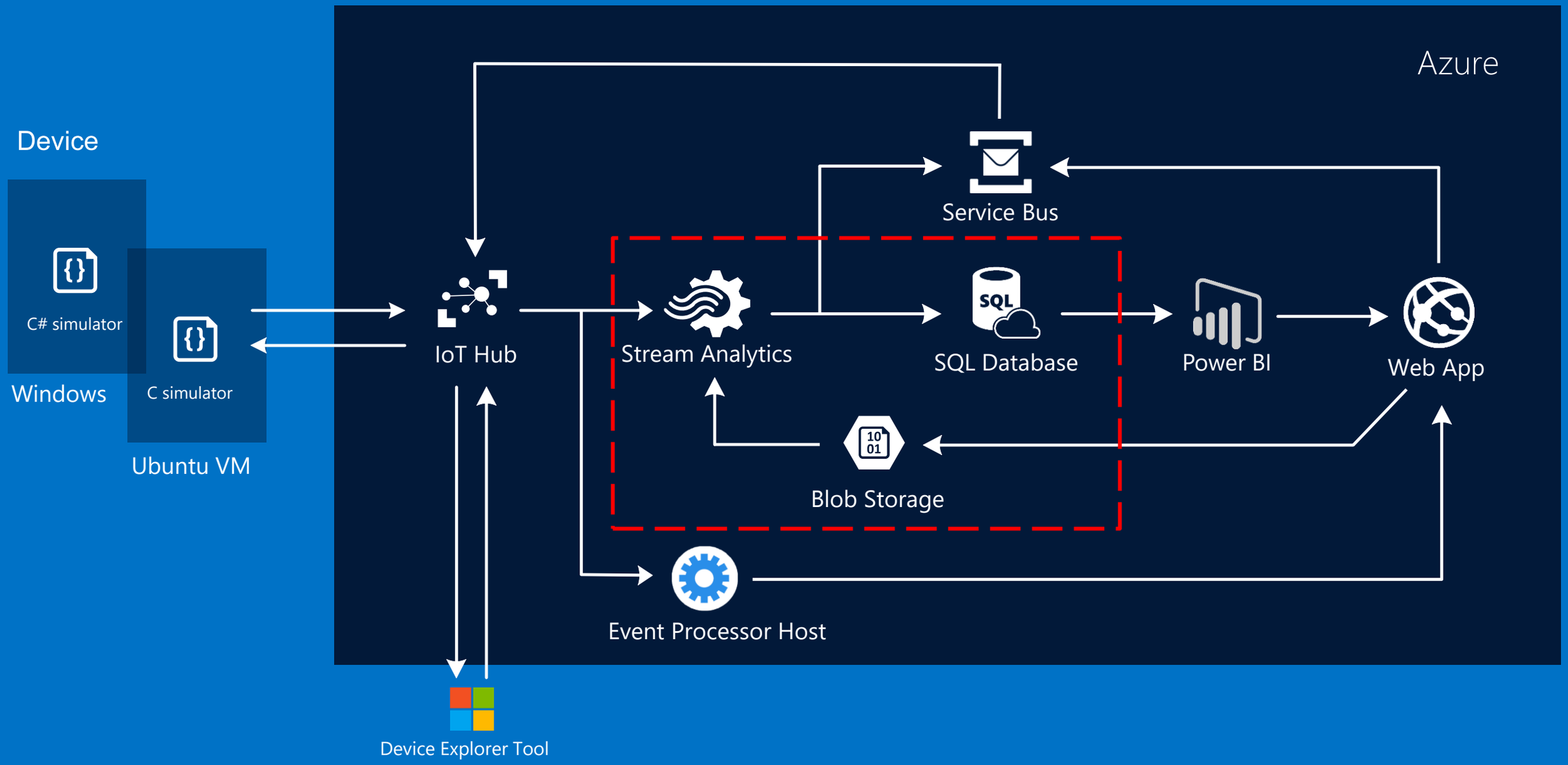
Data Processing and Device Alert Part I

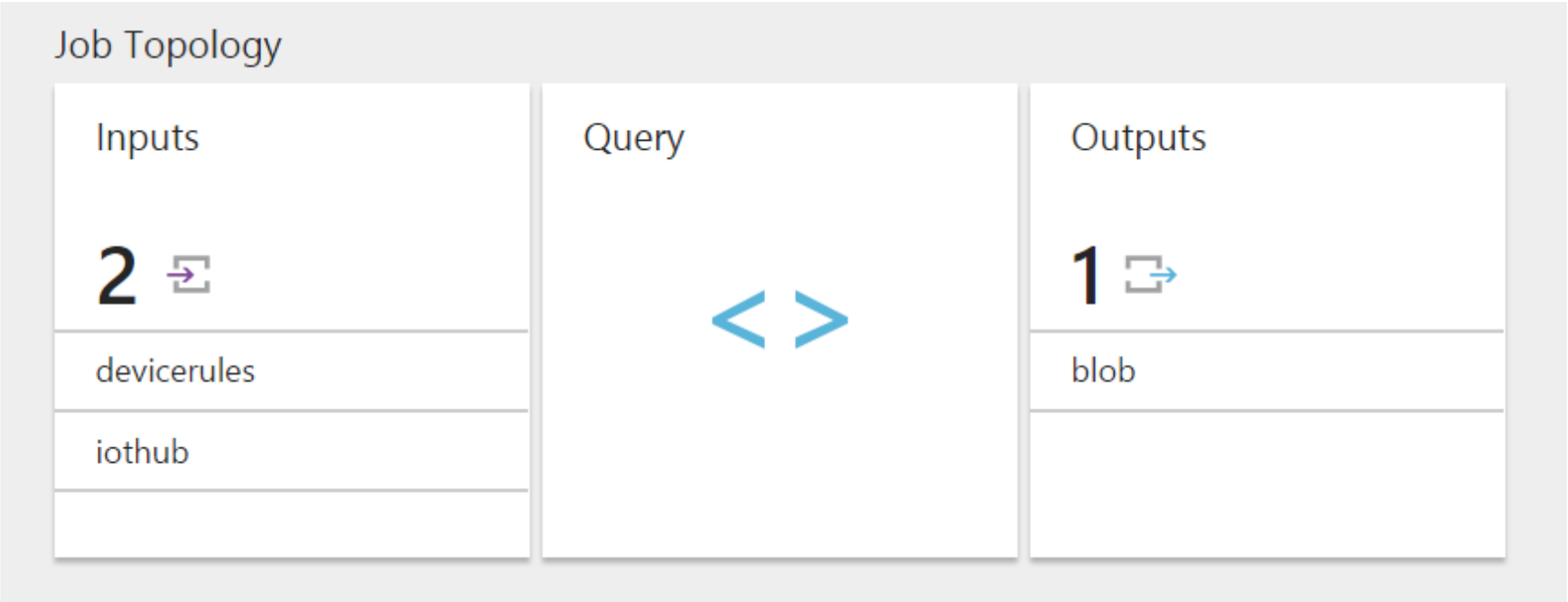
Historic Data Processing in Stream Analytics

HOL 4 – Historic Data Processing in Stream Analytics



Azure Stream Analytics

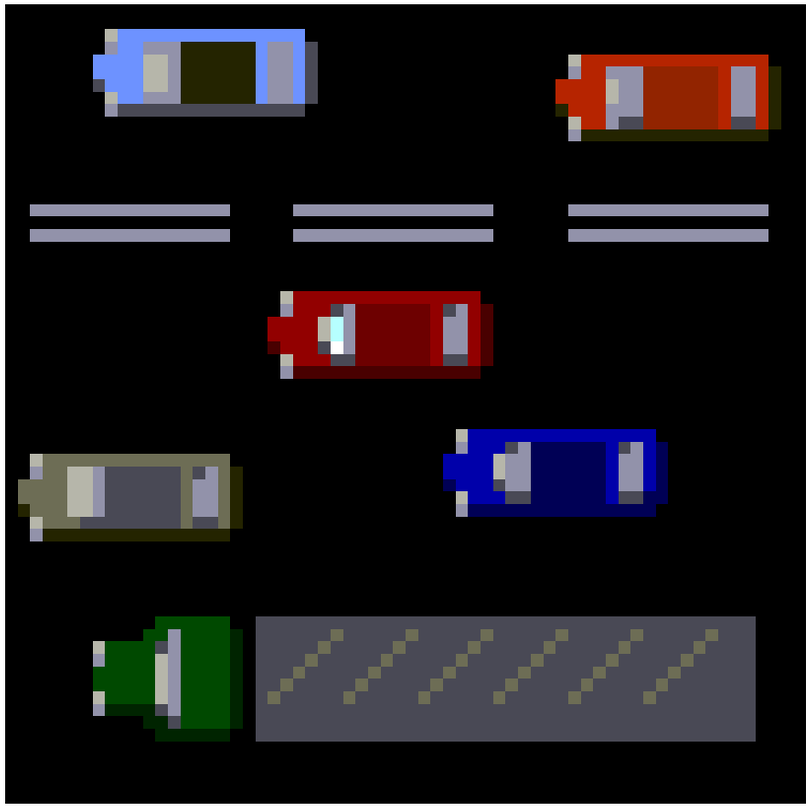
Concept of Azure Stream Analytics



What is Streaming Data?

Data at Rest

Data in Motion



Introducing Azure Stream Analytics

Fully managed real-time analytics

Mission critical reliability and scale

Enables rapid development

Real-time analytics

Fully managed real-time analytics

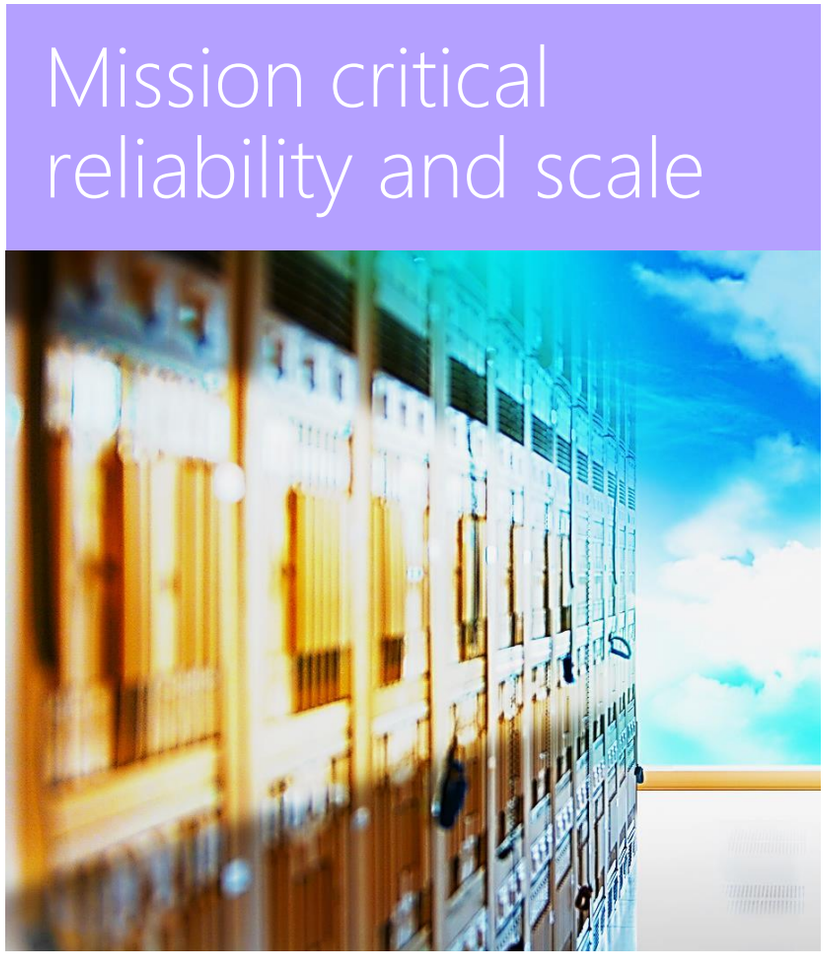
Real-time Analytics

- Intake **millions of events per second** (up to 1 GB/s)
- **Low processing latency**, auto adaptive (sub-second to seconds)
- **Correlate** between different streams, or with reference data
- Find **patterns** or lack of patterns in data in real-time

Fully Managed Cloud Service

- No hardware acquisition and maintenance
- No platform/infrastructure deployment and maintenance
- Easily **expand your business globally** leveraging Azure regions

Mission critical



Mission Critical Reliability

- **Guaranteed event delivery**
- **Guaranteed business continuity**: Automatic and fast recovery

Effective Audits

- **Privacy and security** properties of solutions are evident
- Azure integration for **monitoring and ops alerting**

Easy To Scale

- **Scale** from small to large on demand

Rapid development

Enables rapid development

Rapid Development with SQL like language

- **High-level**: focus on stream analytics solution
- **Concise**: less code to maintain
- **Fast test**: Rapid development and debugging
- First-class support for **event streams and reference data**

Built in temporal semantics

- Built-in **temporal windowing and joining**
- Simple **policy configuration** to manage out-of-order events and late arrivals

SAQL – Language & Library

DML

- SELECT
- FROM
- WHERE
- GROUP BY
- HAVING
- CASE WHEN THEN ELSE
- INNER/LEFT OUTER JOIN
- UNION
- CROSS/OUTER APPLY
- CAST
- INTO
- ORDER BY ASC, DSC

Scaling Extensions

- WITH
- PARTITION BY
- OVER

Date and Time Functions

- DateName
- DatePart
- Day
- Month
- Year
- DateTimeFromParts
- DateDiff
- DateAdd

Temporal Functions

- Lag, IsFirst
- CollectTop

Windowing Extensions

- TumblingWindow
- HoppingWindow
- SlidingWindow

Aggregate Functions

- Sum
- Count
- Avg
- Min
- Max
- StDev
- StDevP
- Var
- VarP

String Functions

- Len
- Concat
- CharIndex
- Substring
- PatIndex

ASA - Inputs

Data stream inputs

- **Event Hub:** Feed events into Azure in real time, and Stream Analytics jobs can process them
- **IoT Hub:** Stream information collected from connected devices directly into a streaming analytics job
- **Blob Storage:** Can be used as an input source for ingesting bulk data

Reference Data

- Static or slow changing used for performing look-ups
- Azure Blob Storage is the only supported reference input
- Source blobs limited to 50MB in size

Input Data Types

- CSV, JSON and Avro Serialized

ASA - Queries

- Performs transformations and computations over streams of events
- Stream Analytics Query Language
  - *Subset of T-SQL syntax*
- Multiple built-in functions
- Supports multiple data types as well as complex
- 3 types of windowing
  - *Tumbling*
  - *Hopping*
  - *Sliding*
- Queries can be created via Azure Portal or via API calls

Save Discard Test

```
WITH [StreamData] AS (SELECT * FROM [IoTHubStream1])

SELECT *
INTO [Telemetry]
FROM [StreamData]

SELECT
    DeviceId,
    AVG (Humidity) AS [AverageHumidity],
    MIN(Humidity) AS [MinimumHumidity],
    MAX(Humidity) AS [MaxHumidity],
    5.0 AS TimeframeMinutes
INTO
    [TelemetrySummary]
FROM
    [StreamData]
WHERE
    [Humidity] IS NOT NULL
GROUP BY
    DeviceId, SlidingWindow (mi, 5)
```

ASA - Outputs

- Multiple options for storing output and viewing analysis results
  Route to one or more outputs
- Flexibility in the consumption and storage of the job output for data warehousing and other purposes

Available Outputs:

- SQL Database
- Blob Storage
- Event Hub
- Power BI
- Table Storage
- Service Bus Queues and Topics
- Document DB

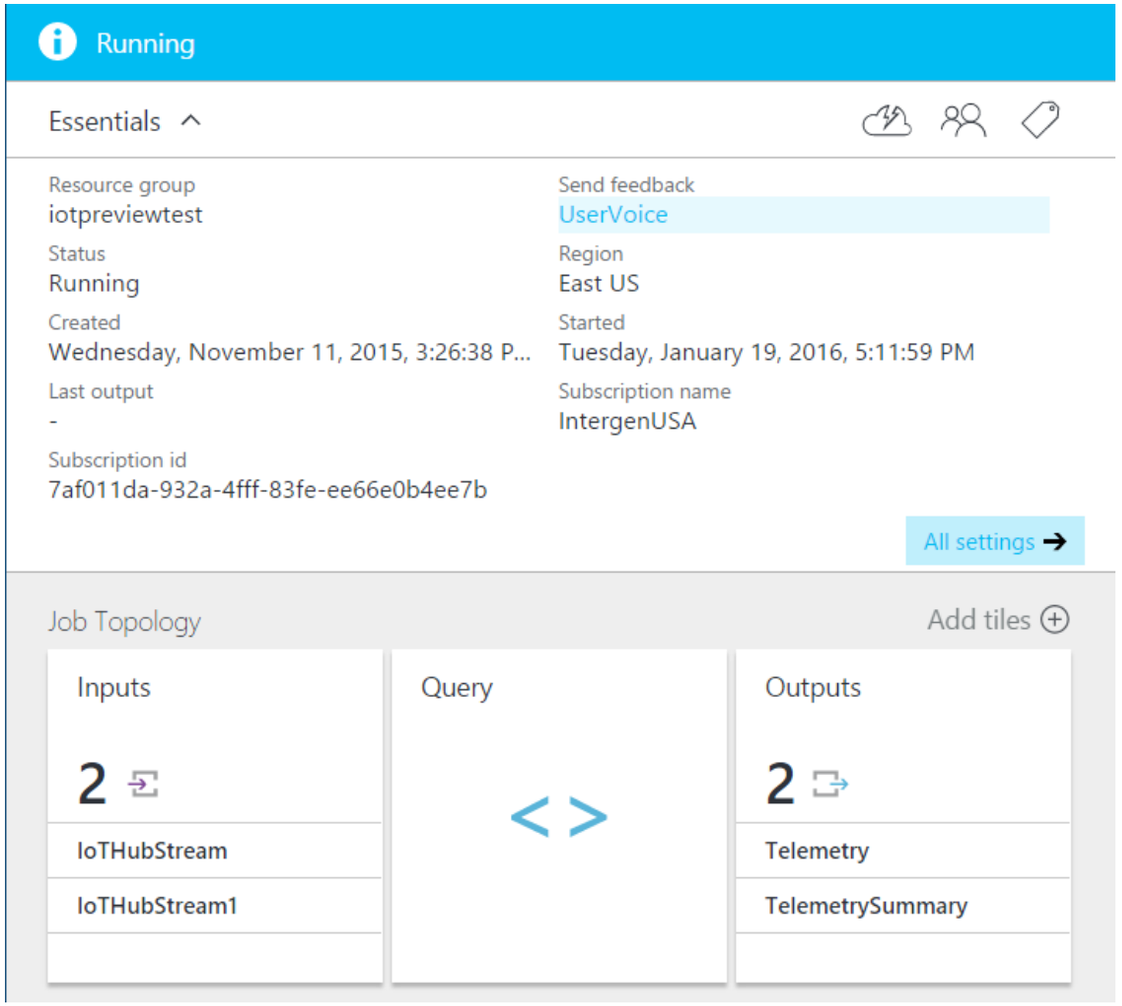
ASA – Management

Portal

- Inputs/Queries/Outputs (stop first)
- Scale & Resource Management
- Start/Stop Jobs
- Other admin options

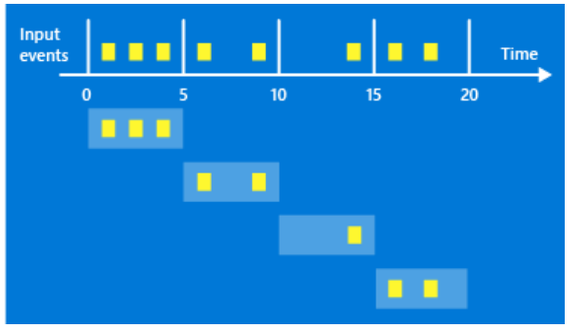
Code

- .NET SDK reference
- REST endpoint available
- ARM via Azure PowerShell
- No extensibility for custom analysis



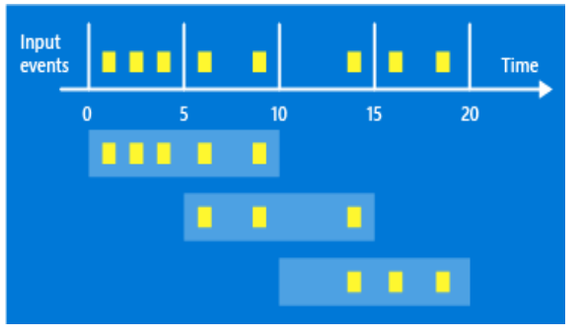
Three types of windows

- Every window operation outputs events at the end of the window
- Will have the time stamp of the window
- All windows have a fixed length



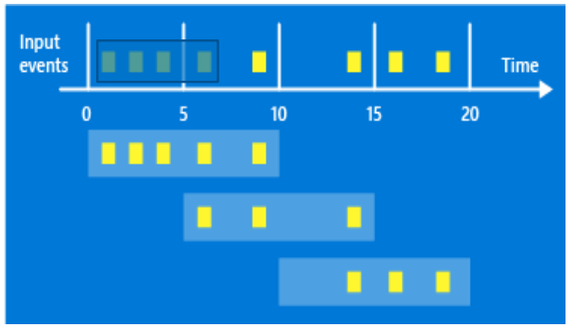
Tumbling window

Aggregate per time interval



Hopping window

Schedule overlapping windows

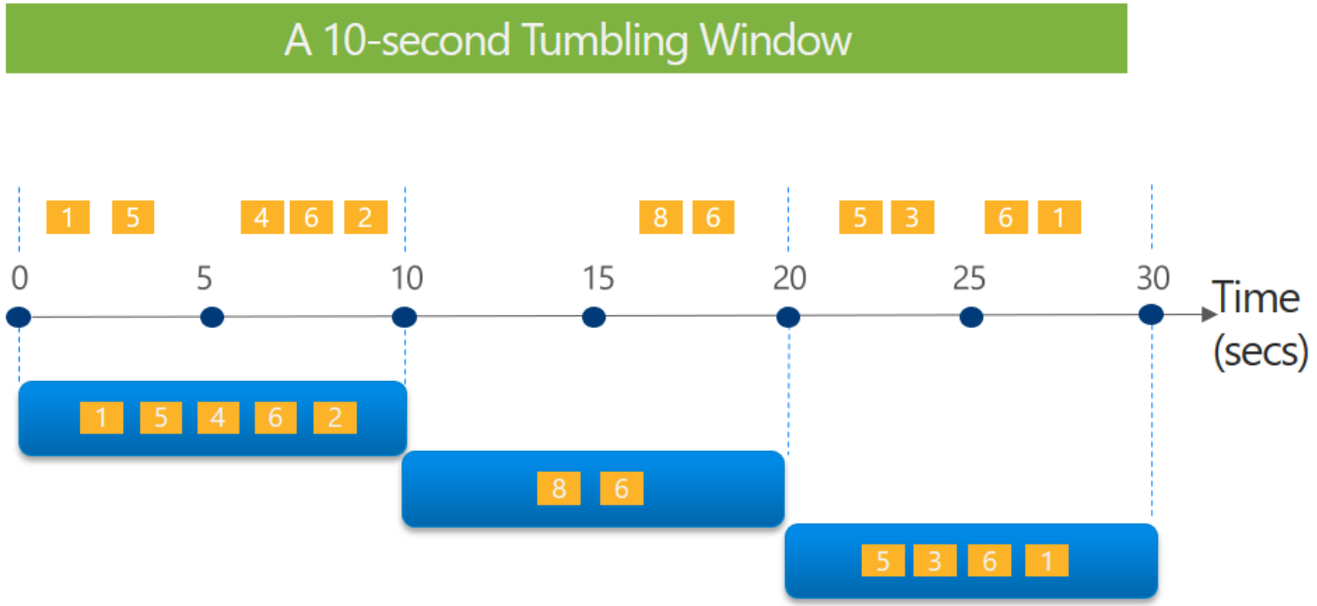


Sliding window

Windows constant re-evaluated

Tumbling Window

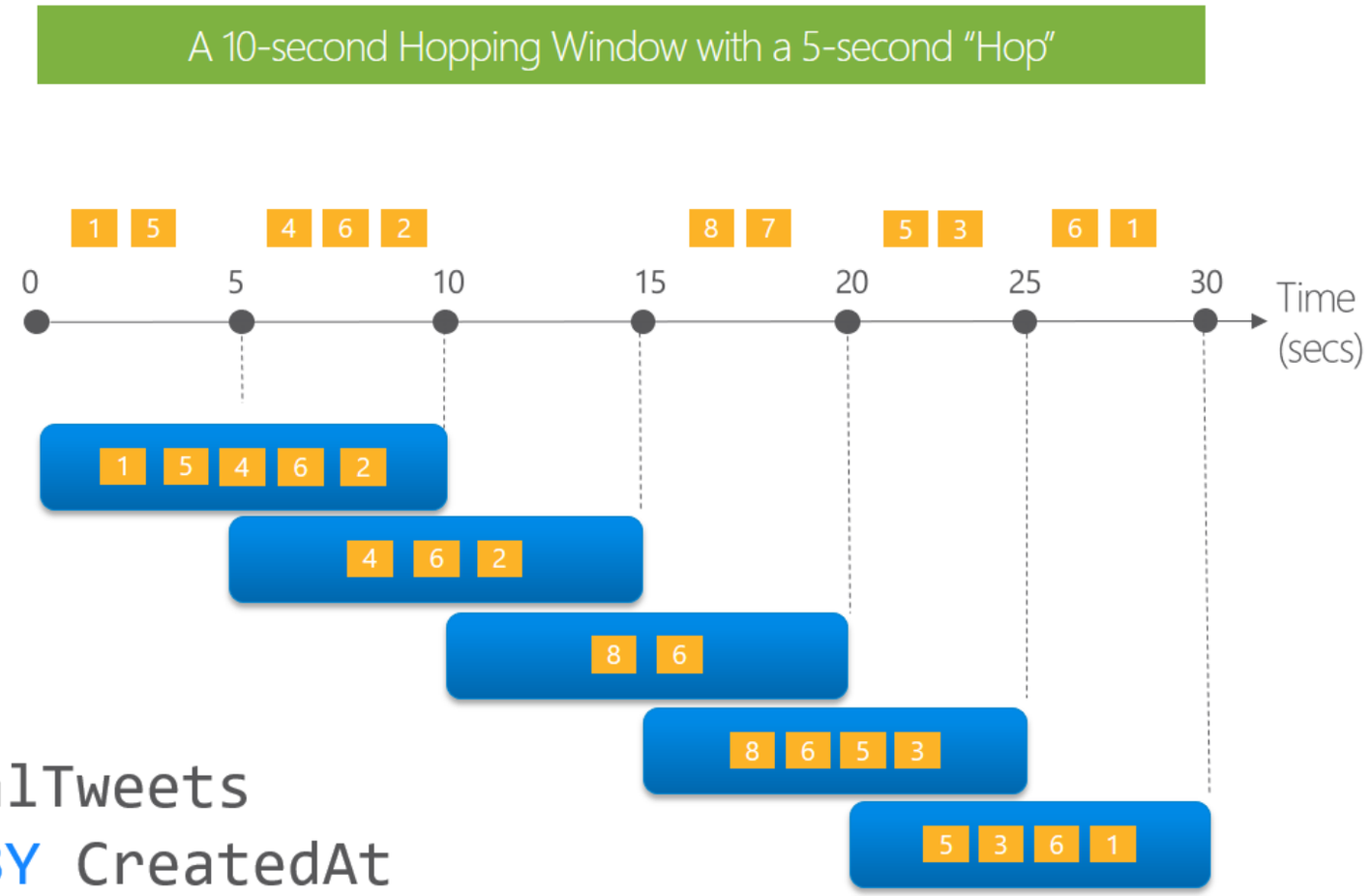
Tell me the count of tweets per time zone every 10 seconds




```
SELECT TimeZone, COUNT(*) AS Count
FROM TwitterStream TIMESTAMP BY CreatedAt
GROUP BY TimeZone, TumblingWindow(second,10)
```

Hopping Window

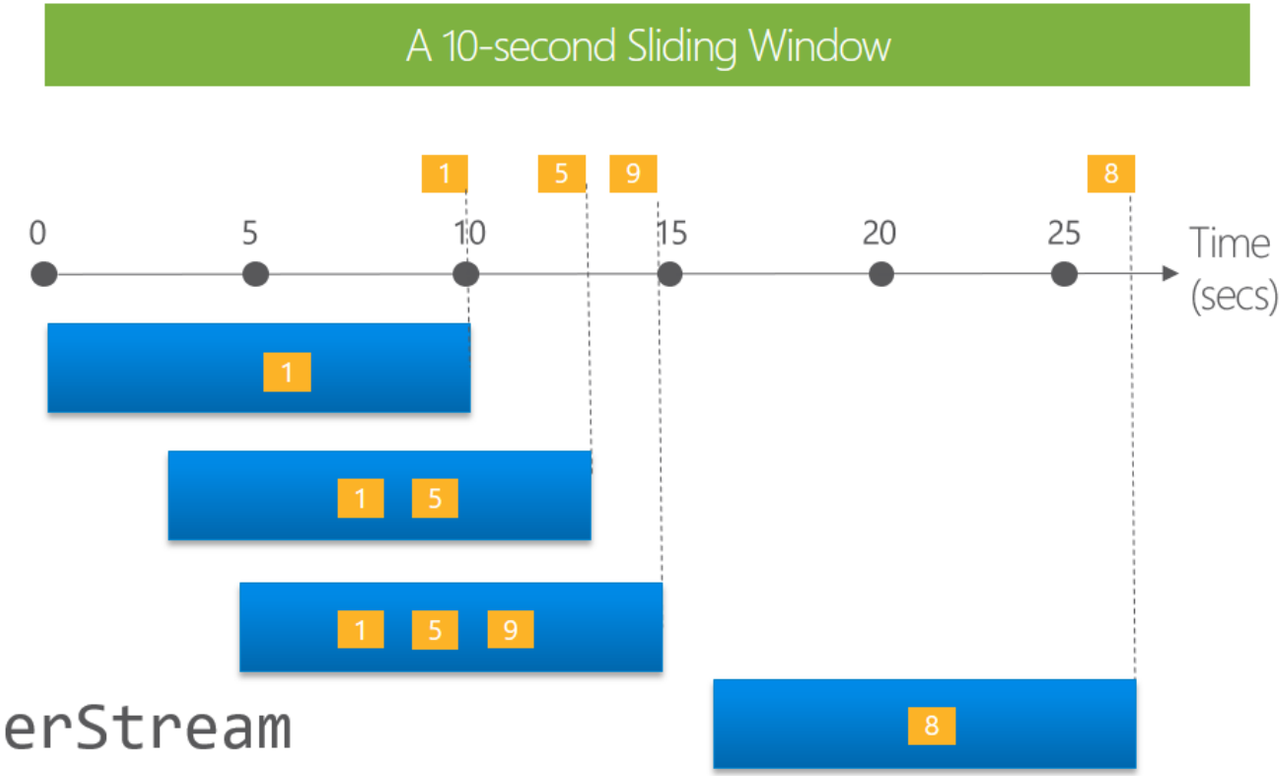
Every 5 seconds give me the count of tweets over the last 10 seconds




```
SELECT Topic, COUNT(*) AS TotalTweets
FROM TwitterStream TIMESTAMP BY CreatedAt
GROUP BY Topic, HoppingWindow(second, 10 , 5)
```

Sliding Window

Give me the count of tweets for all topics which are tweeted more than 10 times in the last 10 seconds




```
SELECT Topic, COUNT(*) FROM TwitterStream
TIMESTAMP BY CreatedAt
GROUP BY Topic, SlidingWindow(second, 10)
HAVING COUNT(*) > 10
```

ASA – Common Query Patterns

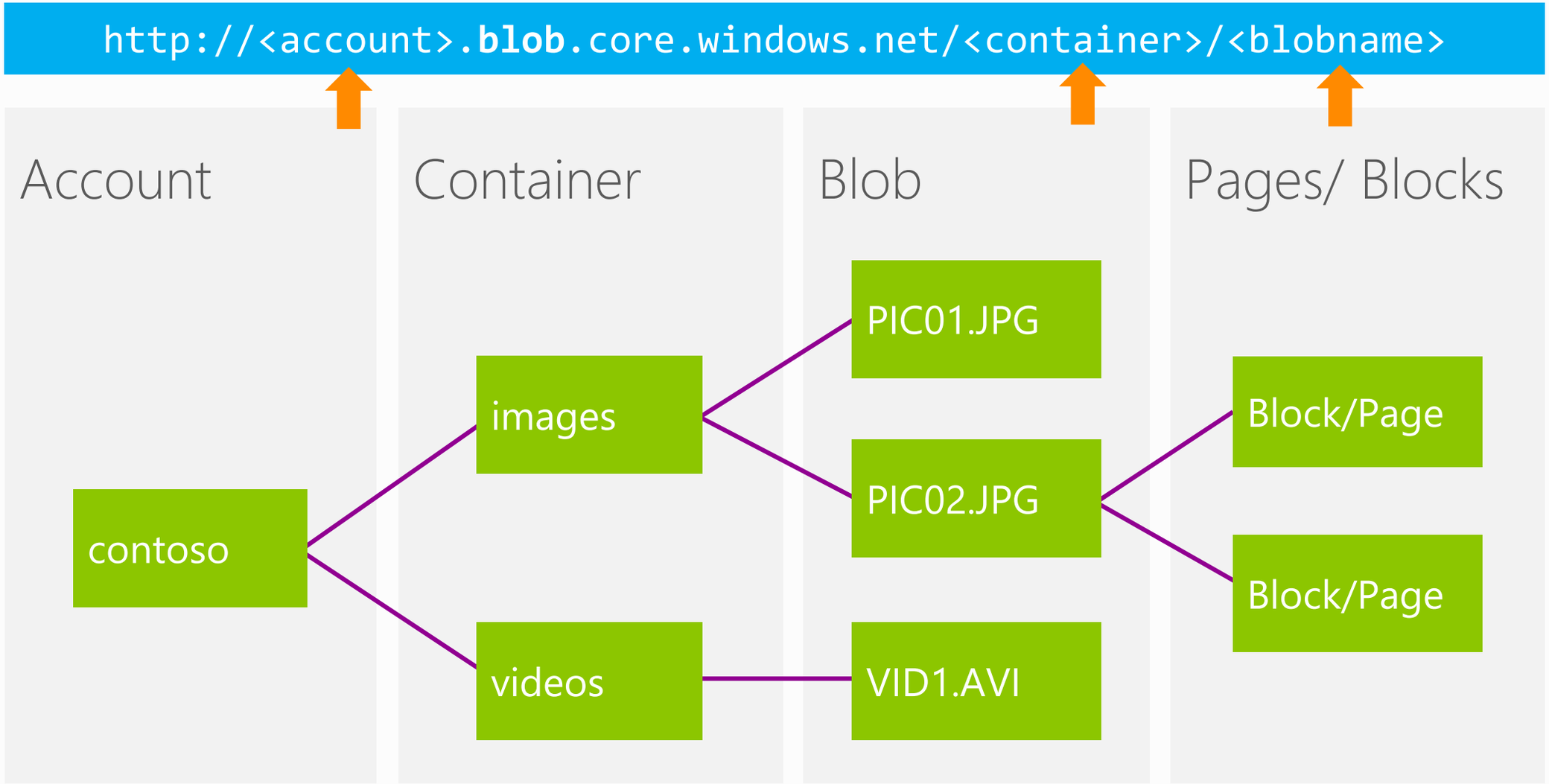
https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-stream-analytics-query-patterns

Azure Blob Storage

Blob

- Binary Large object
- Unstructured data
  - audio, video, document etc.
- Up to 1TB each
- Scoped by the containers

Blob Storage Concepts



Azure SQL Database

Database-as-a-Service

Azure SQL Database

Fully managed database-as-a-service built on SQL with near zero administration

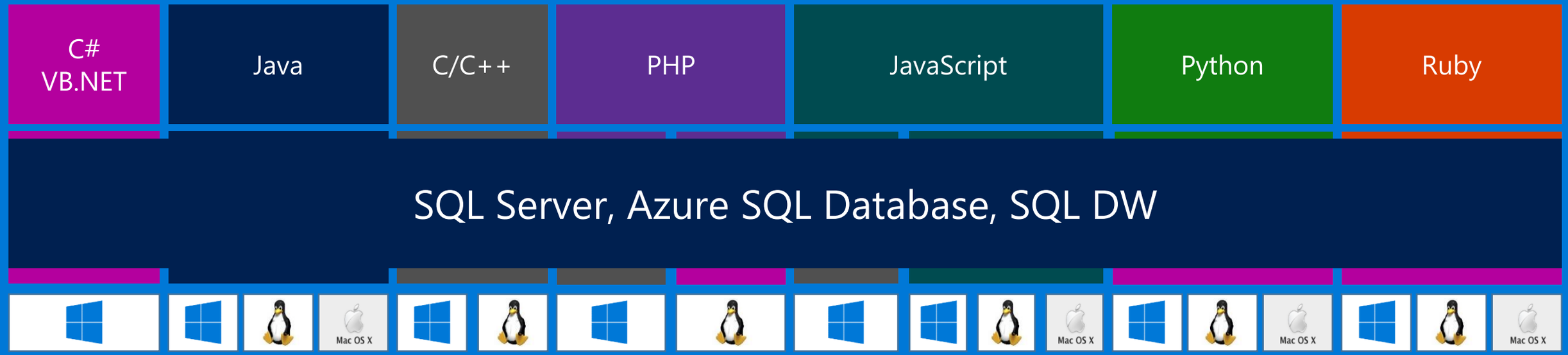
Built for SaaS and Enterprise applications
Predictable performance & Pricing
Elastic database pool for unpredictable SaaS workloads
99.99% availability built-in
Geo-replication and restore services for data protection
Secure and compliant for your sensitive data
Fully compatible with SQL Server 2014 databases

SQL Database Service Tiers

	Basic	Standard	Premium
Intended Use	Light transactional workloads	Go-to option for most business applications	High throughput and business-critical databases
Workload Elasticity	Isolated databases and elastic database pools		
Performance	•	••	•••
Business Continuity	•	••	•••
Programming Surface	Fully compatible with SQL Server 2014 databases		
Availability	99.99%*		

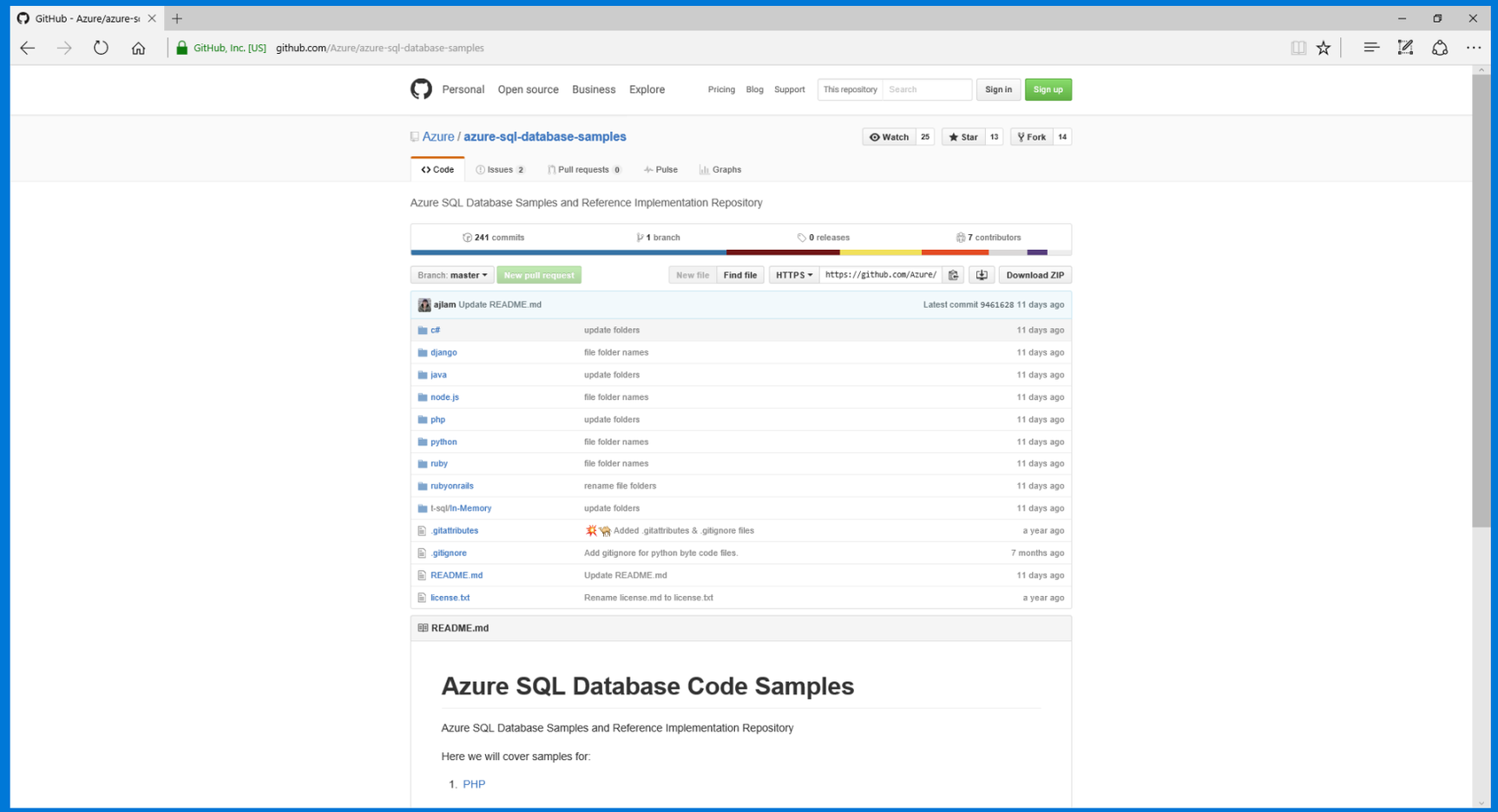
How to connect to SQL DB and start coding

Your choice of language and tooling



Code Samples in GitHub

https://github.com/Azure/azure-sql-database-samples



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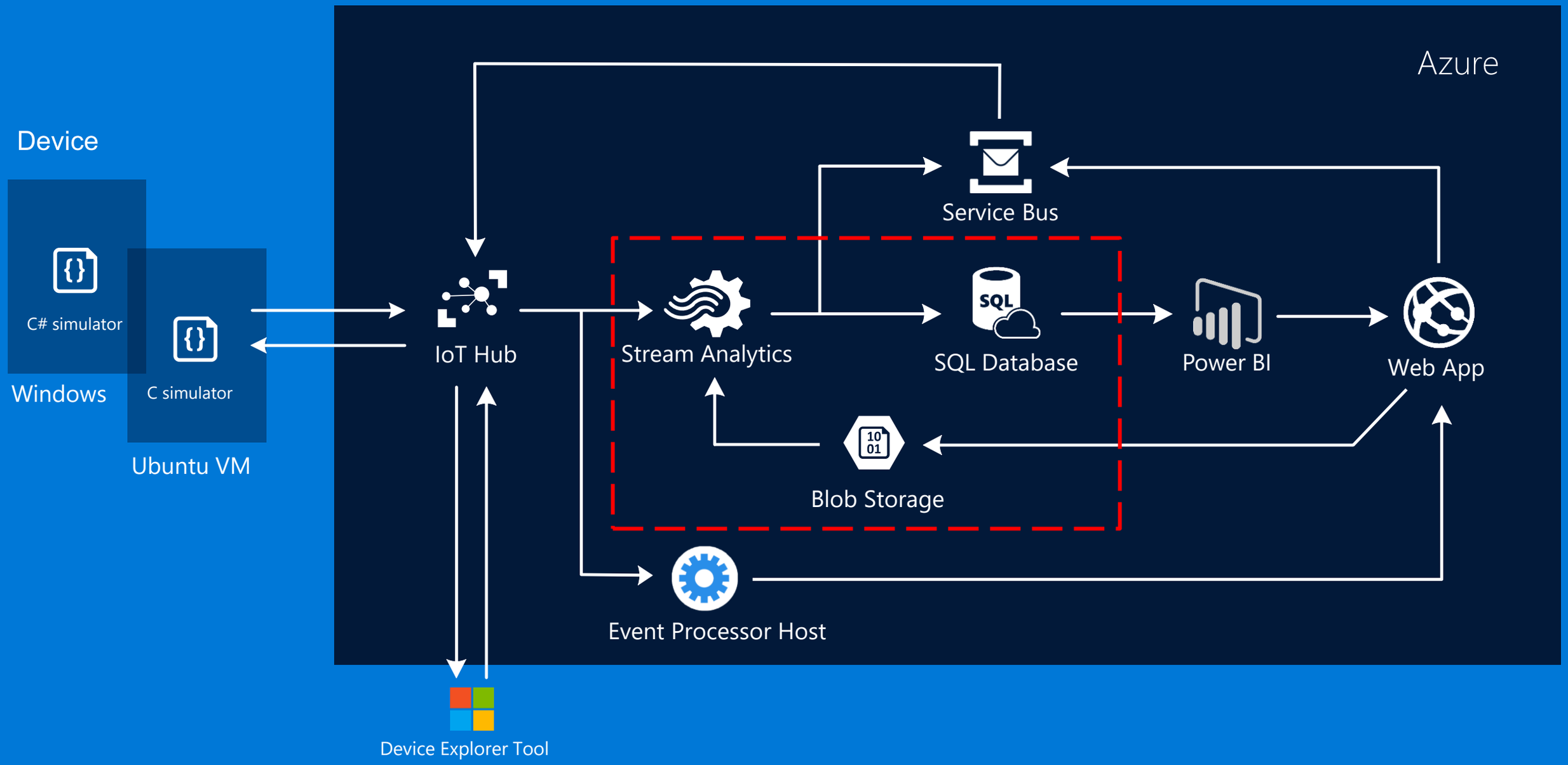
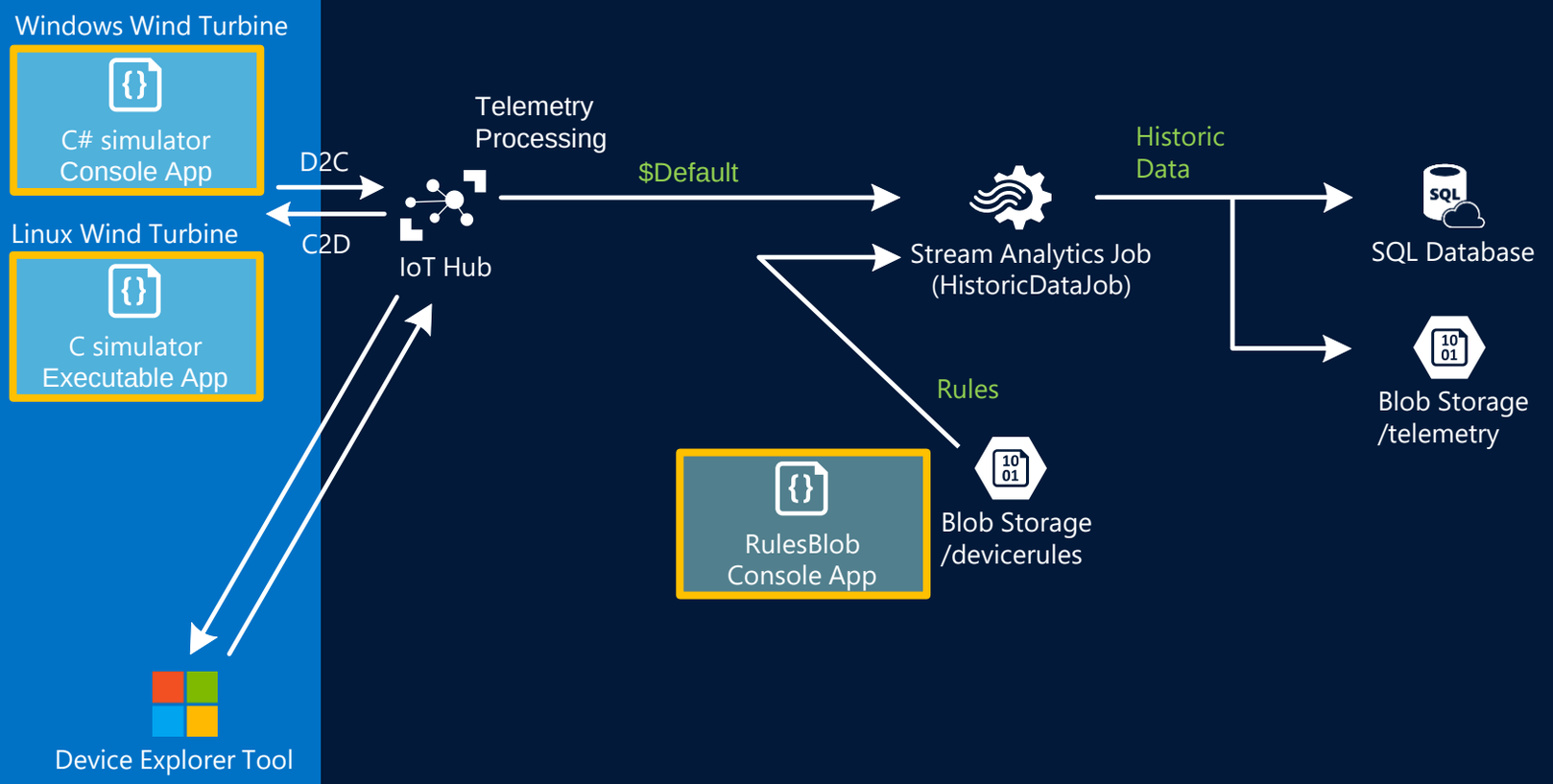
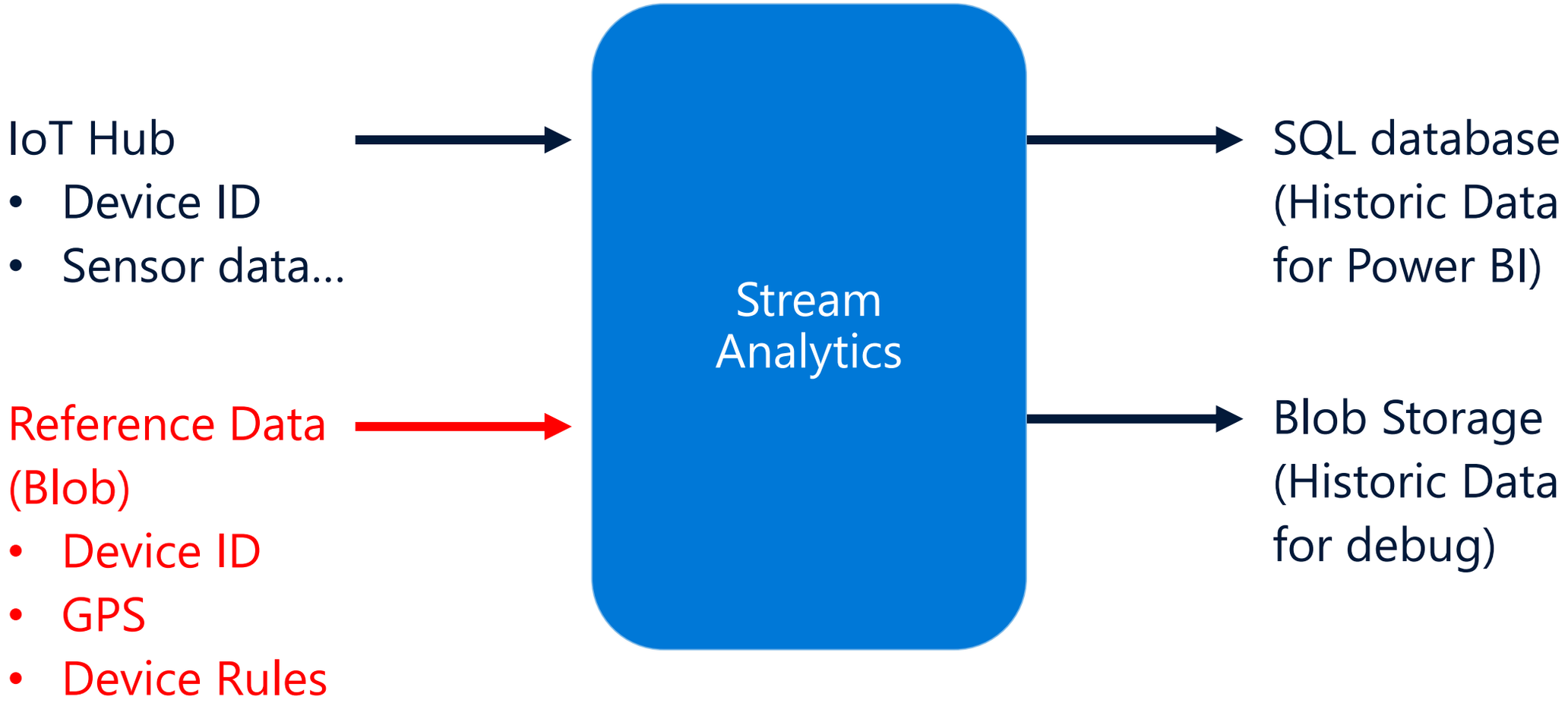


Code & Modules



Reference Data as input to Stream Analytics



Developer Services

- Visual Studio Team Services
- Azure DevTest Labs*
- VS Application Insights*
- HockeyApp
- Developer Tools

Management & Security

- Azure Portal
- Scheduler
- Automation
- Log Analytics
- Key Vault
- Security Center*

Compute

- Virtual Machines
- Virtual Machine Scale Sets
- Cloud Services
- Batch
- RemoteApp
- Service Fabric
- Azure Container Service

Web & Mobile

- Web Apps
- Mobile Apps
- Logic Apps*
- API Apps
- API Management
- Notification Hubs
- Mobile Engagement
- Functions*

Data & Storage

- SQL Database
- DocumentDB
- Redis Cache
- Storage: Blobs, Tables, Queues, Files and Disks
- StorSimple
- Search
- SQL Data Warehouse*
- SQL Server Stretch Database*

Analytics

- Data Lake Analytics*
- Data Lake Store*
- HDInsight
- Machine Learning
- Stream Analytics
- Data Factory
- Data Catalog
- Power BI Embedded*

Internet of Things & Intelligence

- Azure IoT Suite
- Azure IoT Hub
- Event Hubs
- Cortana Intelligence Suite
- Cognitive Services*

Media & CDN

- Media Services
- Content Delivery Network

Identity & Access Management

- Azure Active Directory
- B2C*
- Domain Services*
- Multi-Factor Authentication

Hybrid Integration

- BizTalk Services
- Service Bus
- Backup
- Site Recovery

Networking

- Virtual Network
- ExpressRoute
- Traffic Manager
- Load Balancer
- Azure DNS*
- VPN Gateway
- Application Gateway

Let's Go

- Historic Data Processing in Stream Analytics

  (Please refer the 04-HOL-Historic Data Processing in Stream Analytics file)

  - Create an **Azure SQL Database** for historic data storing
  - Create a reference **Blob** for device rules (Using a windows console App)
  - Provision a **Azure Stream Analytics Job** for the historic data processing
    - **Input**
      - IoTHub
      - Reference Blob
    - **Output**
      - Azure SQL Database
      - Blob

BACKUP

SQL JOIN

customers

CustomerId	Name	Phone	E-mail
1	Walker	123	123@
2	Carol	456	456@
3	LeAnn	789	789@

orders

OrderID	OrderNo	CustomerId
1	1122	2
2	5566	1
3	8899	1
4	3344	3

Name	OrderNo
Walker	5566
Walker	8899
Carol	1122
LeAnn	3344

```
SELECT
    customers.Name, orders.OrderNo
FROM
   customers
LEFT JOIN orders
ON
    customers.CustomerId = orders.CustomerId;
```