Configure MQTT broker authorization

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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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Authorization policies determine what actions the clients can perform on the broker, such as connecting, publishing, or subscribing to topics. Configure MQTT broker to use one or multiple authorization policies with the *BrokerAuthorization* resource. Each *BrokerAuthorization* resource contains a list of rules that specify the principals and resources for the authorization policies.

Link BrokerAuthorization to BrokerListener

To link a *BrokerListener* to a *BrokerAuthorization* resource, specify the `authorizationRef` field in the `ports` setting of the *BrokerListener* resource. Similar to BrokerAuthentication, the *BrokerAuthorization* resource can be linked to multiple *BrokerListener* ports. The authorization policies apply to all linked listener ports. However, there's one key difference compared with BrokerAuthentication:

ⓘ **Important**

To have the *BrokerAuthorization* configuration apply to a listener port, at least one BrokerAuthentication must also be linked to that listener port.

To learn more about *BrokerListener*, see BrokerListener resource.

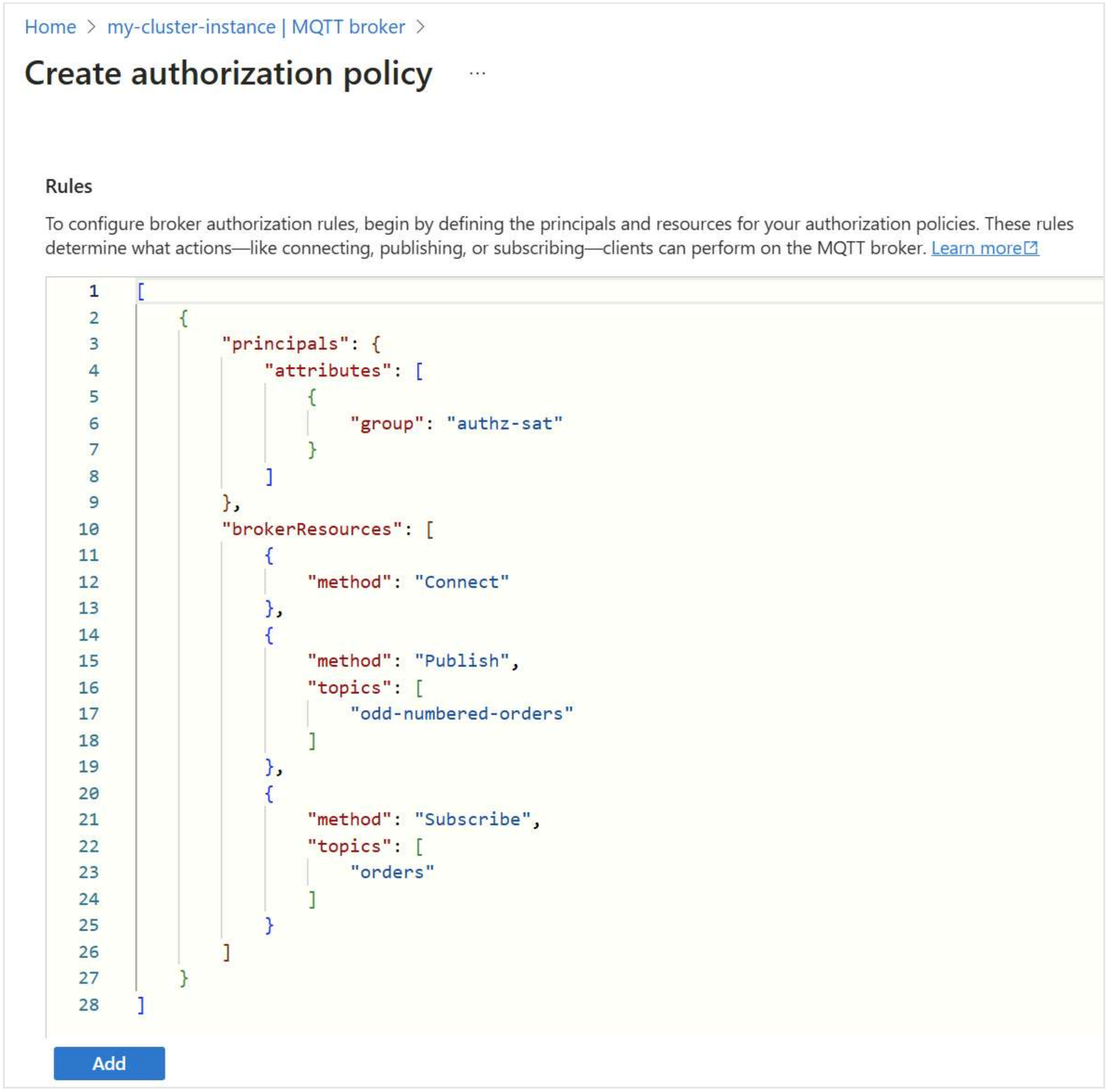
Authorization rules

To configure authorization, create a *BrokerAuthorization* resource in your Kubernetes cluster. The following sections provide examples of how to configure authorization for clients that use usernames, attributes, X.509 certificates, and Kubernetes Service Account Tokens (SATs). For a list of the available settings, see the Broker Authorization API reference.

The following example shows how to create a *BrokerAuthorization* resource using both usernames and attributes:

Portal

1. In the Azure portal, navigate to your IoT Operations instance.
2. Under **Components**, select **MQTT Broker**.
3. Select the **Authorization** tab.
4. Choose an existing authentication policy or create a new one by selecting **Create authorization policy**.


Home > my-cluster-instance | MQTT broker >
Create authorization policy ...

Rules

To configure broker authorization rules, begin by defining the principals and resources for your authorization policies. These rules determine what actions—like connecting, publishing, or subscribing—clients can perform on the MQTT broker. Learn more

```
[
    {
        "principals": {
            "attributes": [
                {
                    "group": "authz-sat"
                }
            ]
        },
        "brokerResources": [
            {
                "method": "Connect"
            },
            {
                "method": "Publish",
                "topics": [
                    "odd-numbered-orders"
                ]
            },
            {
                "method": "Subscribe",
                "topics": [
                    "orders"
                ]
            }
        ]
    }
]
```

This broker authorization allows clients with client IDs `temperature-sensor` or `humidity-sensor`, or clients with attributes `organization` with value `contoso` and `city` with value `seattle`, to:

- Connect to the broker.
- Publish messages to telemetry topics scoped with their client IDs and organization. For example:
  - `temperature-sensor` can publish to `/telemetry/temperature-sensor` and `/telemetry/contoso`.
  - `humidity-sensor` can publish to `/telemetry/humidity-sensor` and `/telemetry/contoso`.
  - `some-other-username` can publish to `/telemetry/contoso`.
- Subscribe to commands topics scoped with their organization. For example:

- `temperature-sensor` can subscribe to `/commands/contoso`.
- `some-other-username` can subscribe to `/commands/contoso`.

Using username for authorization

To use the MQTT username for authorization, specify them as an array under `principals.usernames`. However, depending on the authentication method, the username might not be verified:

- **Kubernetes SAT** - Username shouldn't be used for authorization because it's not verified for MQTTv5 with enhanced authentication.
- **X.509** - Username matches the CN from certificate and can be used for authorization rules.
- **Custom** - Username should only be used for authorization rules if custom authentication validates the username.

To prevent security issues, only use the MQTT username for broker authorization when it can be verified.

Further limit access based on client ID

Because the `principals` field is a logical OR, you can further restrict access based on client ID by adding the `clientIds` field to the `brokerResources` field. For example, to allow clients with client IDs that start with its building number to connect and publish telemetry to topics scoped with their building, use the following configuration:

Portal

In the broker authorization rules for your authorization policy, use the following configuration:

JSON

```json
[
  {
    "brokerResources": [
      {
        "clientIds": [
          "{principal.attributes.building}*"
        ],
        "method": "Connect",
          "topics": []
        },
        {
          "clientIds": [],
          "method": "Publish",
          "topics": [

  "sensors/{principal.attributes.building}/{principal.clientId}/telemetry"
          ]
        }
      ],
      "principals": {
        "attributes": [
          {
            "building": "building22"
          },
          {
            "building": "building23"
          }
        ]
      }
    }
  ]
```

Here, if the `clientIds` weren't set under the `Connect` method, a client with any client ID could connect as long as it had the `building` attribute set to `building22` or `building23`. By adding the `clientIds` field, only clients with client IDs that start with `building22` or `building23` can connect. This ensures not only that the client has the correct attribute but also that the client ID matches the expected pattern.

Authorize clients that use X.509 authentication

Clients that use X.509 certificates for authentication can be authorized to access resources based on X.509 properties present on their certificate or their issuing certificates up the chain.

Using attributes

To create rules based on properties from a client's certificate, its root CA, or intermediate CA, define the X.509 attributes in the *BrokerAuthorization* resource. For more information, see Certificate attributes.

With client certificate subject common name as username

To create authorization policies based on the *client* certificate subject common name (CN) only, create rules based on the CN.

For example, if a client has a certificate with subject `CN = smart-lock`, its username is `smart-lock`. From there, create authorization policies as normal.

Authorize clients that use Kubernetes Service Account Tokens

Authorization attributes for SATs are set as part of the Service Account annotations. For example, to add an authorization attribute named `group` with value `authz-sat`, run the command:

Bash

```bash
kubectl annotate serviceaccount mqtt-client aio-broker-auth/group=authz-sat
```

Attribute annotations must begin with `aio-broker-auth/` to distinguish them from other annotations.

As the application has an authorization attribute called `authz-sat`, there's no need to provide a `clientId` or `username`. The corresponding *BrokerAuthorization* resource uses this attribute as a principal, for example:

Portal

In the Broker authorization rules for your authorization policy, use the following configuration:

JSON

```json
[
  {
    "brokerResources": [
      {
        "clientIds": [],
        "method": "Connect",
        "topics": []
        },
        {
          "clientIds": [],
          "method": "Publish",
          "topics": [
            "odd-numbered-orders"
          ]
        },
        {
          "clientIds": [],
          "method": "Subscribe",
          "topics": [
            "orders"
          ]
        }
      ],
      "principals": {
        "attributes": [
          {
            "group": "authz-sat"
          }
        ]
      }
    }
  ]
```

To learn more with an example, see Set up Authorization Policy with Dapr Client.

State store

MQTT broker provides a state store that clients can use to store state. The state store can also be configured to be highly available.

To set up authorization for clients that use the state store, provide the following permissions:

- Permission to publish to the system key value store `$services/statestore/_any_/command/invoke/request` topic
- Permission to subscribe to the response-topic (set during initial publish as a parameter) `<response_topic>/#`

State store keys

The state store is accessed over the MQTT broker on topic `statestore/v1/FA9AE35F-2F64-47CD-9BFF-08E2B32A0FE8/command/invoke`. Since clients have access to the topic, you can specify keys and access levels under the `stateStoreResources` section of the MQTT broker `brokerResources` configuration.

The `stateStoreResources` section format consists of access level, a pattern indicator, and the pattern.

Portal

Include the `stateStoreResources` section in the rules for your authorization policy.

JSON

```
"stateStoreResources": [
  {
    "method": "", // Values: read, write, readwrite
    "keyType": "", //Values: string, pattern, binary. Default is pattern
    "keys": [
      // List of patterns to match
    ]
  },
]
```

The `method` field specifies the access level.

- Read access is specified with `read`, write access with `write`, and both with `readwrite`.
- Access level is required.
- Read access level implies the actions of `get` and `keynotify`.
- Write access level implies the actions of `set`, `del`, and `vdel`.

The `keyType` field specifies the type of key matching.

- `pattern` to use *glob* style pattern matching
- `string` to do exact match, for example when a key contains characters that might be otherwise matched as a pattern (`*`, `?`, `[0-9]`)
- `binary` to match a binary key

The `keys` field specifies the keys to match. The keys can be specified as *Glob* style patterns, token substitutions, or exact strings.

- *Glob* style examples:
  - `colors/*`: All keys under the "colors/" prefix
  - `number[0-9]`: Any key from "number0" to "number9"
  - `char?`: Any key with prefix "char" and a single digit suffix, like "charA"
  - `*`: Full access to all keys.
- State store keys also support token substitution when key type is `pattern` and curly braces are reserved for this purpose. Token substitution examples:
  - `clients/{principal.clientId}/*`
  - `usernames/{principal.username}/*`
  - `rooms/{principal.attributes.room}/*`

Here's an example of how you might author your state store resources:

Portal

In the Broker authorization rules for your authorization policy, add a similar configuration:

JSON

```json
[
  {
    "brokerResources": [
      {
        "clientIds": [
          "{principal.attributes.building}*"
        ],
        "method": "Connect"
      },
      {
        "method": "Publish",
        "topics": [

"sensors/{principal.attributes.building}/{principal.clientId}/telemetry/*"
        ]
      },
      {
        "method": "Subscribe",
        "topics": [
          "commands/{principal.attributes.organization}"
        ]
      }
    ],
    "principals": {
      "attributes": [
          {
            "building": "17",
            "organization": "contoso"
          }
        ],
        "usernames": [
          "temperature-sensor",
          "humidity-sensor"
        ]
      },
      "stateStoreResources": [
        {
          "method": "Read",
          "keyType": "Pattern",
          "keys": [
            "myreadkey",
            "myotherkey?",
            "mynumerickeysuffix[0-9]",
            "clients/{principal.clientId}/*"
          ]
        },
        {
          "method": "ReadWrite",
          "keyType": "Binary",
          "keys": [
            "xxxxxxxxxxxxxxxxxxxx"
          ]
        }
      ]
    }
  ]
```

Update authorization

Broker authorization resources can be updated at runtime without restart. All clients connected at the time of the update of policy are disconnected. Changing the policy type is also supported.

Bash

```bash
kubectl edit brokerauthorization my-authz-policies
```

Disable authorization

Portal

1. In the Azure portal, navigate to your IoT Operations instance.
2. Under **Components**, select **MQTT Broker**.
3. Select the broker listener you want to edit from the list.
4. On the port you want to disable authorization, select **None** in the authorization dropdown.

Unauthorized publish in MQTT 3.1.1

With MQTT 3.1.1, when a publish is denied, the client receives the PUBACK with no error because the protocol version doesn't support returning error code. MQTTv5 return PUBACK with reason code 135 (Not authorized) when publish is denied.

Related content

- About BrokerListener resource
- Configure authentication for a BrokerListener
- Tutorial: TLS, X.509 client authentication, and attribute-based access control (ABAC) authorization

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