Configure MQTT dataflow endpoints

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> **Important**
>
> This page includes instructions for managing Azure IoT Operations components using Kubernetes deployment manifests, which is in **preview**. This feature is provided with several limitations, and shouldn't be used for production workloads.
>
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MQTT dataflow endpoints are used for MQTT sources and destinations. You can configure the endpoint settings, Transport Layer Security (TLS), authentication, and other settings.

Prerequisites

- An instance of Azure IoT Operations

Azure IoT Operations local MQTT broker

Azure IoT Operations provides a built-in local MQTT broker that you can use with dataflows. You can use the MQTT broker as a source to receive messages from other systems or as a destination to send messages to other systems.

Default endpoint

When you deploy Azure IoT Operations, an MQTT broker dataflow endpoint named "default" is created with default settings. You can use this endpoint as a source or destination for dataflows.

> **Important**
>
> You must use the default endpoint, or one with the same settings, in every dataflow. It can be the source, the destination, or both. For more details, see Dataflows must use

local MQTT broker endpoint.

The default endpoint uses the following settings:

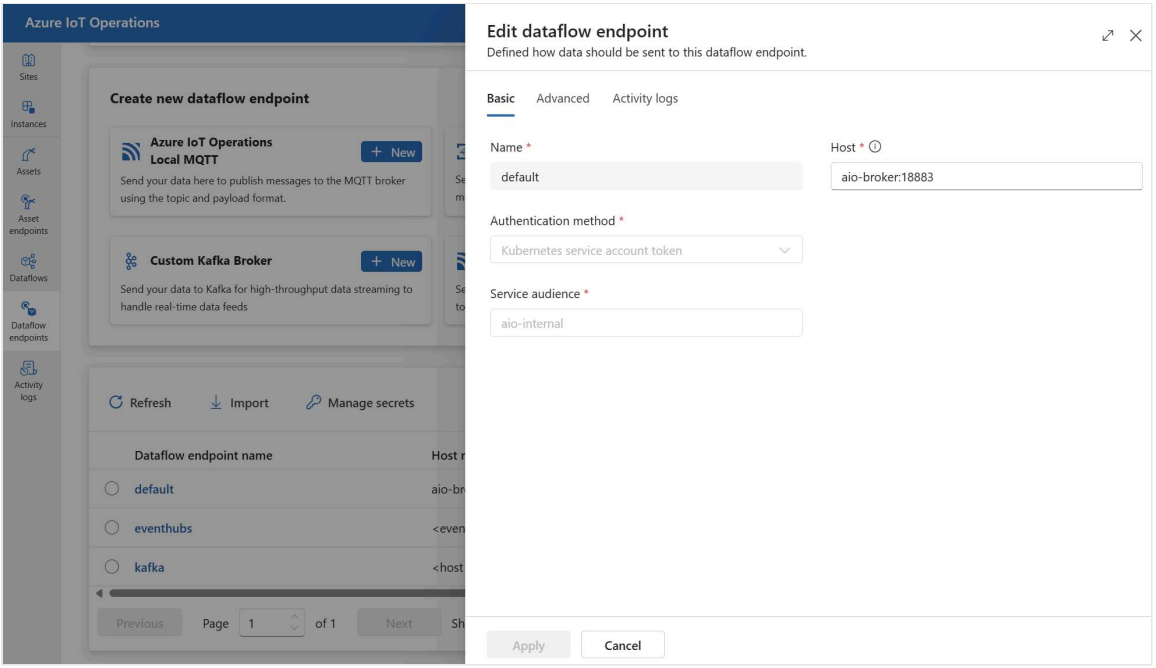
- Host: `aio-broker:18883` through the default MQTT broker listener
- Authentication: service account token (SAT) through the default BrokerAuthentication resource
- TLS: Enabled
- Trusted CA certificate: The default CA certificate `azure-iot-operations-aio-ca-trust-bundle` from the default root CA

> **⊗ Caution**
>
> Don't delete the default endpoint. If you delete the default endpoint, you must recreate it with the same settings.

To view or edit the default MQTT broker endpoint settings:

Portal

1. In the operations experience , select the **Dataflow endpoints**.
2. Select the **default** endpoint to view or edit the settings.

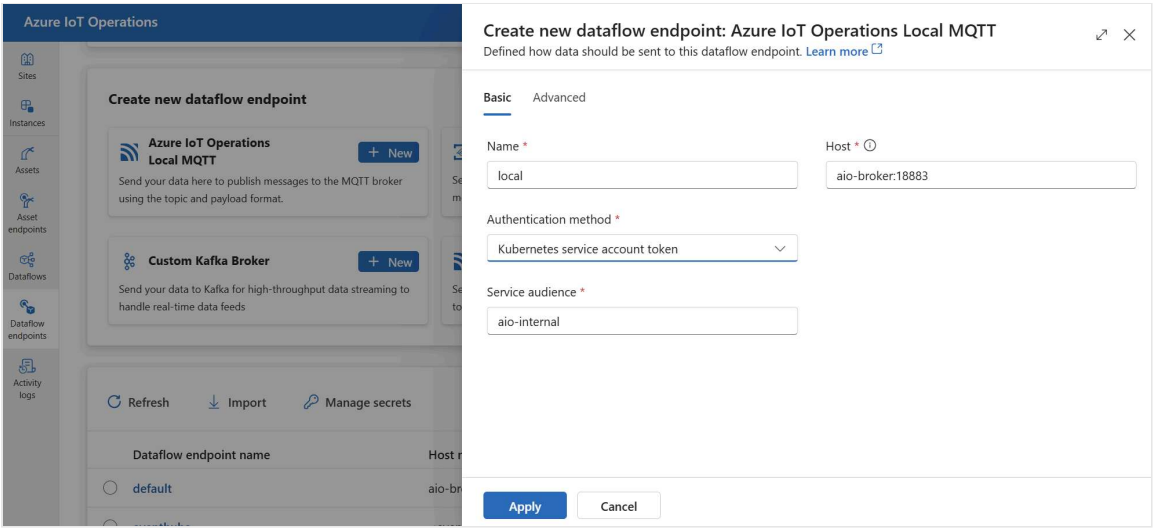


Create new endpoint

You can also create new local MQTT broker endpoints with custom settings. For example, you can create a new MQTT broker endpoint using a different port, authentication, or authorization settings. However, you must still always use the default endpoint as either the source or destination in every dataflow, even if you create new endpoints.

Portal

1. In the operations experience , select the **Dataflow endpoints**.
2. Under **Create new dataflow endpoint**, select **Azure IoT Operations Local MQTT** > **New**.



Enter the following settings for the endpoint:

Expand table

Setting	Description
Name	The name of the dataflow endpoint.
Host	The hostname and port of the MQTT broker. Use the format `<hostname>:<port>`
Authentication method	The method used for authentication. Choose *Service account token*, or *X509 certificate*
Service audience	The audience for the service account token. Required if using *Service account token*.
X509 client certificate	The X.509 client certificate used for authentication. Required if using *X509 certificate*.
X509 client key	The private key corresponding to the X.509 client certificate. Required if using *X509 certificate*.
X509 intermediate certificates	The intermediate certificates for the X.509 client certificate chain. Required if using *X509 certificate*.

Azure Event Grid

Azure Event Grid provides a fully managed MQTT broker that works with Azure IoT Operations dataflows. To configure an Azure Event Grid MQTT broker endpoint, we

recommend that you use managed identity for authentication.

Configure Event Grid namespace

If you haven't done so already, create Event Grid namespace first.

Enable MQTT

Once you have an Event Grid namespace, go to **Configuration** and check:

- **Enable MQTT**: Select the checkbox.
- **Maximum client sessions per authentication name**: Set to **3** or more.

The max client sessions option is important so that dataflows can scale up and still be able to connect. To learn more, see Event Grid MQTT multi-session support.

Create a topic space

In order for dataflows to send or receive messages to Event Grid MQTT broker, you need to create at least one topic space in the Event Grid namespace. You can create a topic space in the Event Grid namespace by selecting **Topic spaces** > **New topic space**.

To quickly get started and for testing, you can create a topic space with the wildcard topic `#` as the topic template.

Assign permission to managed identity

To configure a dataflow endpoint for Event Grid MQTT broker, we recommend using either a user-assigned or system-assigned managed identity. This approach is secure and eliminates the need for managing credentials manually.

After the topic space is created, you need to assign a role to the Azure IoT Operations managed identity that grants permission to send or receive messages to the Event Grid MQTT broker.

If using system-assigned managed identity, in Azure portal, go to your Azure IoT Operations instance and select **Overview**. Copy the name of the extension listed after **Azure IoT Operations Arc extension**. For example, *azure-iot-operations-xxxx7*. Your system-

assigned managed identity can be found using the same name of the Azure IoT Operations Arc extension.

Then, go to the Event Grid namespace > **Access control (IAM)** > **Add role assignment**.

1. On the **Role** tab select an appropriate role like `EventGrid TopicSpaces Publisher` or `EventGrid TopicSpaces Subscriber`. This gives the managed identity the necessary permissions to send or receive messages for all topic spaces in the namespace. To learn more, see Microsoft Entra JWT authentication and Azure RBAC authorization to publish or subscribe MQTT messages.
2. On the **Members** tab:
   a. If using system-assigned managed identity, for **Assign access to**, select **User, group, or service principal** option, then select **+ Select members** and search for the name of the Azure IoT Operations Arc extension.
   b. If using user-assigned managed identity, for **Assign access to**, select **Managed identity** option, then select **+ Select members** and search for your user-assigned managed identity set up for cloud connections.

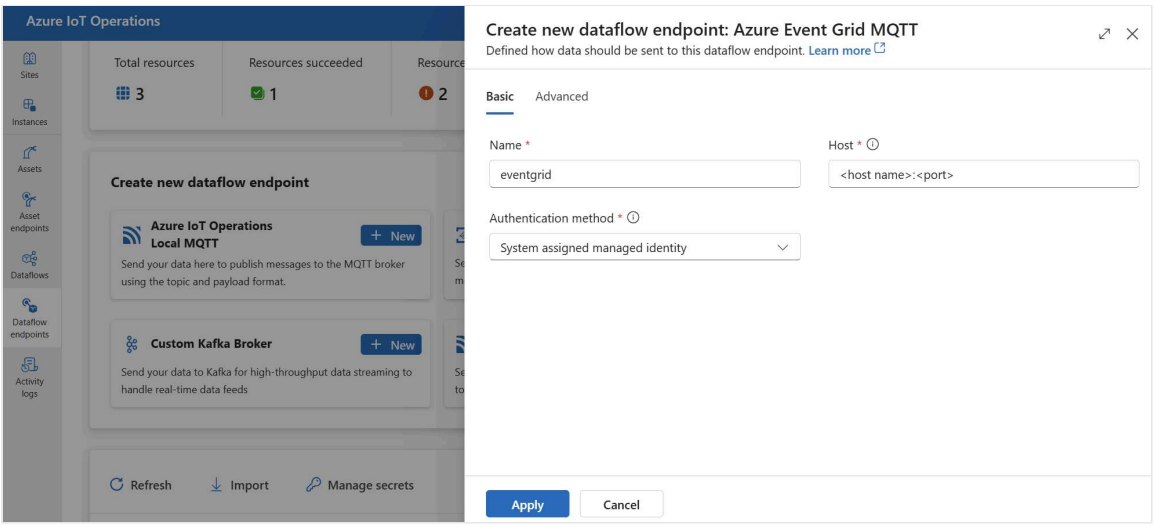
Alternatively, you can assign the role at the topic space level. Go to the topic space > **Access control (IAM)** > **Add role assignment**. Assign the managed identity with an appropriate role like `EventGrid TopicSpaces Publisher` or `EventGrid TopicSpaces Subscriber`. This gives the managed identity the necessary permissions to send or receive messages for the specific topic space.

Create dataflow endpoint for Event Grid MQTT broker

Once the Event Grid namespace is configured, you can create a dataflow endpoint for the Event Grid MQTT broker.

Portal

1. In the operations experience , select the **Dataflow endpoints** tab.
2. Under **Create new dataflow endpoint**, select **Azure Event Grid MQTT** > **New**.



Enter the following settings for the endpoint:

Expand table

Setting	Description
Name	The name of the dataflow endpoint.
Host	The hostname and port of the Event Grid MQTT broker. Use the format `<NAMESPACE>.<REGION>-1.ts.eventgrid.azure.net:8883`
Authentication method	The method used for authentication. We recommend that you choose *System assigned managed identity* or *User assigned managed identity*.

3. Select **Apply** to provision the endpoint.

Once the endpoint is created, you can use it in a dataflow to connect to the Event Grid MQTT broker as a source or destination. The MQTT topics are configured in the dataflow.

Use X.509 certificate authentication with Event Grid

When you use X.509 authentication with an Event Grid MQTT broker, go to the Event Grid namespace > **Configuration** and check these settings:

- **Enable MQTT**: Select the checkbox.
- **Enable alternative client authentication name sources**: Select the checkbox.
- **Certificate Subject Name**: Select this option in the dropdown list.
- **Maximum client sessions per authentication name**: Set to **3** or more.

The alternative client authentication and maximum client sessions options allow dataflows to use client certificate subject name for authentication instead of `MQTT CONNECT Username`. This capability is important so that dataflows can spawn multiple instances and still be able to connect. To learn more, see Event Grid MQTT client certificate authentication and Multi-session support.

Then, follow the steps in X.509 certificate to configure the endpoint with the X.509 certificate settings.

Event Grid shared subscription limitation

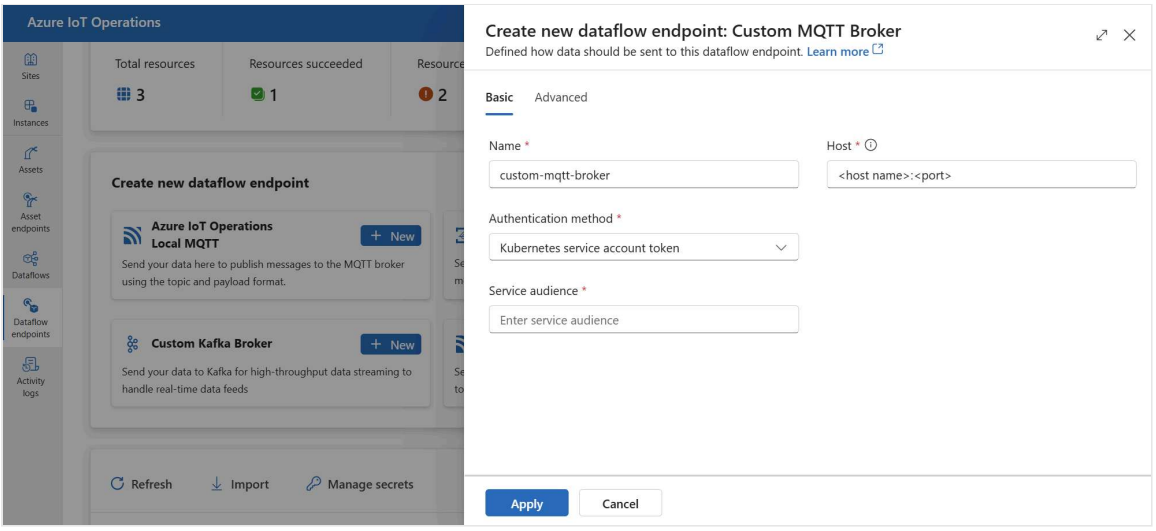
Azure Event Grid MQTT broker doesn't support shared subscriptions, which means that you can't set the `instanceCount` to more than `1` in the dataflow profile if Event Grid is used as a source (where the dataflow subscribes to messages) for a dataflow. In this case, if you set `instanceCount` greater than `1`, the dataflow fails to start.

Custom MQTT brokers

For other MQTT brokers, you can configure the endpoint, TLS, authentication, and other settings as needed.

Portal

1. In the operations experience , select the **Dataflow endpoints** tab.
2. Under **Create new dataflow endpoint**, select **Custom MQTT Broker** > **New**.



3. Enter the following settings for the endpoint:

Expand table

Setting	Description
Name	The name of the dataflow endpoint
Host	The hostname of the MQTT broker endpoint in the format `<hostname>.<port>`.
Authentication method	The method used for authentication. Choose *Service account token*, or *X509 certificate*.
Service audience	The audience for the service account token. Required if using *Service account token*.
X509 client certificate	The X.509 client certificate used for authentication. Required if using *X509 certificate*.
X509 client key	The private key corresponding to the X.509 client certificate. Required if using *X509 certificate*.
X509 intermediate certificates	The intermediate certificates for the X.509 client certificate chain. Required if using *X509 certificate*.

4. Select **Apply** to provision the endpoint.

To customize the MQTT endpoint settings, see the following sections for more information.

Available authentication methods

The following authentication methods are available for MQTT broker dataflow endpoints.

System-assigned managed identity

Before you configure the dataflow endpoint, assign a role to the Azure IoT Operations managed identity that grants permission to connect to the MQTT broker:

1. In Azure portal, go to your Azure IoT Operations instance and select **Overview**.
2. Copy the name of the extension listed after **Azure IoT Operations Arc extension**. For example, *azure-iot-operations-xxxx7*.

3. Go to the cloud resource you need to grant permissions. For example, go to the Event Grid namespace > **Access control (IAM)** > **Add role assignment**.
4. On the **Role** tab select an appropriate role.
5. On the **Members** tab, for **Assign access to**, select **User, group, or service principal** option, then select **+ Select members** and search for the Azure IoT Operations managed identity. For example, *azure-iot-operations-xxxx7*.

Then, configure the dataflow endpoint with system-assigned managed identity settings.

Portal

In the operations experience dataflow endpoint settings page, select the **Basic** tab then choose **Authentication method** > **System assigned managed identity**.

In most cases when using with Event Grid, you can leave the settings empty as shown. This sets the managed identity audience to the Event Grid common audience `https://eventgrid.azure.net`. If you need to set a different audience, you can specify it in the settings.

Portal

Not supported.

User-assigned managed identity

To use user-assigned managed identity for authentication, you must first deploy Azure IoT Operations with secure settings enabled. Then you need to set up a user-assigned managed identity for cloud connections. To learn more, see Enable secure settings in Azure IoT Operations deployment.

Before you configure the dataflow endpoint, assign a role to the user-assigned managed identity that grants permission to connect to the MQTT broker:

1. In Azure portal, go to the cloud resource you need to grant permissions. For example, go to the Event Grid namespace > **Access control (IAM)** > **Add role assignment**.
2. On the **Role** tab select an appropriate role.
3. On the **Members** tab, for **Assign access to**, select **Managed identity** option, then select **+ Select members** and search for your user-assigned managed identity.

Then, configure the dataflow endpoint with user-assigned managed identity settings.

Portal

In the operations experience dataflow endpoint settings page, select the **Basic** tab then choose **Authentication method** > **User assigned managed identity**.

Here, the scope is optional and defaults to `https://eventgrid.azure.net/.default` which works for all Azure Event Grid namespaces. If you need to set a different scope, you can specify it in the settings via Bicep or Kubernetes.

Kubernetes service account token (SAT)

To use Kubernetes service account token (SAT) for authentication, you don't need to create a secret. The SAT is used to authenticate with the MQTT broker by matching the audience.

Portal

In the operations experience dataflow endpoint settings page, select the **Basic** tab then choose **Authentication method** > **Service account token**.

Enter the service audience.

X.509 certificate

Many MQTT brokers, like Event Grid, support X.509 authentication. Dataflows can present a client X.509 certificate and negotiate the TLS communication.

The certificate and private key must be in PEM format and not password protected.

Tip

PEM format is a common format for certificates and keys. Certificates and keys in PEM format are base64-encoded ASCII files with a headers that look like `-----BEGIN CERTIFICATE-----` and `-----BEGIN EC PRIVATE KEY----`

If you have a certificate in another format, you can convert it to PEM format using OpenSSL. To learn more, see How to convert a certificate into the appropriate

format .

Before configuring the dataflow endpoint, create a secret with the certificate and private key.

- If you use the operations portal, the secret is automatically formatted and synced to the Kubernetes cluster.
- If you use Bicep or Kubernetes, manually create the secret with the certificate and private key in the same namespace as the MQTT dataflow endpoint.

  Bash

  ```
  kubectl create secret generic <X509_SECRET_NAME> -n azure-iot-operations --from-file=client_cert.pem=<CLIENT_CERT_FILE>.pem --from-file=client_key.pem=<PRIVATE_KEY_FILE>.pem --from-file=client_intermediate_certs.pem=<INTERMEDIATE_CERT_FILE>.pem
  ```

  Here, the secret must have `client_cert.pem` and `client_key.pem` as the key names for the certificate and private key. Optionally, the secret can also have `client_intermediate_certs.pem` as the key name for the intermediate certificates.

Portal

Important

To use the operations experience portal to manage secrets, Azure IoT Operations must first be enabled with secure settings by configuring an Azure Key Vault and enabling workload identities. To learn more, see Enable secure settings in Azure IoT Operations deployment.

Important

The operations experience portal currently has a known issue where creating a X.509 secret results in a secret with incorrectly encoded data. To learn more and the workaround, see known issues.

In the operations experience dataflow endpoint settings page, select the **Basic** tab then choose **Authentication method** > **X509 certificate**.

Here, under **Synced secret name**, enter a name for the secret. This name is used to reference the secret in the dataflow endpoint settings and is the name of the secret as stored in the Kubernetes cluster.

Then, under *X509 client certificate*, *X509 client key*, and *X509 intermediate certificates*, select **Add reference** to add the certificate, private key, and intermediate certificates. On the next page, select the secret from Azure Key Vault with **Add from Azure Key Vault** or **Create new** secret.

If you select **Create new**, enter the following settings:

Expand table

Setting	Description
Secret name	The name of the secret in Azure Key Vault. Pick a name that is easy to remember to select the secret later from the list.
Secret value	The certificate, private key, or intermediate certificates in PEM format.
Set activation date	If turned on, the date when the secret becomes active.
Set expiration date	If turned on, the date when the secret expires.

To learn more about secrets, see Create and manage secrets in Azure IoT Operations.

Anonymous

To use anonymous authentication, set the authentication method to `Anonymous`.

Portal

In the operations experience dataflow endpoint settings page, select the **Basic** tab then choose **Authentication method** > **None**.

Advanced settings

You can set advanced settings for the MQTT broker dataflow endpoint such as TLS, trusted CA certificate, MQTT messaging settings, and CloudEvents. You can set these settings in the dataflow endpoint **Advanced** portal tab, within the dataflow endpoint custom resource.

Portal

In the operations experience, select the **Advanced** tab for the dataflow endpoint.

TLS settings

TLS mode

To enable or disable TLS for the MQTT endpoint, update the `mode` setting in the TLS settings.

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the checkbox next to **TLS mode enabled**.

The TLS mode can be set to `Enabled` or `Disabled`. If the mode is set to `Enabled`, the dataflow uses a secure connection to the MQTT broker. If the mode is set to `Disabled`, the dataflow uses an insecure connection to the MQTT broker.

Trusted CA certificate

Configure the trusted CA certificate for the MQTT endpoint to establish a secure connection to the MQTT broker. This setting is important if the MQTT broker uses a self-signed certificate or a certificate signed by a custom CA that isn't trusted by default.

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the **Trusted CA certificate config map** field to specify the ConfigMap

containing the trusted CA certificate.

This ConfigMap should contain the CA certificate in PEM format. The ConfigMap must be in the same namespace as the MQTT dataflow resource. For example:

Bash

```
kubectl create configmap client-ca-configmap --from-file root_ca.crt -n azure-iot-operations
```

> **Tip**
>
> When connecting to Event Grid MQTT broker, the CA certificate isn't required because the Event Hubs service uses a certificate signed by a public CA that is trusted by default.

Client ID prefix

You can set a client ID prefix for the MQTT client. The client ID is generated by appending the dataflow instance name to the prefix.

> **Caution**
>
> Most applications should not modify the client ID prefix. Don't modify this after an initial IoT Operations deployment. Changing the client ID prefix after deployment might result in data loss.

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the **Client ID prefix** field to specify the prefix.

QoS

You can set the Quality of Service (QoS) level for the MQTT messages to either 1 or 0. The default is 1.

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the **Quality of service (QoS)** field to specify the QoS level.

Retain

Use the `retain` setting to specify whether the dataflow should keep the retain flag on MQTT messages. The default is `Keep`.

Setting this field to `Keep` is useful to ensure that the remote broker has the same messages retained as the local broker, which can be important for Unified Namespace (UNS) scenarios.

If set to `Never`, the retain flag is removed from the MQTT messages. This can be useful when you don't want the remote broker to retain any messages or if the remote broker doesn't support retain.

To configure retain settings:

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the **Retain** field to specify the retain setting.

The *retain* setting only takes effect if the dataflow uses MQTT endpoint as both source and destination. For example, in an MQTT bridge scenario.

> **Important**
>
> Azure Event Grid MQTT broker currently doesn't support the retain flag. This means if you set the retain flag to `Keep` for an Event Grid MQTT broker endpoint and it's being used as a destination, the messages are rejected. To avoid this, set the retain flag to `Never` when using Event Grid MQTT broker as a destination.

Session expiry

You can set the session expiry interval for the dataflow MQTT client. The session expiry interval is the maximum time that an MQTT session is maintained if the dataflow client disconnects. The default is 600 seconds. To configure the session expiry interval:

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the **Session expiry** field to specify the session expiry interval.

MQTT or WebSockets protocol

By default, WebSockets isn't enabled. To use MQTT over WebSockets, set the `protocol` field to `WebSockets`.

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the **Protocol** field to specify the protocol.

Max inflight messages

You can set the maximum number of inflight messages that the dataflow MQTT client can have. The default is 100.

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the **Maximum in-flight messages** field to specify the maximum number of inflight messages.

For subscribe when the MQTT endpoint is used as a source, this is the receive maximum. For publish when the MQTT endpoint is used as a destination, this is the maximum number of messages to send before waiting for an acknowledgment.

Keep alive

You can set the keep alive interval for the dataflow MQTT client. The keep alive interval is the maximum time that the dataflow client can be idle before sending a PINGREQ message to the broker. The default is 60 seconds.

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the **Keep alive** field to specify the keep alive interval.

CloudEvents

CloudEvents are a way to describe event data in a common way. The CloudEvents settings are used to send or receive messages in the CloudEvents format. You can use CloudEvents for event-driven architectures where different services need to communicate with each other in the same or different cloud providers.

The `cloudEventAttributes` options are `Propagate` or `CreateOrRemap`. To configure CloudEvents settings:

Portal

In the operations experience dataflow endpoint settings page, select the **Advanced** tab then use the **Cloud event attributes** field to specify the CloudEvents setting.

The following sections provide more information about the CloudEvents settings.

Propagate setting

CloudEvent properties are passed through for messages that contain the required properties. If the message doesn't contain the required properties, the message is passed through as is.

Expand table

Name	Required	Sample value	Output value
`specversion`	Yes	`1.0`	Passed through as is
`type`	Yes	`ms.aio.telemetry`	Passed through as is
`source`	Yes	`aio://mycluster/myoven`	Passed through as is
`id`	Yes	`A234-1234-1234`	Passed through as is
`subject`	No	`aio/myoven/telemetry/temperature`	Passed through as is
`time`	No	`2018-04-05T17:31:00Z`	Passed through as is. It's not restamped.
`datacontenttype`	No	`application/json`	Changed to the output data content type after the optional transform stage.
`dataschema`	No	`sr://fabrikam-schemas/123123123234234234234234#1.0.0`	If an output data transformation schema is given in the transformation configuration, `dataschema` is changed to the output schema.

CreateOrRemap setting

CloudEvent properties are passed through for messages that contain the required properties. If the message doesn't contain the required properties, the properties are generated.

Expand table

Name	Required	Generated value if missing
`specversion`	Yes	`1.0`
`type`	Yes	`ms.aio-dataflow.telemetry`
`source`	Yes	`aio://<target-name>`
`id`	Yes	Generated UUID in the target client

Name	Required	Generated value if missing
`subject`	No	The output topic where the message is sent
`time`	No	Generated as RFC 3339 in the target client
`datacontenttype`	No	Changed to the output data content type after the optional transform stage
`dataschema`	No	Schema defined in the schema registry

Next steps

To learn more about dataflows, see Create a dataflow.

ⓘ **Note:** The author created this article with assistance from AI. Learn more

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