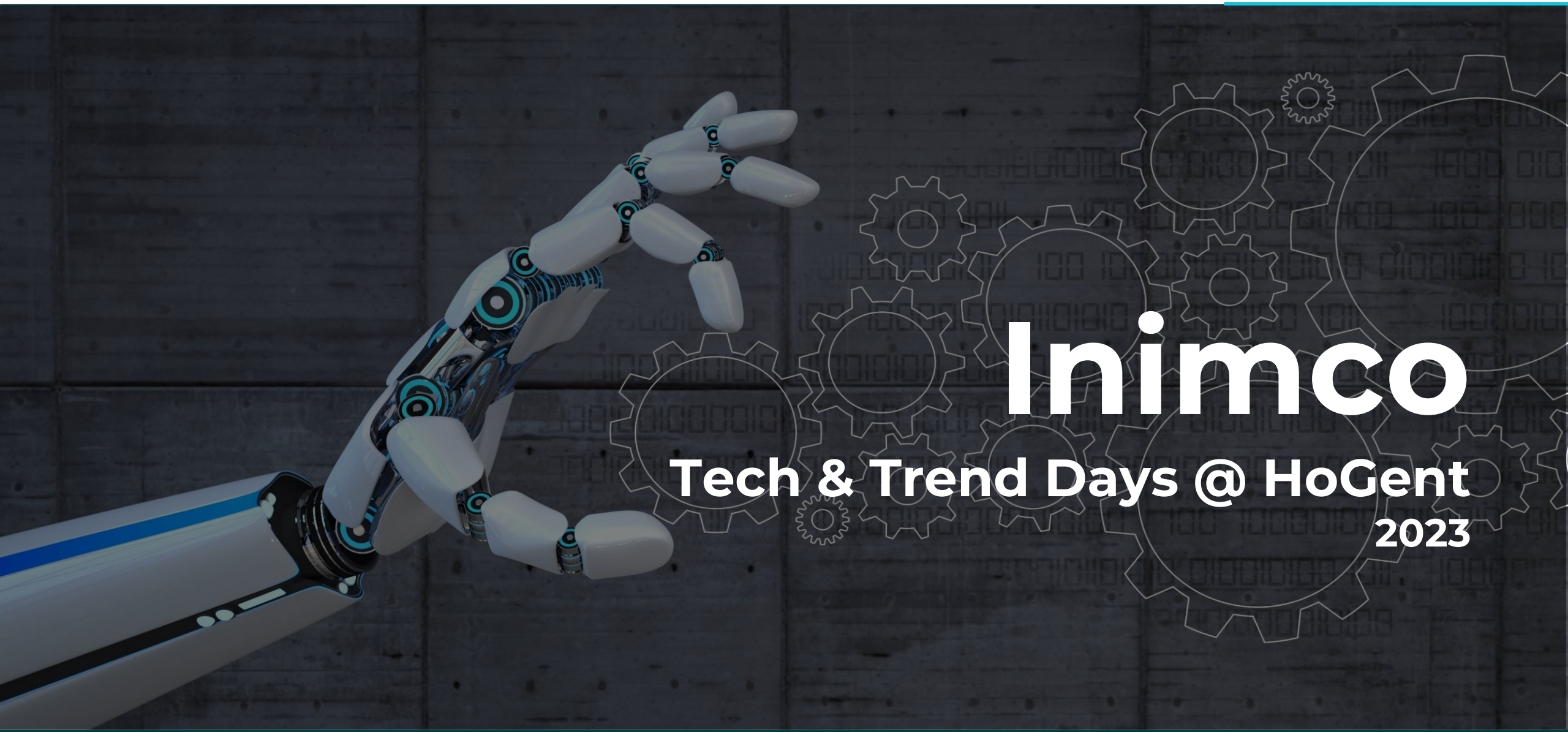

Inimco

Tech & Trend Days @ HoGent 2023

Workshop

Intro & Setup

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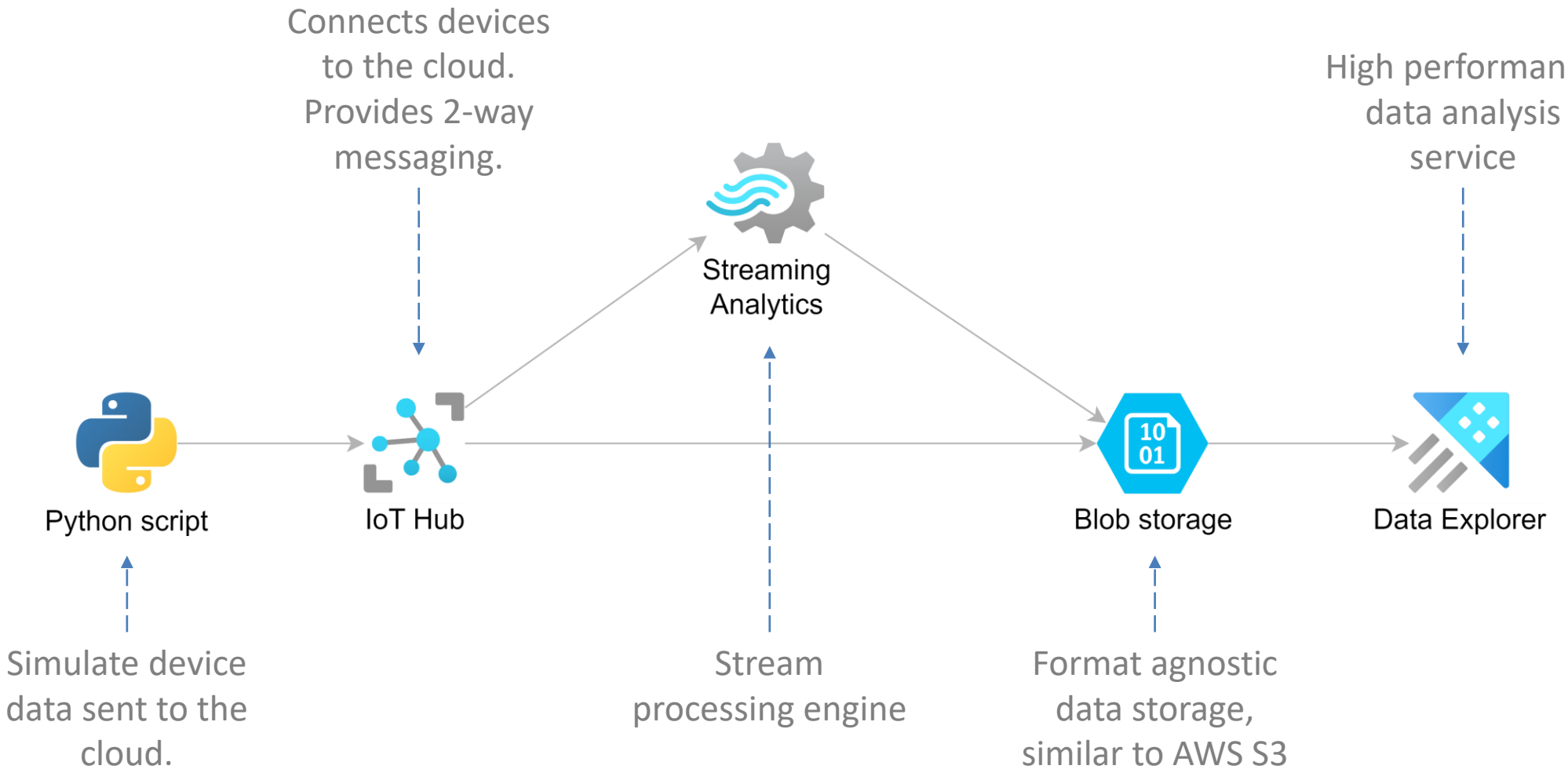
Architecture



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Data source

- 3 devices producing telemetry
  - Electricity
  - Gas
  - Weather conditions
- Simulated using a Python script

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Requirements

- Azure (Student) account
- Python >= 3.9
- Optional
  - Git
  - Azure CLI
  - Azure IoT Explorer
  - Azure Storage Explorer
  - Power BI Desktop

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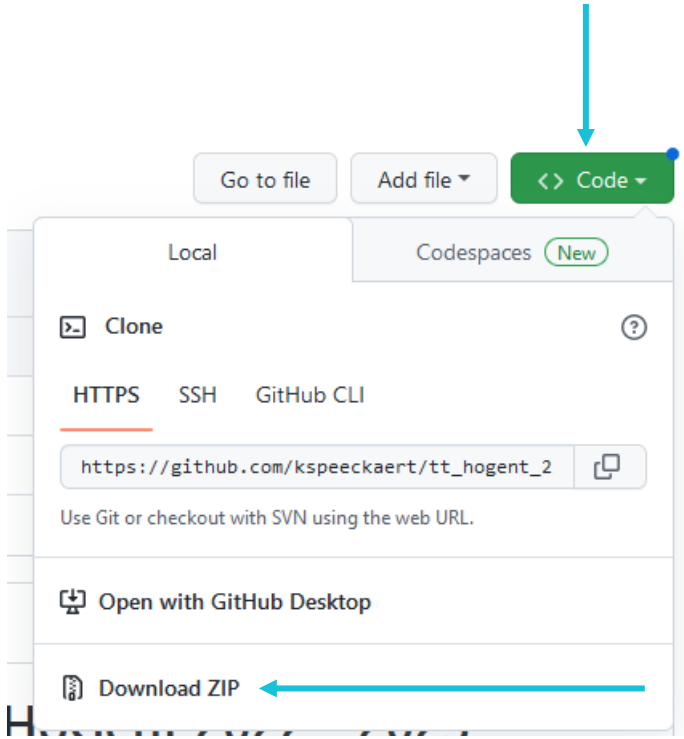
Git Repository

https://github.com/kspeeckaert/tt_hogent_22_23

Clone
(if you have git installed)

- or -

Download



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Azure Portal

https://portal.azure.com

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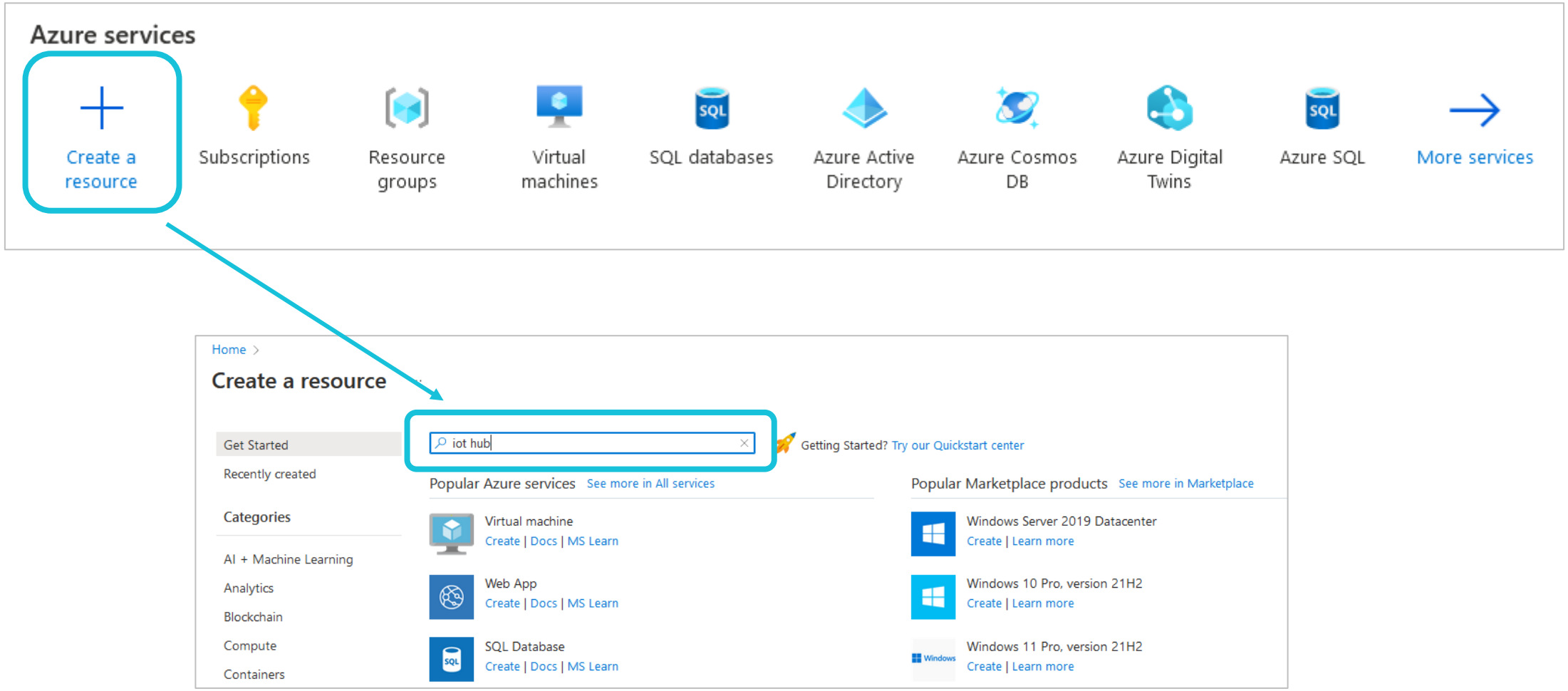
Azure Portal



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Part I - Simulation

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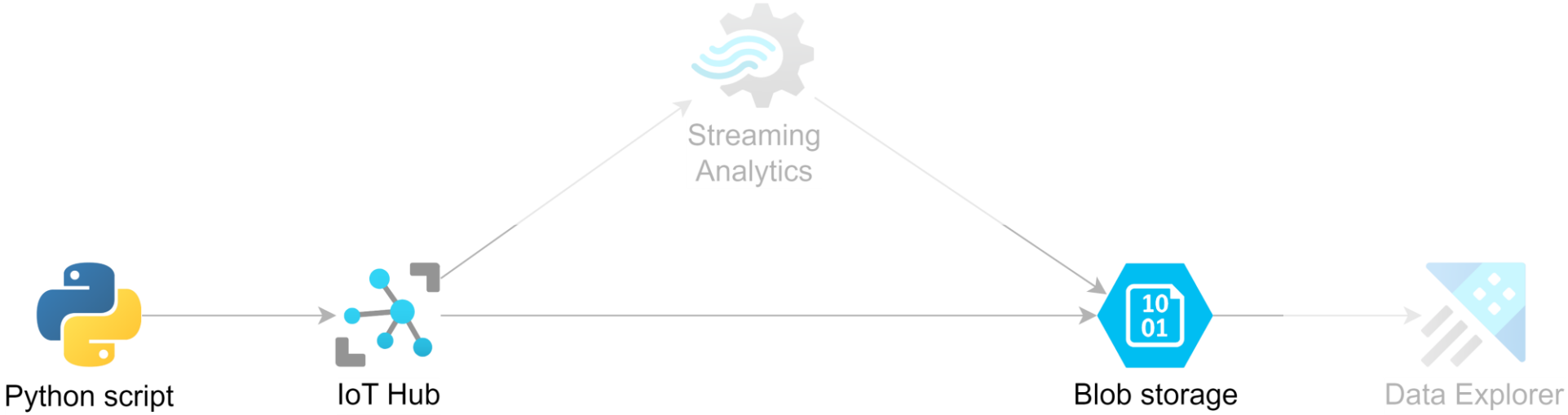
Architecture



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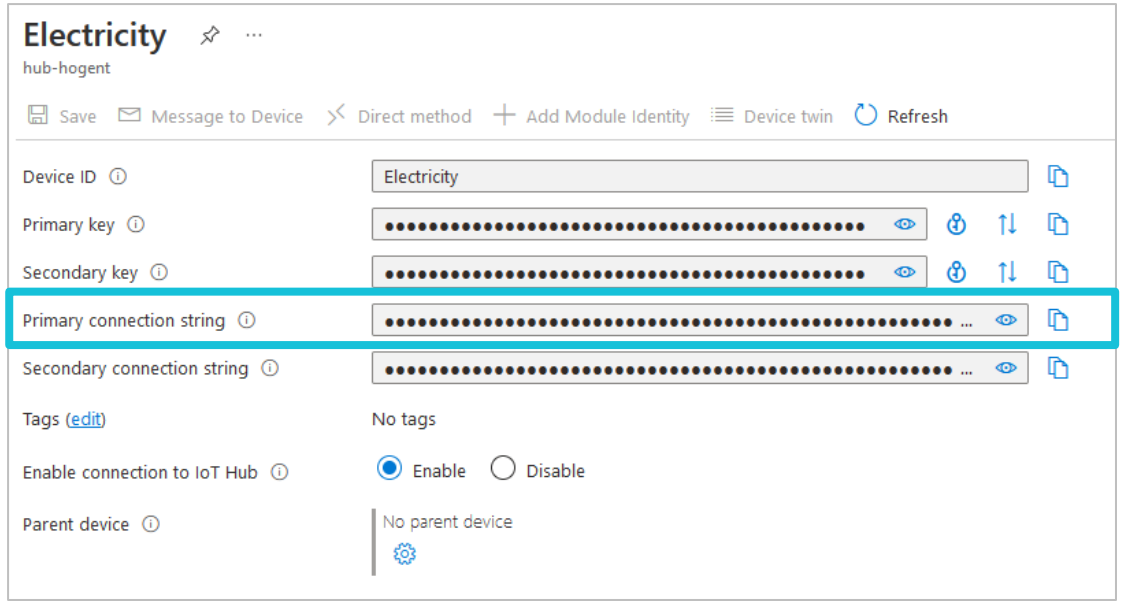
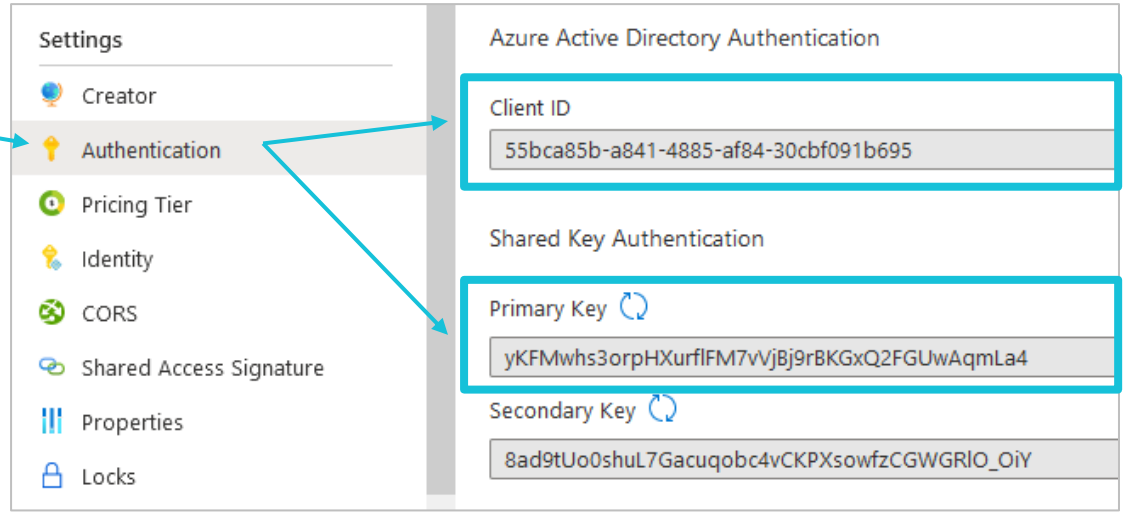
1. Resource Group
2. IoT Hub
   - Create devices
   - Grab connection strings
3. Azure Maps
   - Grab Client ID and Primary Key
4. Configure simulation script
5. Run!





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simul_config.json

```
{
    "gas": {
        "conn_str": "HostName=hub-hogent.azure-devices.net;DeviceId=
        "interval": 10
    },
    "electricity": {
        "conn_str": "HostName=hub-hogent.azure-devices.net;DeviceId=
        "interval": 5
    },
    "weather": {
        "conn_str": "HostName=hub-hogent.azure-devices.net;DeviceId=
        "interval": 120,
        "coordinates": {
            "lat": 51.0330995,
            "lon": 3.6865697
        },
        "az_maps": {
            "subscription_key": "yKFMwhs3orp                9rBKGxQ2FG
            "client_id": "55bca85b-                -30cbf091b695"
        }
    }
}
```


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Install Python requirements

```
pip install -U -r requirements.txt
```


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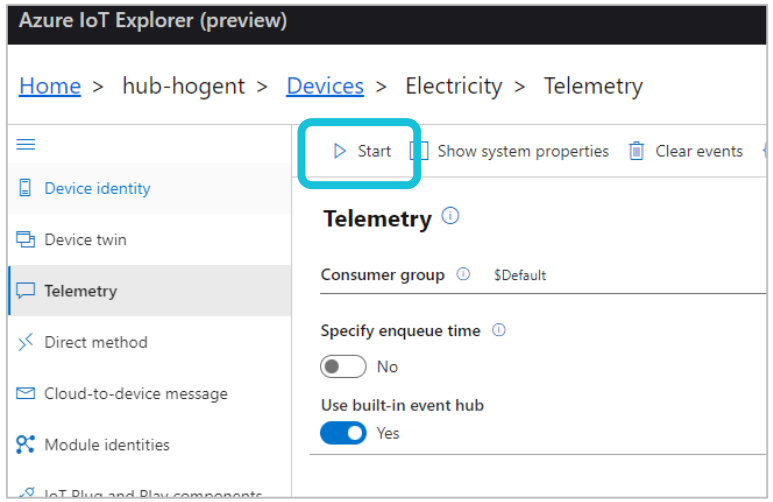
Start simulator

```
python device_simulators.py
```

Check incoming data

- Use Azure IoT Explorer
  - Login
  - Select IoT Hub
  - Select device, then *Telemetry*
  - Click *Start*



- Open Windows Terminal / Command prompt

```
az iot hub monitor-events --hub-name hub-hogent
```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Anyone spot the issue?

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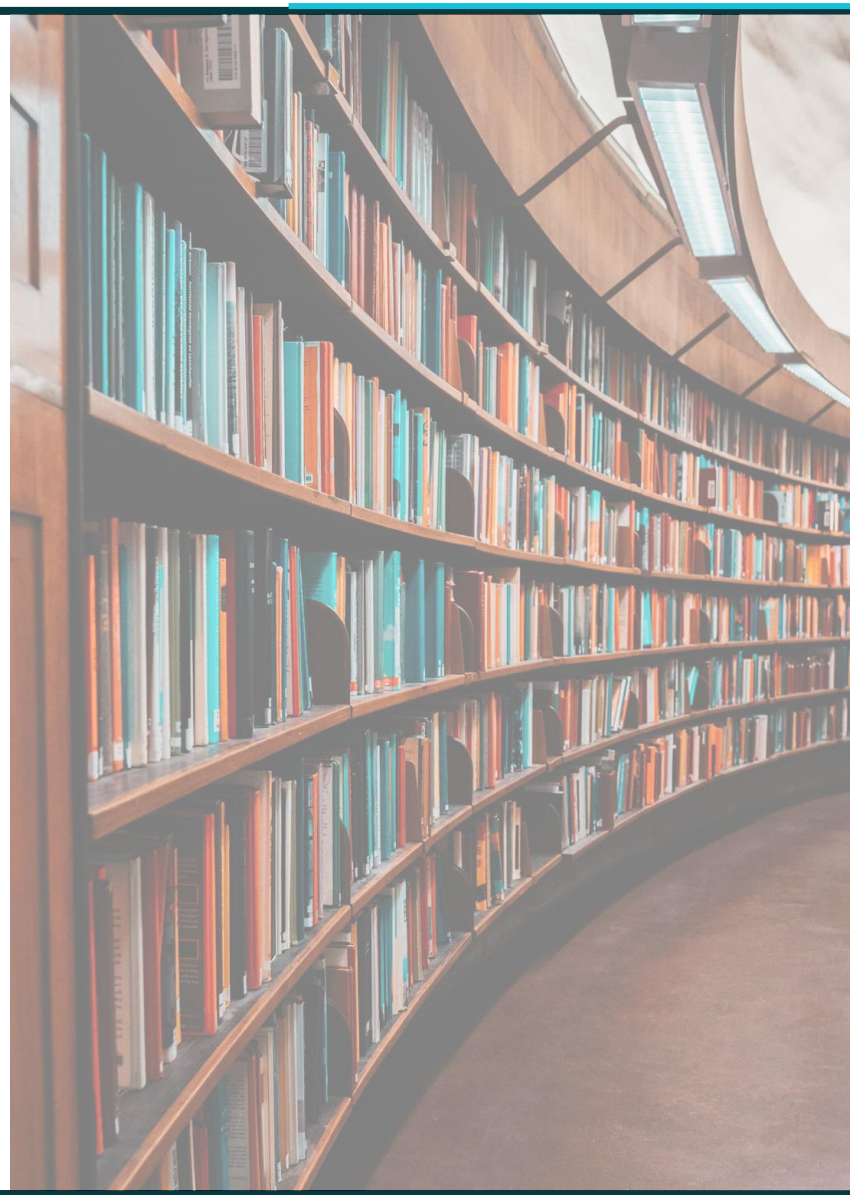
Store raw telemetry data

1. Create Storage Account
   - Select the resource group
   - Region: West Europe
   - Redundancy: Locally redundant storage (LRS)
2. Create blob container
3. Configure message routing in IoT Hub
   - Define custom endpoint (blob container)
   - Define route to endpoint



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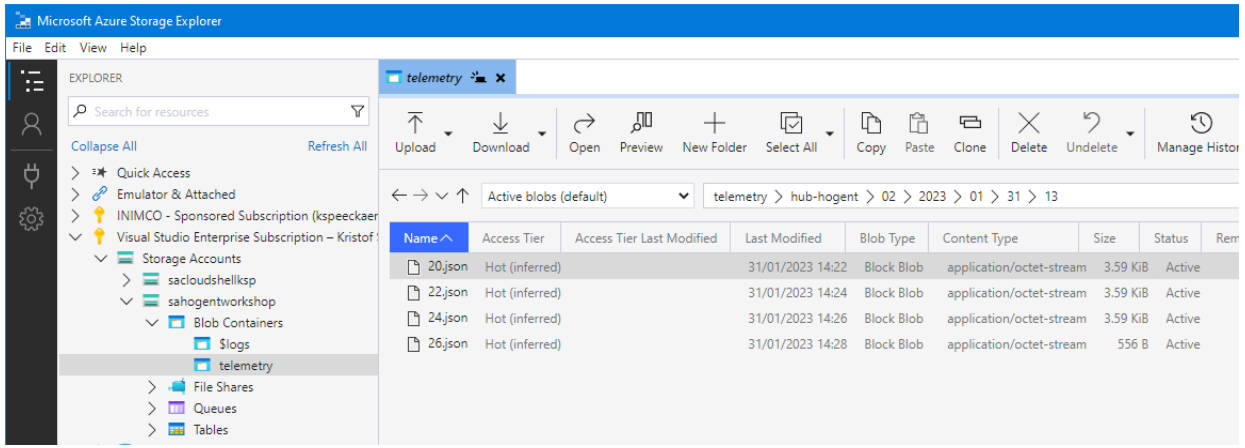
Check stored data

- Navigate to the blob container in Azure Portal
- Use Azure Storage Explorer
  - Login
  - Expand *Storage Accounts*
  - Select the storage account
  - Expand *Blob Containers*
  - Select the blob container



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Part II – Streaming Analytics

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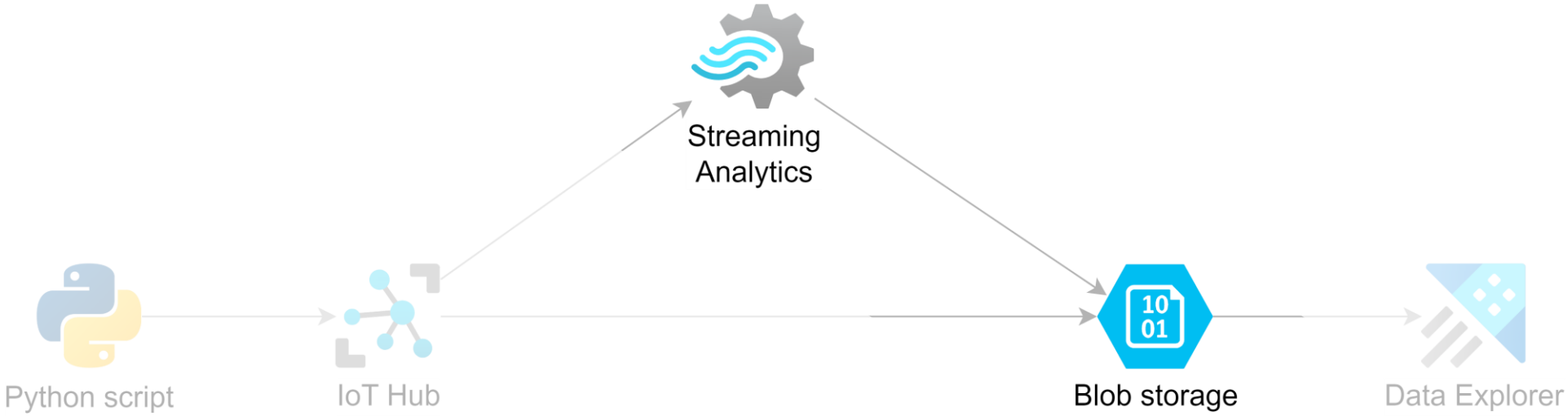
Architecture



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Azure Stream Analytics

“Azure Stream Analytics is a fully managed stream processing engine that is designed to analyze and process large volumes of streaming data with sub-millisecond latencies”

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Stream processing

- Stream Analytics
  - Input(s)
  - Output(s)
  - Query
- Actions
  - Aggregate
  - Enrich
  - Apply ML
- Outputs
  - Real-time dashboards
  - Websites / applications
  - Data lakes / Data stores
  - …

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Setup

1. Create Stream Analytics Job
2. Add IoT Hub as input
3. Add blob container as output
   - Store in a separate folder
4. Define the query to aggregate the data
   - Calculate *average* consumption for the *last 60 seconds*
   - Output *every 5 seconds*
5. Run!

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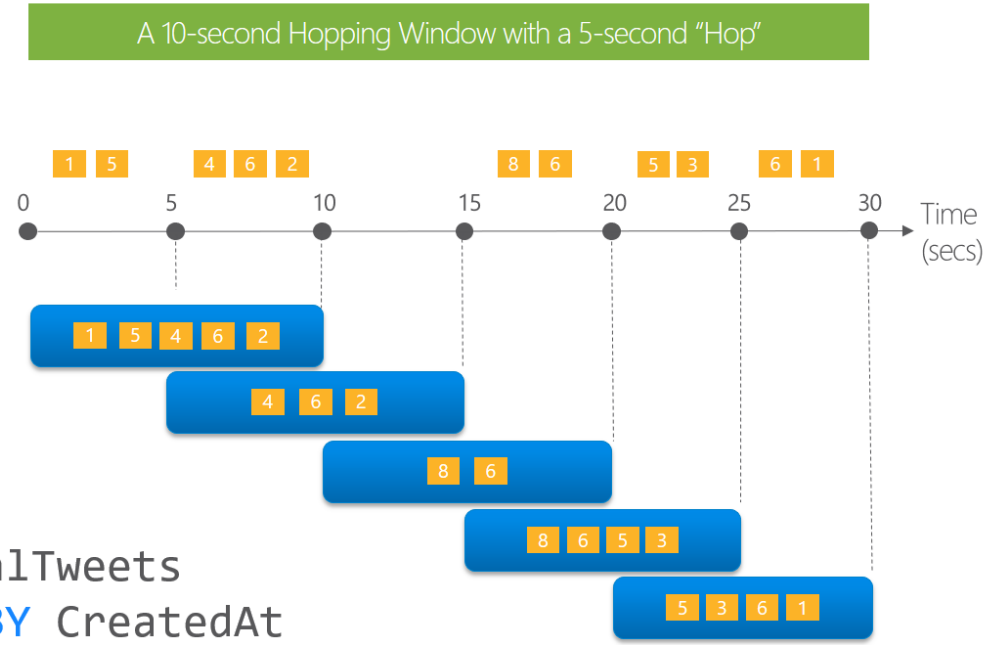
Hopping window

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)
```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ASA Query

Calculate *average* consumption for the *last 60 seconds*
Output *every 5 seconds*

```
SELECT System.Timestamp() AS timestamp
      ,ID as ean
      ,IoTHub.ConnectionDeviceId as device_type
      ,CASE IoTHub.ConnectionDeviceId
        WHEN 'Electricity' THEN AVG(L1_Cons)
        WHEN 'Gas' THEN AVG(current_cons)
        ELSE NULL
       END as avg_value
FROM [hub-hogent]
TIMESTAMP BY timestamp
WHERE IoTHub.ConnectionDeviceId IN ('Gas', 'Electricity')
GROUP BY ID
        ,IoTHub.ConnectionDeviceId
        ,HoppingWindow(second, 60, 5)
```


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Part III – Data Explorer

Architecture

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Azure Data Explorer

“Azure Data Explorer is a fully managed, high-performance, big data analytics platform that makes it easy to analyze high volumes of data in near real time.”

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Azure Data Explorer

- High performance, optimised for big data
- Append-only, immutable data
- Batch and streaming ingestion
- Ideal for
  - structured or semi-structured data
  - time series analysis
- Uses Kusto Query Language (KQL)

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Free ADX cluster

https://aka.ms/kustofree

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1. Setup Data Explorer cluster
2. Create a database
3. Ingest raw data from blob container
4. Query data

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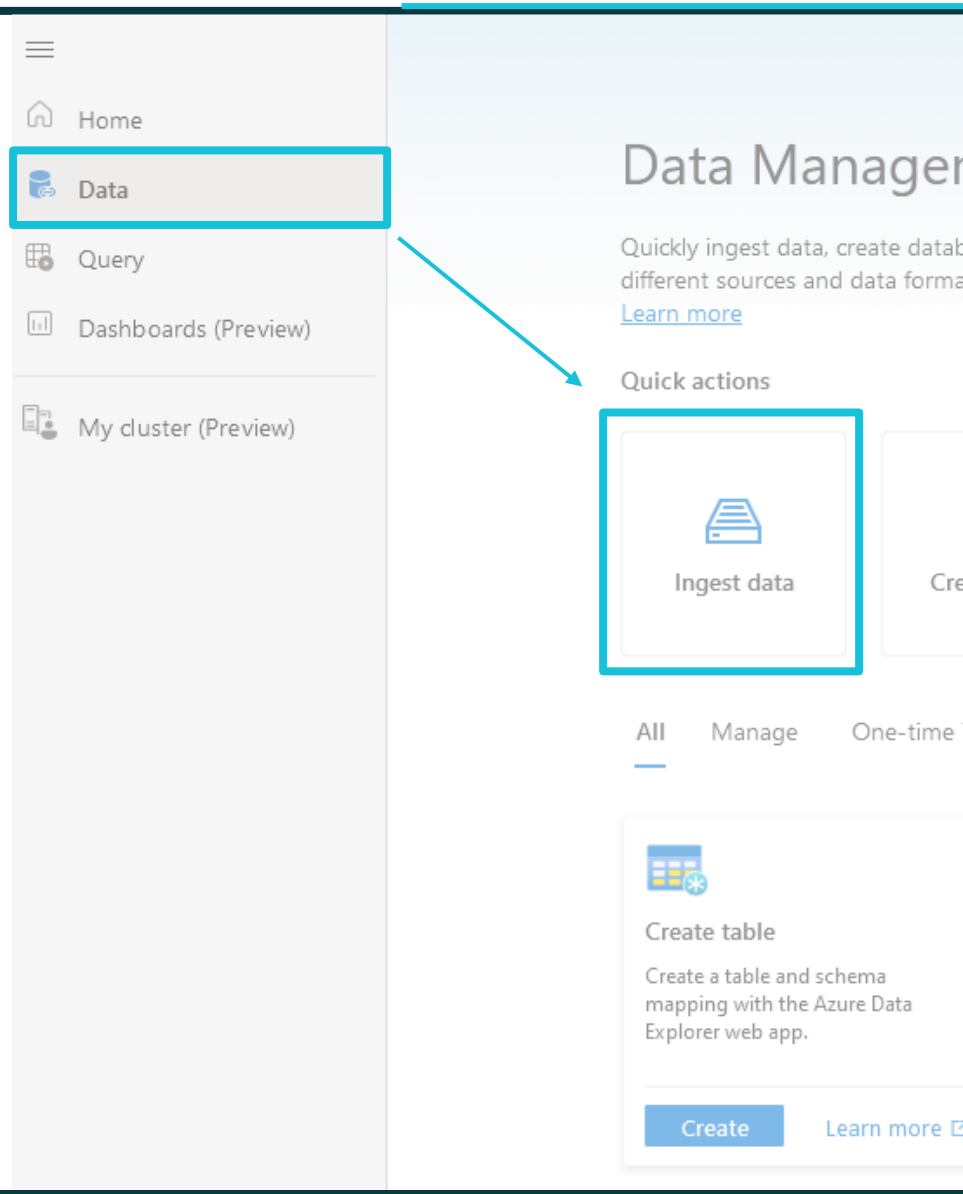
Ingest data

- Ingest into 2 tables
  - Raw data (electricity, gas and weather)
  - Averaged utility data (generated by ASA)
- Split raw data into
  - electricity data
  - gas data
  - weather data



Split raw data

- Create 3 tables
  - util_electric
  - util_gas
  - weather

```
.set util_electric
<| raw_telemetry
    | where SystemProperties.connectionDeviceId == 'Electricity'
    | project Body
    | evaluate bag_unpack(Body)
```

- Sample query
  - Can you figure out the others?
  - `Weather` needs a little more… *unpacking*

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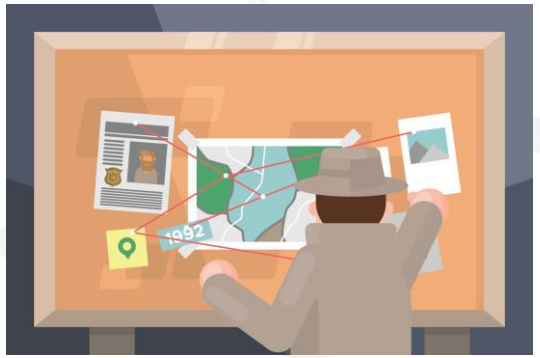
Want more?

- Kusto QL
  - Kusto Detective Agency: https://detective.kusto.io

- SQL
  - SQL Police Department: https://sqlpd.com
  - SQL Murder Mystery: https://mystery.knightlab.com
  - The Schemaverse: https://schemaverse.com



- Azure
  - 30 Days to Learn It https://developer.microsoft.com/en-us/offers/30-days-to-learn-it

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"That's all Folks!"