

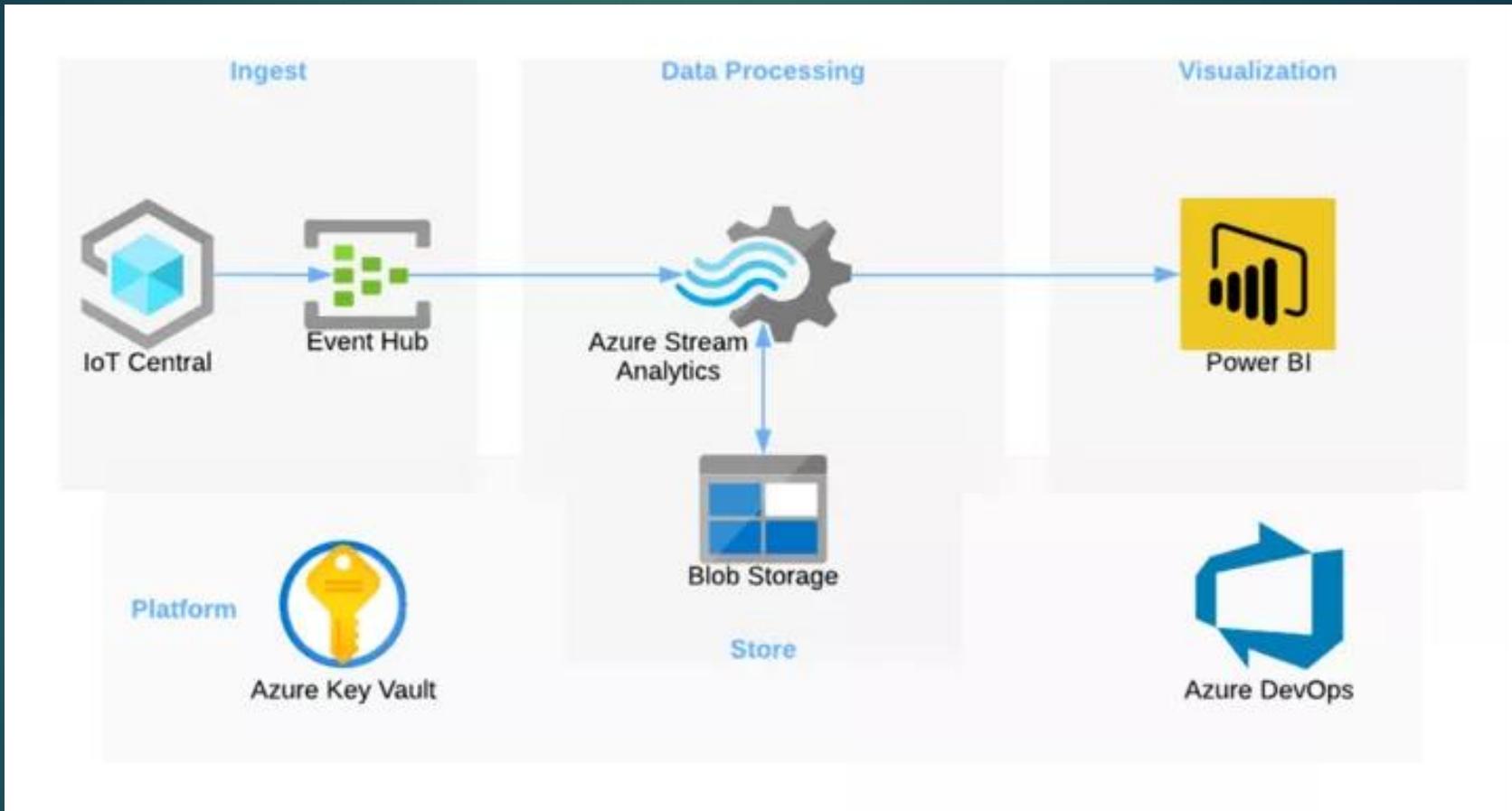


AZURE
STREAMING
ANALYTICS

PROCESSING STREAM DATA WITH SQL

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April 2024



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PROJECT OVERVIEW

- ▶ Azure IOT simulator
- ▶ <https://azure-examplesgithub.io/raspberry-pi-web-simulator/>

PROJECT PROCESS AND ACHIEVABLES

- ▶ IoT Monitoring system
- ▶ Defined source output and job query by creating stream analytics job
- ▶ SQL query language over a stream of data
- ▶ Out-of-the-box Azure integrations
- ▶ Custom function support
- ▶ Visualize the data with Power BI

CONCEPTS AND DEMONSTRATIONS

- ▶ Stream input
- ▶ Define source
- ▶ Define output
- ▶ Define job SQL-based query language
- ▶ Start job
- ▶ Real Time Analysis
- ▶ Stream output

AZURE RESOURCES USED

- ▶ IOT Hub
- ▶ Stream analytics job
- ▶ Storage Account :Blob storage

IOT DEVICE SIMULATOR

BROWSER-BASED RASSBERRY PI SIMULATOR

The screenshot shows a browser-based simulator for a Raspberry Pi. On the left, there's a breadboard simulation with a blue BME280 module connected to a red LED. On the right, a Node.js code editor displays sample code for an IoT device. The code uses the 'wiring-pi' library and the 'azure-iot-device' library to connect to an IoT hub via MQTT. It also includes logic for reading data from a BME280 sensor and sending messages to the hub. Below the code editor, there are buttons for 'Run', 'Stop', and 'Reset'. A note at the bottom says: 'Click 'Run' button to run the sample code(When sample is running, code is read-only). Click 'Stop' button to stop the sample code running. Click 'Reset' to reset the code.We keep your changes to the editor even you refresh the page.'

```
1  /*
2   * IoT Hub Raspberry Pi NodeJS - Microsoft Sample Code - Copyright (c) 2017 - Licensed MIT
3   */
4  const wpi = require('wiring-pi');
5  const Client = require('azure-iot-device').Client;
6  const Message = require('azure-iot-device').Message;
7  const Protocol = require('azure-iot-device-mqtt').Mqtt;
8  const BME280 = require('bme280-sensor');
9
10 const BME280_OPTION = {
11   i2cBusNo: 1, // defaults to 1
12   i2cAddress: BME280.BME280_DEFAULT_I2C_ADDRESS() // defaults to 0x77
13 };
14
15 const connectionString = '[Your IoT hub device connection string]';
16 const LEDPin = 4;
17
18 var sendingMessage = false;
19 var messageId = 0;
20 var client, sensor;
21 var blinkLEDTimeout = null;
22
23
24
```

Run Reset

Click 'Run' button to run the sample code(When sample is running, code is read-only).
Click 'Stop' button to stop the sample code running.
Click 'Reset' to reset the code.We keep your changes to the editor even you refresh the page.

Using the sample GitHub io Rasberry Pi web simulator.
Replacing the connection string 15 to simulate the Device in this Project.

Current temp
Near record



18:22
11/04/2024

CREATING IOT HUB IN AZURE PORTAL

The screenshot shows the Microsoft Azure Marketplace search interface. A search bar at the top contains the query 'iot hub'. Below the search bar, there are several filters: 'Pricing : All', 'Operating System : All', 'Publisher Type : All', 'Product Type : All', and 'Publisher name : All'. A message box at the top left says 'New! Get AI-generated suggestions for your search. Ask AI to suggest products, articles, and solutions for what you need.' with a 'View suggestions' button. The main area displays a grid of search results. The first result is 'IoT Hub' by Microsoft, described as a service for connecting, monitoring, and managing IoT devices. The second result is 'IoT Hub Device Provisioning Service' by Microsoft, described as a service for seamless, zero-touch registration of devices to IoT Hub. The third result is 'Device Update for IoT Hub' by Microsoft, described as a service for securely and reliably updating devices with Device Update for IoT Hub. The fourth result is 'Insights Hub' by Siemens DI Software, described as an industrial IoT service solution with advanced analytics and AI. The fifth result is 'IoT Edge Metrics Collector' by Microsoft, described as a service for collecting Prometheus metrics from IoT Edge modules and transporting them to Azure Monitor or IoT Hub. The bottom of the screen shows the Windows taskbar with various pinned icons.

IOT Hub created

The screenshot shows the Azure portal's 'streamiothub' overview page. The left sidebar includes links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Events, Device management, Devices, IoT Edge, Configurations + Deployments, Updates, Queries, Hub settings, and Built-in endpoints. The main content area displays resource details: Resource group (move) : streamresourcegrp, Status : Active, Location : East US, Service region : East US, Subscription (move) : Azure for Students, Tags (edit) : Add tags, and Usage (Get started). It also shows a chart titled 'IoT Hub Usage' with the message 'Number of messages used' and a bar chart showing 'Messages used today: 0'. At the bottom, there are buttons for 'Show data for last:' with options: 1 Hour, 6 Hours, 12 Hours, 1 Day (highlighted in blue), 7 Days, and 30 Days. The bottom of the screen shows the Windows taskbar with various pinned icons.

IOT Hub as input stream sending telemetry from IOT Device and as an input for the Stream Analytics Job to be created

CREATING AN IOT DEVICE FROM IOT HUB

The screenshot shows the Microsoft Azure StreamIoTHub Devices page. The left sidebar includes links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Events, Device management (Devices selected), IoT Edge, Configurations + Deployments, Updates, and Queries. The main content area displays a table with one row for 'myiotdevice'. The columns are Device ID, Type, Status, Last status update, Authentication type, C2D ... (partially visible), and Tags. The device details are: Device ID - myiotdevice, Type - IoT Device, Status - Enabled, Last status update - --, Authentication type - Shared Access Signature, and Tags - 0.

IOT Device Blade is selected and a new device added referred to as My IOT Device

My IOT Device is opened and the primary connection string is copied to replace the connection string on the Raspberry Pi web simulator

The screenshot shows the Microsoft Azure StreamIoTHub Device blade for 'myiotdevice'. It includes fields for Device ID (myiotdevice), Primary key, Secondary key, Primary connection string, Secondary connection string, Tags (No tags), Enable connection to IoT Hub (Enable selected), Parent device (No parent device), and Module identities (Module ID, Connection State, Connection State Last Updated, Last Activity Time (UTC)). Below the blade, it says 'There are no module identities for this device.'

CONNECTION CHECK

Inbox (7,858) - dianeawes@gmail.com | myiotdevice - Microsoft Azure | streamblobstore - Microsoft Az... | Raspberry Pi Azure IoT Web Sim

azure-samples.github.io/raspberry-pi-web-simulator/

Raspberry Pi Azure IoT Online Simulator

Help English ▾

BME280

Raspberry Pi Model B+ v1.2

fritzing

```
/*
 * IoT Hub Raspberry Pi NodeJS - Microsoft Sample Code - Copyright (c) 2017 - Licensed MIT
 */
const wpi = require('wiring-pi');
const Client = require('azure-iot-device').Client;
const Message = require('azure-iot-device').Message;
const Protocol = require('azure-iot-device-mqtt').Mqtt;
const BME280 = require('bme280-sensor');

const BME280_OPTION = {
  i2cBusNo: 1, // defaults to 1
  i2cAddress: BME280.BME280_DEFAULT_I2C_ADDRESS() // defaults to 0x77
};

const connectionString = 'HostName=streamiohub.azure-devices.net;DeviceId=myiotdevice;Sha
const LEDPin = 4;

var sendingMessage = false;
var messageId = 0;
var client, sensor;
var blinkLEDtimeout = null;
```

Stop Reset

Message sent to Azure IoT Hub

>

Sending message: {"messageId":6,"deviceId":"Raspberry Pi Web Client","temperature":29.88929160915}

>

Message sent to Azure IoT Hub

>

Sending message: {"messageId":7,"deviceId":"Raspberry Pi Web Client","temperature":25.072289765108}

>

Message sent to Azure IoT Hub

>

29°C Mostly clear

Search

20:48 11/04/2024

Primary connection string from IOT HUB replacing the connection string 15 in IOT DEVICE, hit run and the simulator working correctly by sending messages to IOT HUB , ensure its always running

SERVICES TO ANALYZE THE IOT STREAM

Stream Analytics Job creation

The screenshot shows the 'New Stream Analytics job' creation wizard in the Microsoft Azure portal. The 'Basics' tab is selected. Configuration details include:

- Subscription: Azure for Students
- Resource group: streamresourcegrp
- Name: streamanalyticjob2024
- Location: East US
- Hosting environment: Cloud
- Streaming units: 1
- Storage:
 - Subscription: Azure for Students
 - Storage account: streamblobstore
 - Authentication mode: Connection string

At the bottom, there are 'Previous' and 'Next' buttons, and a prominent blue 'Create' button.

One server
selected in this
project

The screenshot shows the 'StreamAnalyticsJob | Overview' page in the Microsoft Azure portal. The deployment status is shown as complete:

Your deployment is complete

Deployment name : StreamAnalyticsJob
Subscription : Azure for Students
Resource group : streamresourcegrp

Start time : 11/04/2024, 20:57:42
Correlation ID : 4a6fb1b88-7965-4484-990d-a4c91a05a...

Deployment details

Next steps

Go to resource

Give feedback

Tell us about your experience with deployment

Cost management

Microsoft Defender for Cloud

Free Microsoft tutorials

Work with an expert

Azure experts are service provider partners

Streaming unit is most important choice in creation of Stream Analytics Job

SERVICES TO ANALYZE THE IOT STREAM

STREAM ANALYTICS JOB CREATED

Inbox (7,858) - dianeavwes@gn | streamanalyticjob2024 - Micros | streamblobstore - Microsoft Az... | Raspberry Pi Azure IoT Web Sim | +

portal.azure.com/#@SaskPolytech.onmicrosoft.com/resource/subscriptions/a632c51a-0777-435a-920b-628c7af3468b/resourcegroups/streamresourcegrp...     

Microsoft Azure  Copilot |        

Home > StreamAnalyticsJob | Overview >

 **streamanalyticjob2024**  

Stream Analytics job

  Start job  Delete  Move  Refresh  Share feedback  3 actions required

 Overview  Activity log  Access control (IAM)  Tags  Diagnose and solve problems

Job topology

 Inputs  Functions  Query  Outputs  No-code editor (preview)

Settings

 Environment  Storage account settings

 29°C Mostly clear  Search               21:00 11/04/2024

streamanalyticjob2024 Stream Analytics job

Created

Essentials

Resource group (..) : [streamresourcegrp](#) Created : Thursday, April 11, 2024 8:58 PM
Location : East US Started :
Status : Created Output watermark :
Subscription ([move](#)) : [Azure for Students](#) Cluster : Shared
Subscription ID : a632c51a-0777-435a-920b-628c7af3468b Hosting environment : Cloud
Pricing plan : StandardV2 ([manage](#)) Virtual Network : Disabled
Tags ([edit](#)) :

[JSON View](#)

[Get started](#) [Properties](#) [Monitoring](#) [Tutorials](#)

Which best describes your needs?

I want to build my job using a query  I want to build my job without code

Stream Analytics Job once created defines the inputs and outputs

AZURE BLOB STORAGE CREATION

The screenshot shows the Microsoft Azure Stream Blobstore deployment overview page. It displays a summary of the deployment, including the deployment name (streamblobstore_1712861804002), start time (11/04/2024, 19:57:32), subscription (Azure for Students), and resource group (streamresourcegrp). A message indicates that the deployment is complete. The page also includes sections for deployment details, next steps, and links to cost management, Microsoft Defender for Cloud, free tutorials, and expert work.

Blob storage is created from a storage account by disabling the hierarchical namespace.

Blob storage created

The screenshot shows the Microsoft Azure Stream Blobstore storage account overview page. It displays the storage account details, including the resource group (streamresourcegrp), location (eastus), subscription (Azure for Students), and disk state (Available). The blob service configuration is shown, with the hierarchical namespace set to disabled. Other settings include default access tier (Hot), blob anonymous access (Disabled), blob soft delete (Enabled (7 days)), container soft delete (Enabled (7 days)), require secure transfer for REST API operations (Enabled), storage account key access (Enabled), minimum TLS version (Version 1.2), and infrastructure encryption (Disabled).

Setting	Value
Hierarchical namespace	Disabled
Default access tier	Hot
Blob anonymous access	Disabled
Blob soft delete	Enabled (7 days)
Container soft delete	Enabled (7 days)
Require secure transfer for REST API operations	Enabled
Storage account key access	Enabled
Minimum TLS version	Version 1.2
Infrastructure encryption	Disabled

BLOB CONTAINER CREATION

Created a blob container named output for outputting the streamed data

The screenshot shows the Microsoft Azure portal interface. The top navigation bar includes tabs for 'Inbox (7,858) - dianeavwes@gmail.com', 'streamanalyticjob2024 - Micros...', 'New container - Microsoft Azure', and 'Raspberry Pi Azure IoT Web Sim...'. The main title 'New container' is displayed above the configuration form.

Left Sidebar: The sidebar lists various storage account management options: Overview, Activity log, Tags, Diagnose and solve problems, Access Control (IAM), Data migration, Events, Storage browser, and Storage Mover. Under 'Data storage', 'Containers' is selected.

Container List: A table displays existing containers. One row is selected for '\$logs', showing the 'Last modified' date as 11/04/2024, 19:58:03.

New Container Form:

- Name:** The input field contains 'bloboutput'.
- Anonymous access level:** The dropdown menu is set to 'Private (no anonymous access)'.
- Advanced:** A note states: 'The access level is set to private because anonymous access is disabled on this storage account.'

Bottom Right: Buttons for 'Create' and 'Give feedback' are visible.

Taskbar: The taskbar at the bottom shows the system tray with icons for battery, signal, and network, along with the date and time (11/04/2024, 21:06).

BLOB OUT PUT CREATED IN STREAM ANALYTICS JOB

The screenshot shows the Microsoft Azure Stream Analytics job output blade. On the left, there's a sidebar with options like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Job topology, Inputs, Functions, Query, Outputs, No-code editor (preview), Settings, Environment, and Storage account settings. The Outputs section is currently selected. In the main area, there's a search bar and an 'Add output' button. A dropdown menu is open, listing various output types: Azure Data Explorer, Azure Function, Azure Synapse Analytics, Blob storage/ADLS Gen2, Cosmos DB, Data Lake Storage Gen1, Event Hub, Kafka (preview), PostgreSQL database, Power BI, Service Bus queue, Service Bus topic, and SQL Database. The 'Blob storage/ADLS Gen2' option is highlighted with a blue selection bar.

Navigating to the output blade by the left under job topology, add stream output. Blob storage output is selected. Connectivity automatically tested.

Azure Blob storage(new output alias) is being used to output streamed data.

The screenshot shows the Microsoft Azure Stream Analytics job output blade after creating a new output alias. The sidebar and overall layout are identical to the previous screenshot. In the main output list, there is one entry: 'outputblob'. It has an 'Alias ↑' column value of 'outputblob', a 'Type' column value of 'Blob storage/ADLS Gen2', and a 'Conn' column with a gear icon. The 'Outputs' section in the sidebar is still selected.

CREATING A QUERY IN AZURE STREAM ANALYTICS JOB

Defining input and output in the stream analytics job

The screenshot shows the Azure Stream Analytics job interface. The left sidebar has a tree view with 'streamanalyticjob2024 | Inputs' selected. The main area shows the 'Inputs' blade with a table for stream inputs. The 'Stream input' dropdown is open, showing various options: Blob storage/ADLS Gen2, Event Hub, IoT Hub, Kafka (preview), Reference input, Blob storage/ADLS Gen2, and SQL Database. The 'IoT Hub' option is highlighted.

*Open the input blade under job topology in the stream analytics job.
-Add an input, choose a type IOT HUB as input alias*

IOT hub input created and connectivity automatically tested.

The screenshot shows the same Azure Stream Analytics job interface as before, but with a new entry in the 'Inputs' blade table. The table now has one row: 'iotinput'. The columns are 'Alias' (with value 'iotinput'), 'Source type' (with value 'Stream'), 'Type' (with value 'IoT Hub'), and 'Conn' (with status 's'). The rest of the interface remains the same, with the left sidebar showing the 'Inputs' blade selected.

QUERY SECTION OF THE STREAM ANALYTICS JOB

Development editor

```
1 /*  
2 Here are links to help you get started with Stream Analytics Query Language:  
3 Common query patterns - https://go.microsoft.com/fwlink/?LinkId=619153  
4 Query language - https://docs.microsoft.com/stream-analytics-query/query-language-elements-azure-stream-analytics  
5 */  
6 SELECT  
7 | *  
8 | INTO  
9 | [outputblob]  
10 | FROM
```

messageId	deviceId	temperature	humidity	EventProcessedUtcTime	PartitionId	Event
1	"Raspberry Pi Web Cli..."	21.41606231113368	61.174239926462576	"2024-04-11T20:28:30..."	0	"202"

First IOT input as top input, all data into blob output saved and tested. Sample dataset at the bottom, refresh to get updated sample. Live data pulled from IOT device.

The query blade under job topology is selected revealing an editor where queries are run, typed, and tested. Standard SQL statement using input and output aliases

messageId	deviceId	temperature	humidity	EventProcessedUtcTime	PartitionId	Event
1	"Raspberry Pi Web Cli..."	21.41606231113368	61.174239926462576	"2024-04-11T20:28:30..."	0	"202"
2	"Raspberry Pi Web Cli..."	20.26971331044479	63.24005457117622	"2024-04-11T20:28:30..."	0	"202"
3	"Raspberry Pi Web Cli..."	21.379651456379754	71.69504875313292	"2024-04-11T20:28:30..."	0	"202"

CONNECTING STREAM FROM IOT TO BLOB USING QUERY

streamanalyticjob2024

Stream Analytics job

Start job

You have not configured the diagnostic settings for this job yet.
Add diagnostic settings in the diagnostic settings pane.

Streaming units: 1

Environment: Standard

Job output start time: Now

Start

SQL Query to send the job to blob storage once the start job is clicked

streamanalyticjob2024

Stream Analytics job

Starting

Essentials

Resource group ...	Created
streamresourcegrp	Thursday, April 11, 2024 8:58 PM
Location	Started
East US	:
Status	Output watermark
Starting	:
Subscription (move)	Cluster
Azure for Students	Shared
Subscription ID	Hosting environment
a632c51a-0777-435a-920b-628c7af3468b	Cloud
Pricing plan	Virtual Network
StandardV2 (manage)	Disabled

Troubleshooting

No recent errors and warnings

Job diagram (preview)

View all activity logs

CONNECTING STREAM CONTINUES

The screenshot shows the Microsoft Azure Storage blob container 'bloboutput'. The left sidebar includes 'Overview', 'Diagnose and solve problems', 'Access Control (IAM)', 'Settings' (with 'Shared access tokens', 'Access policy', 'Properties', and 'Metadata' options), and a weather widget. The main area displays a table with columns: Name, Modified, Access tier, Archive status, Blob type, Size, and Lease state. One row is present: a blob named '2024' with a size of '-'.

Storage account output container opened to view file

File opened, refresh to see growth in size of data.

The screenshot shows the Microsoft Azure Storage blob container 'bloboutput' after a file has been uploaded. The table now lists two blobs: one named '2024' and another named '1601032489_d6e6ae...'. The '2024' blob is a Block blob with a size of 8.96 KiB and an 'Available' lease state. The '1601032489...' blob is also a Block blob with a size of 8.96 KiB and an 'Available' lease state.

BLOB STORAGE OUTPUT REVIEWED

The screenshot shows the Microsoft Azure Blob storage interface. The left sidebar lists navigation options like Home, Resource groups, and StreamResourceGrp. The main area displays a table of blobs with columns: Name, Modified, Access tier, Archive status, Blob type, Size, and Lease state. Two blobs are listed: [...] and 04.

Streaming data in csv format, once refreshed continuous flow of data noticed

The screenshot shows the Microsoft Azure Blob storage interface with a preview of a CSV file. The preview table has 15 rows of data, each containing fields: messageId, deviceId, temperature, humidity, EventProcessedUtcTime, PartitionId, and EventEnqueuedUtcTime. The data represents sensor readings from a Raspberry Pi Web Client over time.

	messageId	deviceId	temperature	humidity	EventProcessedUtcTime	PartitionId	EventEnqueuedUtcTime
1	1,Raspberry Pi Web Client	24,10622050370821	77,8314457276726	2024-04-11T22:21:17.26897			
2	2,Raspberry Pi Web Client	21,32798952563432	74,96663016475972	2024-04-11T22:21:18.69445			
3	3,Raspberry Pi Web Client	22,4306883152828	71,0517660810881	2024-04-11T22:21:20.67752			
4	4,Raspberry Pi Web Client	29,08649332831718	75,55931684361735	2024-04-11T22:21:22.7552			
5	5,Raspberry Pi Web Client	30,6169215954513	79,696748393615	2024-04-11T22:21:24.72342			
6	6,Raspberry Pi Web Client	21,147411578375873	73,78571175299709	2024-04-11T22:21:27.3484			
7	7,Raspberry Pi Web Client	25,368631844901252	70,32582193418046	2024-04-11T22:21:29.3170			
8	8,Raspberry Pi Web Client	20,737637231199823	74,50060158159703	2024-04-11T22:21:31.3169			
9	9,Raspberry Pi Web Client	30,882188900426783	71,0012085866412	2024-04-11T22:21:33.28693			
10	10,Raspberry Pi Web Client	24,087939937292274	69,631371221696	2024-04-11T22:21:35.36378			
11	11,Raspberry Pi Web Client	21,523728254264242	79,21633674808953	2024-04-11T22:21:37.332			
12	12,Raspberry Pi Web Client	25,40235179989873	66,62728872481521	2024-04-11T22:21:39.3013			
13	13,Raspberry Pi Web Client	31,004730875858467	75,01540869873891	2024-04-11T22:21:41.270			
14	14,Raspberry Pi Web Client	22,017766626743803	72,61262053899556	2024-04-11T22:21:43.363			

NEW OUTPUT CREATION

Introducing Power Bi

The screenshot shows the Azure Stream Analytics job overview page for 'streamanalyticjob2024'. In the 'Outputs' section, a new Power BI output is being configured. The dialog box shows the following details:

- Group workspace: d83f4c30-c15c-4d9f-b87c-3cb8ab772639
- Authentication mode: User token
- Dataset name: iotinput
- Table name: temperature

The 'Authorize connection' section indicates that the user needs to authorize with Power BI to configure settings, with a 'Save' button at the bottom.

Power bi selected and authorised, then created. Connection added & tested

Power bi as a new output, in order to add an output the job is stopped by going to the overview page of stream analytics job. Licenced Power Bi opened on desktop.

The screenshot shows the Azure Stream Analytics job overview page for 'streamanalyticjob2024'. The 'Outputs' section now lists the newly created Power BI output:

Alias	Type	A...	R...
iotpowerbioutput	Power BI	User	
outputblob	Blob storage/ADLS Gen2	Conn	

NEW QUERY DEFINED

The screenshot shows the Azure Stream Analytics job configuration interface. On the left, a sidebar lists various job settings like Overview, Activity log, and Inputs. The main area shows the 'streamanalyticjob2024' job with its inputs ('iotinput') and outputs ('iotpowerbioutput', 'outputblob'). The 'Query' section is active, displaying a T-SQL query:

```
7  SELECT
8    system.Timestamp AS windowEnd,
9    AVG(temperature)AS temperature
10   INTO
11    [iotpowerbioutput]
12   FROM
13    [iotinput]
14   GROUP BY
15    TumblingWindow(second,2)
16
```

The 'Input preview' tab shows sample data from 'iotinput':

messageId	deviceid	temperature	humidity	EventProcessedUtc
1	"Raspberry Pi Web Cli...	29.69138252361546	78.08097610314847	"2024-04-12T10:00:4

A message at the bottom states: "While sampling data, no data was received from '1' partitions."

A new query was created, grabbing an average over time window with a group by statement using a tumbling window function with duration in 2 seconds, Data streamed to power Bi

Query selected and tested. Test output revealed in few minutes showing average temperature and pasted date. Query saved.

The screenshot shows the same Azure Stream Analytics job configuration interface, but the 'Test results' tab is now active. It displays the results of the query execution:

windowEnd	temperature
"2024-04-12T11:26:18.000000Z"	29.69138252361546
"2024-04-12T11:26:20.000000Z"	24.197013313045712

A message at the bottom states: "Showing 0 rows from 'iotpowerbioutput'."

OVERVIEW ON STREAM ANALYTICS JOB

The screenshot shows the Azure Stream Analytics job configuration page. On the left, there's a navigation sidebar with links like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Job topology, Inputs, Functions, Query, Outputs, No-code editor (preview), and Settings. The main area shows a 'Start job' dialog. It lists 'Inputs (1)' (iotinput) and 'Outputs (2)' (iotpowerbioutput, outputblob). A 'Test query' window is open, displaying the following T-SQL code:

```
1 SELECT
2   *
3   INTO
4     [outputblob]
5   FROM
6     [iotinput]
7   SELECT
8     system.Timestamp
9     AVG(temperature)
10
```

The 'Test results' tab is selected, showing a single row of data from the iotpowerbioutput:

windowEnd	datetime
2024-04-12T10:37:52.0000000Z	

At the bottom of the dialog is a 'Start' button.

Overview on stream job to start the job. Hit start. Always verify simulator is still running and sending in messages.

Power Bi work space, data set tab to review result. IOT data streaming set seen. Creating a new dash board next

The screenshot shows the Power BI workspace interface. On the left, there's a sidebar with Home, Create, Browse, OneLake data hub, Apps, Workspaces, and streaming workspace. The main area shows a 'streaming workspace' template workspace. It has a 'New' button, an 'Upload' button, a 'Create app' button, a 'Manage access' button, and a '...'. Below this is a table with columns: Name, Type, Owner, Refreshed, Next refresh, and Endorsement. There is one item listed: 'iotdataset' (Semantic model, streaming worksp..., Refreshed: 12/04/24, 11:43:02, Next refresh: N/A).

STREAMING SET DASH BOARD

The screenshot shows a Power BI dashboard titled "streamanalyticsdataset". It features two cards labeled "temperature" with the value "21". Below these is a line chart titled "temperature BY WINDOWEND" showing data from 12:14 to 12:16. The chart displays a fluctuating line with a green trend line. The left side of the dashboard has a sidebar with various icons for "Home", "Create", "Browse", "OneLake data hub", "Workspaces", "streaming workspace", "streamanalyticsdataset", and "Power BI". The taskbar at the bottom shows the date as 12/04/2024 and the weather as "Partly sunny" at 32°C.

Average out put data from IOT device over a period of two seconds achieved .Sum of average temperature by window end

The screenshot shows a Power BI report titled "streaming workspace" with a report name "SUM OF AVG_TEMPERATURE_BY_WINDOWEND". The main area displays a line chart with a large value "26.67" overlaid. Below the chart is a data grid showing the "Sum of Avg_Temperature" for various "windowEnd" times. The sidebar on the left includes "Home", "Create", "Browse", "streaming workspace", "Untitled report", and "streamanalyticsdataset". The right sidebar contains "Visualizations", "Filters", and a "Data" section with a "Value" dropdown set to "Sum of Avg_Temperature". The taskbar at the bottom shows the date as 12/04/2024 and the weather as "Partly sunny" at 34°C.

windowEnd	Sum of Avg_Temperature
04/12/24 03:09:12 PM	26.89
04/12/24 03:09:18 PM	26.15
04/12/24 03:09:24 PM	25.71
04/12/24 03:09:30 PM	25.81
04/12/24 03:09:36 PM	26.48
04/12/24 03:09:42 PM	28.25
04/12/24 03:09:48 PM	27.62
04/12/24 03:09:54 PM	26.42
04/12/24 03:10:00 PM	27.08
04/12/24 03:10:06 PM	26.54

Streaming data set added to dashboard, temperature field used to display live data using card and line chart date added and temperature used as value. Average output data analyzed

SECOND QUERY DEFINED

The screenshot shows the Microsoft Azure Stream Analytics job configuration interface. The left sidebar lists various job settings like Overview, Activity log, and Inputs. The main area displays the query definition:

```
8 | SELECT
9 |     DateAdd(second,-15, system.Timestamp)AS WindowStart,
10 |     system.Timestamp AS windowEnd,
11 |     AVG(temperature)AS Avg_Temperature
12 |     INTO
13 |     [iotpowerbioutput]
14 |     FROM
15 |     [iotinput]
16 |     GROUP BY
17 |     HoppingWindow(second,15,6);
```

The 'Test results' tab is selected, showing the following sample data:

WindowStart	windowEnd	Avg_Temperature
"2024-04-12T15:07:33.000000Z"	"2024-04-12T15:07:48.000000Z"	26.302254568134273
"2024-04-12T15:07:39.000000Z"	"2024-04-12T15:07:54.000000Z"	26.302254568134273

Query for hopping windows to select and transform data also outputting to power bi. Job stopped before adding query

Job started successfully, test results viewed.

The screenshot shows the Microsoft Azure Stream Analytics job configuration interface. The right side of the screen displays a success message: "Stream Analytics job started successfully Started Stream Analytics job 'streamanalyticjob2024' successfully." The query definition and test results are identical to the previous screenshot, indicating the job is running.

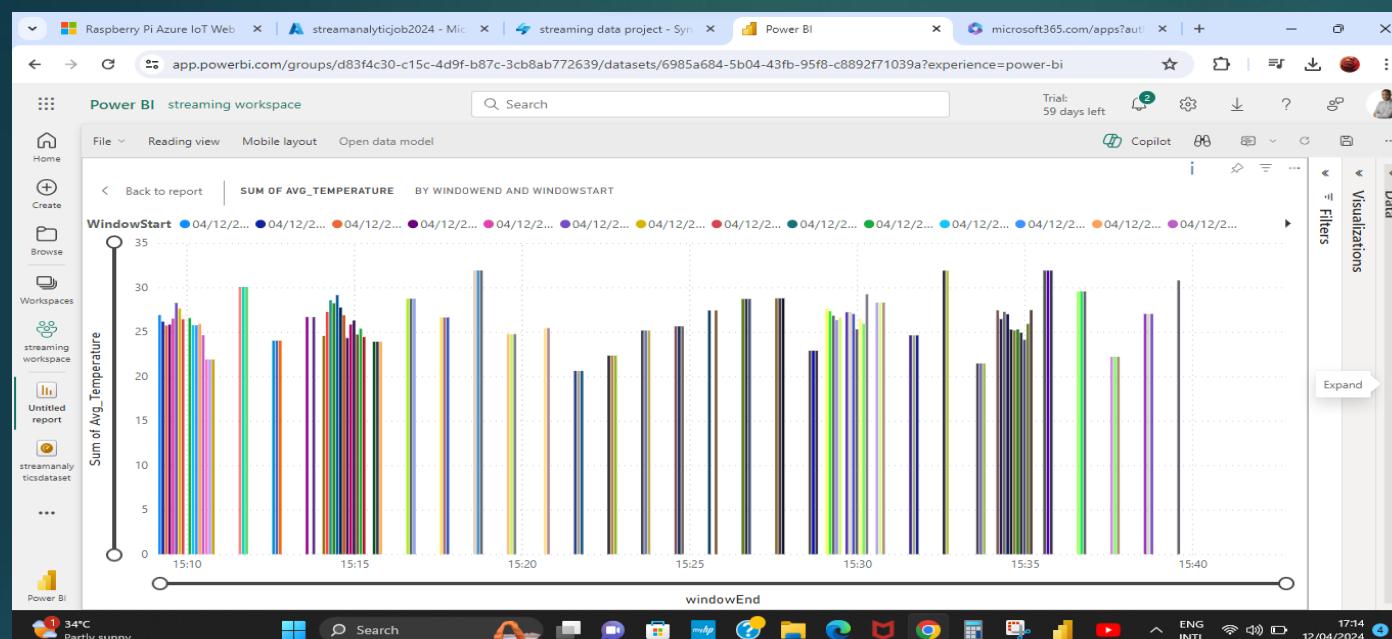
RESULTS ACQUIRED

The screenshot shows the Microsoft Azure Blob storage interface. The left sidebar displays navigation links such as Home, bloboutput (Container), Overview, Diagnose and solve problems, Access Control (IAM), Settings, Shared access tokens, Access policy, Properties, and Metadata. The main content area shows a table of blobs with columns: Name, Modified, Access tier, Archive status, Blob type, Size, and Lease state. There are five blobs listed, all of which are Block blob types with sizes ranging from 9.2 KiB to 14.47 KiB. The 'bloboutput' container has an 'Access key' authentication method and is located at bloboutput / 2024 / 04 / 12.

More files viewed
in Blob storage

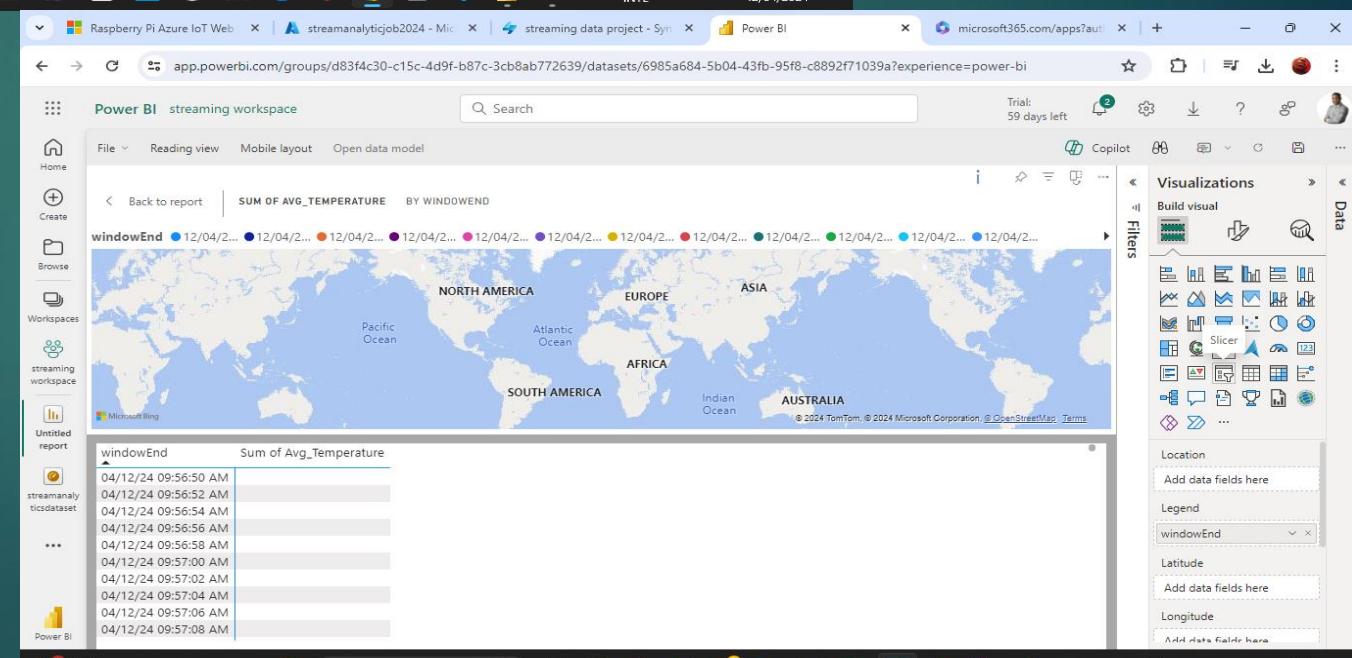
The screenshot shows a Power BI dashboard titled 'streamanalyticsdataset'. The left sidebar includes Home, Create, Browse, Workspaces, streaming workspace, streamanalyticsdataset, streamanalyticsdataset, and Power BI. The main area features a sunburst chart with the title 'total temperature over time'. The chart is divided into segments representing different time windows, with each segment labeled with its percentage value (e.g., 1 (0.3%)). A legend on the right side, titled 'windowEnd', lists various time points from April 12, 2024, at 09:56:50 AM to 09:57:20 AM. The Power BI ribbon at the bottom indicates a weather forecast of 34°C Mostly sunny.

MORE RESULTS OUTPUTS FROM POWER BI



The sum of average temperature by windowend and windowstart

Sum of average temperature by windowend



FINAL OUTPUT RESULT FROM POWER BI

SUM OF AVG_TEMPERATURE BY WINDOWEND AND WINDOWSTART

windowEnd	04/12/24 03:08:57 PM	04/12/24 03:09:03 PM	04/12/24 03:09:09 PM	04/12/24 03:09:15 PM	04/12/24 03:09:21 PM	04/12/24 03:09:27 PM	04/12/24 03:09:33 PM	04/12/24 03:09:39 PM
04/12/24 03:09:12 PM	26.89							
04/12/24 03:09:18 PM		26.15						
04/12/24 03:09:24 PM			25.71					
04/12/24 03:09:30 PM				25.81				
04/12/24 03:09:36 PM					26.48			
04/12/24 03:09:42 PM						28.25		
04/12/24 03:09:48 PM							27.62	
04/12/24 03:09:54 PM								
04/12/24 03:10:06 PM								
04/12/24 03:10:12 PM								

34°C Partly sunny Search ENG INTL 17:15 12/04/2024

Sum of average temperature by windowend and windowstart