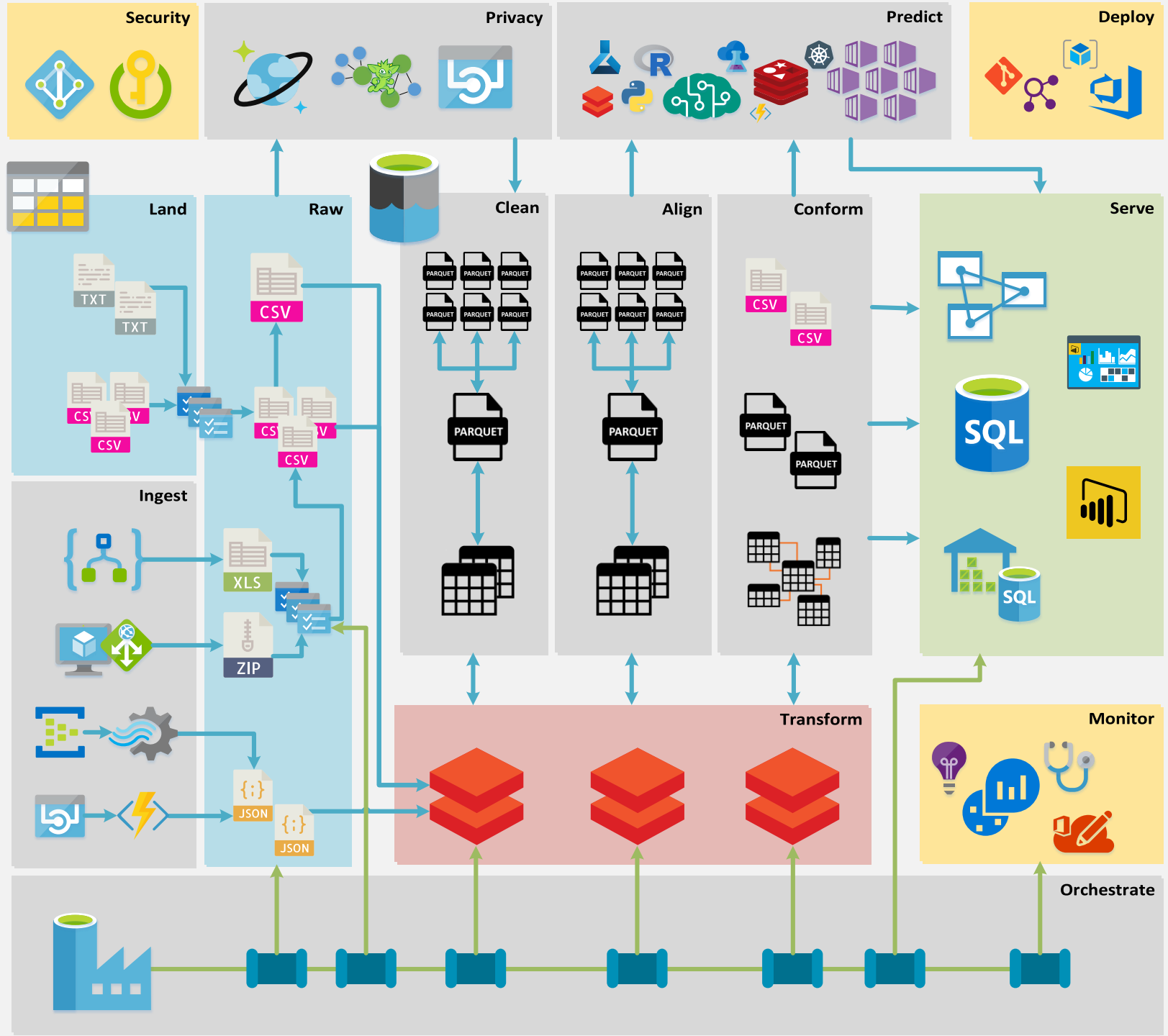
# Applying a Lambda Architecture in Azure



# Applying a ~~Lambda~~ Architecture in Azure
## ^ Databricks Delta
## (AKA Delta Lake)



# Modern Data Warehouse

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# Azure Stream Analytics

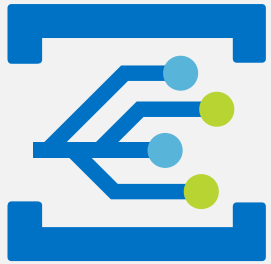
- **Real-time data problems** ✓
- **What is ASA and why use it** ✓
- **Production Considerations** ✓
- **Lambda Architecture** ✓

**Other Thoughts…**

Are there any other real-time tools and techniques we should consider?

2016

2019

# Thanks for Listening


## **Paul Andrew**

@MrPaulAndrew

Microsoft® Most Valuable Professional

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**Email:** paul@mrpaulandrew.com
**Blog:** mrpaulandrew.com
**GitHub:** github.com/mrpaulandrew


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