

IoT Gateway for Kepware Edge

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Welcome to the IoT Gateway Help

This is the user documentation for Kepware IoT Gateway. This documentation is updated regularly to reflect the latest functionality and information.

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Overview

What is the IoT Gateway?
What can the plug-in do?
What other software is needed to run the IoT Gateway?
What is the data format?

Configuring Agents

How do I add an agent connection?
How do I add an IoT Gateway tag item?

Troubleshooting

How do I find and correct issues?
What messages does the IoT Gateway produce?

Help version 1.094

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Overview

The "Internet of Things" IoT Gateway is an optional feature that allows system and device tags to be published to third-party endpoints through industry standard IP based protocols. When the value for a configured tag changes or when a publish rate is met, an update is sent to the corresponding third-party endpoint with a configurable payload of tag ID, value, quality and timestamp in a standard JSON format. The IoT Gateway offers the following features:

- Ability to publish data consisting of a name, value, quality, and timestamp from any data source in the server (e.g. drivers, plug-ins, or system tags)
- Standard human readable JSON data format
- Support for publishing via MQTT
- Support for reading data from MQTT Client
- Configurable data collection rate, as frequent as 10 milliseconds up to once per 27.77 hours (99999990 milliseconds) for the MQTT Client
- Configurable data publish rate, as frequent as 10 milliseconds up to once per 27.77 hours (99999990 milliseconds) for the MQTT Client
- Support for authentication and TLS / SSL encryption
- Support for user-level access based on the User Manager and Security Policies Plug-In
- Configurable header and payload information for integration with different third-party endpoints

General Operation

This section explains how the components, server runtime,, work together to form the basis of the IoT Gateway. This also serves as an introduction to the terminology used in this document.

Initialization

An agent configuration is created using the Configuration API. Details of this are covered later in the document. There may be multiple agents configured in the same project or configuration. Each of these agents creates its own instance on the gateway.

Startup

Data Updates

Data updates are managed by the server runtime. The agent creates a server item reference from each configured tag and polls for data at the configured scan rate like any other client. Scan rates are configured on a per tag basis.

Each data update persisted to the agent consists of four elements: ID, value, quality, and timestamp.

All buffered data is sent with narrow format. The **Every Scan** feature sends an update to the gateway to be published to an endpoint for every good-quality scan of the tag whether or not there was a data change. A bad-quality scan will be sent only once. When the “every scan” option is set on a tag, the deadband setting for that tag is ignored. The “Wide format” option sends only the last data update for every tag enabled on that agent on each publish whether there was a data update or not. No buffered data is sent with the “Wide format” option.

Data Buffer

Each individual agent has a buffer of 100,000 events in case the third-party endpoint is unreachable. An event is a single value change of a single tag that is configured on that agent. The buffer stores the oldest 100,000 events; when full, it drops new data coming in. This buffer is entirely in memory and is not written to disk. There is no buffer enabled when using the “wide format”.

Configure the Gateway

The IoT Gateway administrative settings are automatically configured on installation. The `server_iotgateway` service is configured from the Settings sections of the Administration menu. Generally, these settings do not need to be adjusted once established for the IoT Gateway to function properly.

Port: specifies the TCP/IP port that the server runtime and configuration use to communicate with the gateway service. The valid range is 1024 to 65535. The **Default** button populates the field with the default port number of 57212, configured by the server.

Tips:

1. The default port is recommended unless there is a conflict with another application using that port.
2. Before changing the port setting, verify there is no conflict with the new port number.
3. The gateway service does not accept remote connections, so there should be no firewall implications associated with this port assignment.

In the MQTT Agent area:

Click on the **Manage Certificate...** button to configure security certificate use for the MQTT agent.

See Also:

[Importing a Client-Side Certificate for MQTT Client Agent](#)

[Importing a Server-Side Certificate for Authentication with Client Agents](#)

Importing a Server-Side Certificate for Authentication with Client Agents

The MQTT client agents will receive a server-side certificate from their intended targets when these agents are configured for secure connections (HTTPS or MQTT over TLS). For authentication to be successful, a user may need to make the server-side certificate's Certificate Authority Root Certificate accessible to the agents for use during connection negotiation. If the server certificate is self-signed, a user must make a copy the server's self-signed certificate accessible to the agents. The client agents use the Microsoft Windows, computer-level, trusted certificate store to keep track of these certificates. By using this store, most recognized certificate authorities are already approved. To import a certificate, use the below instructions.

Note: It is necessary to log in to the computer with an account that is part of the Local Administrators user group to add certificates to the appropriate Windows certificate store.

See Also: *Configuring a Gateway Certificate, Importing an MQTT Certificate*

Command Line Steps

1. From the **Start** menu, select **All Programs**.
2. Choose **Accessories** then right-click on **Command Prompt** and select **Run as Administrator** from the menu.
3. In the command prompt window, navigate to the location of the certificate.
4. Enter the command:

```
certutil -addstore "Root" <CertificateName>
```

 where the <CertificateName> is the name of the .cer or .crt file.
5. Press Enter to execute the command.
6. Verify the import is complete when several lines of output appear ending with:

```
CertUtil: -addstore command completed successfully.
```

Agent Properties – General

Identification

Name: Specify or alter name identifying this client or connection.

Description: Enter a string or phrase to identify this client or connection.

Type: Verify the agent type:

MQTT Client

Configuration

Enabled: Set **Yes** or **No** to make the selected connection active or inactive.

Ignore Quality Changes: Set this property to **Yes** to only receive changes in the tag value in the client. This can be helpful when constant communication with a device is an issue and quality changes are not desired.

Agent Properties – Message

To change the order of the default JSON data load or to remove data items, access the agent **Properties** and expand the **Message** group. Properties, such as Template, access an editing dialog where the format can be updated.

Template: identify any data to be sent before or after the JSON payload. This data is sent once per publish. Each variable may be preceded by any word or name, followed by a colon, then the variable. Key value pairs of static text may be included. To access the multi-line editor, click the text in Template field. Valid variables are:

- |SERVERTIMESTAMP| the time and date when the gateway published the data to the endpoint, in UNIX or POSIX time format
- |SERVERISO8601UTC| the date and time of the publish represented as a string in the ISO8601-1-2019 standard, for the UTC time zone
- |SERVERISO8601LOCAL| the date and time of the publish represented as a string in the ISO8601-1-2019 standard, for the server's LOCAL time zone
- |SERVERDATE| the same date and time as the timestamp, but in human-readable form
- |SERVERNAME| the hostname of the server
- |VALUES| the combined payload of the following box

Expansion of [VALUES]: the format for the JSON payload delivered to the endpoint. These values may be re-ordered or removed. A single publish event to the endpoint may include multiple instances of the data in this box. For example, if a tag had four data changes between publish events, there would be four complete JSON strings for that tag within this array. As with the Format box, each variable may be preceded by any desired word or descriptor. A colon is needed to separate the name from the variable. Valid variables are:

- |CHANNEL| The name of the channel without the fully qualified path
- |DEVICE| The name of the device without the fully qualified path
- |TAGNAME| The name of the selected tag
- |TAGVALUE| The value of the tag
- |TAGQUALITY| This denotes if the tag was read as good or bad
- |TAGTIMESTAMP| This is the time when the TAGVALUE was received
- |TAG| The name of the tag without the fully qualified path
- |TAGADDRESS|⁽¹⁾ The address of the tag
- |TAGDESCRIPTION|^(1,2) The description of the tag
- |TAGCLIENTACCESS|⁽¹⁾ This denotes if the tag can be written to or not
- |TAGISO8601UTC| This is the time when the TAGVALUE was received, represented as a string in the ISO8601-1-2019 standard, for the UTC time zone
- |TAGISO8601LOCAL| This is the time when the TAGVALUE was received, represented as a string in the ISO8601-1-2019 standard, for the server's LOCAL time zone

● **Note**⁽¹⁾: These macros are only updated in an agent on start-up (enable/disable cycle). Any changes to the underlying server tag properties are not passed through to the agents at runtime. To update these values, momentarily Disable then Enable the agent after server tag configuration changes have been made.

● **Note**⁽²⁾: The |DESCRIPTION|, |TAGDESCRIPTION|, |CHANNEL|, and |DEVICE| variables work for most drivers, but do not work with the tags under the Advanced Tags Plug-In.

● **See Also:** [Advanced Template](#), [Standard Template](#)

Agent Properties – Security for MQTT Agents

To configure or change MQTT agent authorization, access **Properties**, then specify **Security** to adjust the credentials as needed.

Client ID: Specify or confirm the unique identity for this agent's communication with the broker. Most brokers do not need a Client ID to connect.

Username: Enter the authorized user for authentication on the broker.

Password: Enter the password for basic authentication on the broker.

Notes:

- If not using an SSL encrypted connection, the username and password are sent as plain text to the broker. This is a limitation of the protocol.
- The connection publishes to the broker. To verify the broker is receiving, check the Event Log for errors.
- Connecting multiple MQTT Agents to a Broker using the same Client ID can introduce connectivity loss for one / many of the agents using the same Client ID.

TLS Version: Specify the Transport Layer Security (TLS) version to use when connecting securely. The choices are Default, v1.2, and v1.3. When Default is selected, the version of TLS that is used depends on the Java virtual machine that is being used. Users should choose the highest TLS version support by the MQTT Broker.

Client Certificate: Enable to support application-based authentication, also known as two-way authentication. The client certificate is configured in the IoT Gateway tab of the Server Administration.

See Also:

*Importing an MQTT Certificate, [Configuring a Self-Signed Certificate](#)
Consult the documentation for server, User Manager, and Security Policies Plug-in.*

Agent Properties – Last Will

Enable Last Will and Testament: Select Yes or No to enable a "last will" message. The default setting is No.

Topic: identifies the topic or path to serve as the last will and testament message.

Message: contains the text that subscribed clients will receive in the last will and testament message. This is typically an explanation of the ungraceful disconnect, such as "offline" or "unexpected exit" to help the client.

In addition to the Last Will message, the MQTT agent publishes a message to the Last Will topic if the first data publish succeeds and when the MQTT agent is shut down due to a project edit, server reinitialize, or server shutdown.

On first successful publish, the following text is published to the Last Will topic if the feature is enabled:

```
"Server is online."
```

On graceful shutdown, the following text is published to the Last Will topic if the feature is enabled:

```
"Server is shutting down."
```

Agent Properties – Subscriptions

The MQTT agent can be configured to subscribe to a topic on the broker, allowing other publishers to write to tags under that agent. When enabled, the agent listens to this topic with a QOS of 0 for properly formatted JSON to write to a tag.

Listen for Write Requests Select Yes or No to allow agent to subscribe. The default setting is No.

Topic: Specify the topic to which the agent should subscribe. The default topic is `iotgateway/write`.

Notes:

- The MQTT agent checks the topic specified for JSON data in the proper format. Once the agent parses the data, it attempts to write the value to the specified tag.
- Only tags that have been added to the MQTT agent may be written.

Write formatting

To perform a write to multiple tags, the data needs to be in the following format:

```
[{"id": "Channel1.Device1.Tag1", "v": 42}, {"id": "Channel1.Device1.Tag2", "v": 523}]
```

The example above shows a JSON array that should update both Tag1 and Tag2 when parsed by the MQTT agent.

A single write may be sent as a standalone JSON object or as an array of one object:

```
{"id": "Channel1.Device1.Tag1", "v": 42}
```

Using Mosquitto_sub.exe to update Tag1 from a DOS command line would look like:

```
mosquitto_pub.exe -t iotgateway/write -m "[{"id": \"Channel1.Device1.Tag1\", \"v\": 42}]"
```

The "Channel1.Device1.Tag1" should be replaced by the tag to be written and "42" by the value to be written.

Tip: Any failures to update a tag using this method are posted to the Event Log.

Note: The MQTT subscription option does not check for user authorization against the User Manager or Security Policies Plug-In. Any valid JSON published to the configured topic will be written to the server. Configure the MQTT broker to verify that appropriate authentication is used at that level.

Data

The IoT Gateway pushes data in a standard JSON format via the MQTT Clients. This format may then be consumed by the third-party endpoint and broken down in an appropriate way. All data types are fully supported by the IoT Gateway with the exception of String Arrays. Strings Arrays may only be read and not written to from the agents that support writes.

[Standard Template Data Format](#)

[Advanced Template Data Format](#)

[Adding Tags](#)

[CSV Import and Export](#)

[System Tags](#)

Standard Template Data Format

The standard template pushes data in a JSON format via the clients. The data structure for these agents looks like the following sample by default:

```
{ "timestamp": 1438011255230,
  "values":
  [
    { "id": "Channel1.Device1.Tag1", "v": 250, "q": true, "t": 1438011254668 }
  ]
}
```

The components used in the above sample are defined as follows:

- timestamp = The time, in milliseconds, that the data was published to the endpoint since the UNIX epoch
- id = The unique name of the tag
- v = The value of the tag
- q = True means good quality update, false means bad (i.e. lost communications to the underlying device or invalid configuration)
- t = The time the tag data was sampled in milliseconds since the UNIX epoch

The format of a 2 by 2 array is as follows:

```
{ "timestamp": 1438011255653,
  "values":
  [
    { "id": "Channel1.Device1.Tag1", "v": "[1,2][3,4]", "q": true, "t": 1438011254924 }
  ]
}
```

Note: When writing an array, all opening and closing brackets, as well as commas between the array elements, must be included. All values for an array must be written at one time. A missing value in the array prevents the entire array from being written.

For a Browse request, a JSON list of the IoT item names available with a “succeeded” and “reason” field is returned. The reason field remains empty if succeeded is true.

```
{ "browseResults":
  [
    { "id": "Channel1.Device1.Tag1" }
  ],
  "succeeded": true, "reason": ""
}
```

For a Read request, a JSON list of the IoT item names and values with an “s” for success and “r” for reason is returned, such as:

```
{ "readResults":
  [
```

```
{
  "id": "Channel1.Device1.Tag1", "s": true, "r": "",
  "v": 4878, "t": 1444307548259
}
]
```

For a Write request, a JSON list of the IoT items with an “s” for success and “r” for reason is returned, such as:

```
{
  "writeResults": [
    {
      "id": "Channel1.Device1.Tag1", "s": true, "r": ""
    }
  ]
}
```

• See Also: [Advanced Template](#)

Advanced Template Data Format

The IoT Gateway pushes data in a standard JSON format via the MQTT Clients. This format may then be consumed by the third-party endpoint and broken down in an appropriate way. The MQTT agent have the ability to use an advanced template for pushing data. This template engine uses a subset of Handlebars. The Advanced Template allows more complete control over the payload format. In addition to JSON, formats like XML and CSV can be generated using this template. The Advanced Template is a drop-down selection in the Message Format field.

Variables

Like the Standard Template, variables can be inserted into the template representing publish time and data changes. Top-level variables like SERVERDATE and SERVERTIMESTAMP can be inserted anywhere in the template.

SERVERNAME	Hostname of the server, allowing users to distinguish the source of data in complex multi-server environments
SERVERTIMESTAMP	Time of publish, represented as the number of milliseconds since January 1st, 1970, midnight
SERVERDATE	Date and time of publish as human-readable string
SERVERISO8601UTC	Date and time of the publish, represented as a string in the ISO8601-1-2019 standard, for the UTC time zone
SERVERISO8601LOCAL	Date and time of the publish, represented as a string in the ISO8601-1-2019 standard, for the server’s LOCAL time zone

The VALUES variable represents a list of every data change in the publish. Each data change contains variables for the tag name, value, quality, and timestamp.

CHANNEL ⁽²⁾	The name of the channel without the fully qualified path
DEVICE ⁽²⁾	The name of the device without the fully qualified path
TAGNAME	The name of the tag ('Channel.Device.Tag')
VALUE	The value of the tag
QUALITY	“true” if the tag was read successfully, “false” if the tag could not be read (e.g. a connection issue)
TIMESTAMP	The time at which the tag was read, represented as the number of milliseconds in UTC time since January 1st, 1970 , midnight
TAG	The name of the tag, without its fully qualified path ('Tag')
ADDRESS ⁽¹⁾	The address of the tag
DESCRIPTION ^(1,2)	The description of the tag
CLIENTACCESS ⁽¹⁾	This denotes if the tag can be written to or not
LINEFEED	This inserts a single 'line feed' (\n) and can be used to format messages that require this syntax over the default 'carriage return, line feed' (\r\n) that is inserted upon adding a new line in the property editor. This can be helpful when the mes-

	sage recipient expects a single line feed when processing the data
ISO8601UTC	The time when the TAGVALUE was received represented as a string in the ISO8601-1-2019 standard, for the UTC time zone
ISO8601LOCAL	The time when the TAGVALUE was received represented as a string in the ISO8601-1-2019 standard, for the server's LOCAL time zone

● **Note**⁽¹⁾: These macros are only updated in an agent on start-up (enable/disable cycle). Any changes to the underlying server tag properties are not passed through to the agents at runtime. To update these values, momentarily Disable then Enable the agent after server tag configuration changes have been made.

● **Note**⁽²⁾: The |DESCRIPTION|, |TAGDESCRIPTION|, |CHANNEL|, and |DEVICE| variables work for most drivers, but do not work with the tags under the Advanced Tags Plug-In.

Syntax

The 'each' keyword allows text to be generated for each item update. The template inside the 'each' block is evaluated once for every item update in the publish. Depending on the format, this can be used to make each update a JSON object or a CSV row for example.

```
|#each VALUES|
|TAGNAME|, |VALUE|, |QUALITY|, |TIMESTAMP|,
|/each|
```

In this example, each item update is formatted as line of comma-separated values, allowing import into a spreadsheet program or parsed by a CSV library:

```
Channel1.Device1.Tag1, 23, true, 1456150184825,
Channel1.Device2.Tag2, 1.79e308, true, 1456150184825,
...
```

Example Templates

Several example templates are provided for common scenarios.

If using a format other than JSON, be sure to set the Content-Type header in the Header tab. For XML data, 'Content-Type: text/xml' is suggested, while 'Content-Type: text/plain' is appropriate for CSV and most other formats.

XML Template

```
<updates>
|#each VALUES|
<update>
  <id>|TAGNAME|</id>
  <value>|VALUE|</value>
  <quality>|QUALITY|</quality>
  <timestamp>|TIMESTAMP|</timestamp>
</update>
|/each|
</updates>
```

XML Sample Output

```
<updates>
  <update>
    <id>Channel1.Device1.Tag1</id>
    <value>23</value>
    <quality>true</quality>
    <timestamp>1456150184825</timestamp>
  </update>
  <update>
    <id>Channel1.Device2.Tag2</id>
    <value>1.79e308</value>
    ...
  </update>
  ...
</updates>
```

CSV Template

```
|#each VALUES|
|TAGNAME|, |VALUE|, |QUALITY|, |TIMESTAMP|,
|/each|
```

CSV Sample Output

```
Channel1.Device1.Tag1, 23, true,
1456150184825,
Channel1.Device2.Tag2, 1.79e308, true,
1456150184825,
...
```

JSON, Wide Format

This template generates a flat JSON object with no hierarchy.

Template

```
{
|#each VALUES|
  "|TAGNAME|_value": |VALUE|,
  "|TAGNAME|_quality": |QUALITY|,
  "|TAGNAME|_timestamp": |TIMESTAMP|,
|/each|
}
```

Sample Output

```
{
  "Channel1.Device1.Tag1_value": 23,
  "Channel1.Device1.Tag1_quality": true,
  "Channel1.Device1.Tag1_timestamp":
1456150184825,
  "Channel1.Device2.Tag2_value": 1.79e308,
  "Channel1.Device2.Tag2_quality": true,
  ...
}
```

Additional Syntax

The default advanced template contains the following syntax:

```
|#unless @last|,|/unless|
```

This can be read as: “Unless this is the last item in the list, insert a comma.”

This effectively eliminates the trailing comma for the last item in a list. While this can be omitted in most cases, it is necessary if the consumer of the payload treats trailing commas as a syntax error.

Errors

If an invalid template is defined, an error message is posted to the Event Log. This message provides the line number and cause of the error. The agent stops publishing updates until a valid template is entered.

• **See Also:** [Standard Template](#)

Adding Tags to an Agent

Once an agent is configured, it's ready to add tags. Follow the instructions below to:

- [Add a Single Tag to a Publishing Agent](#)
- [Add Multiple Tags to a Publishing Agent](#)
- [Add a Single Tag to a Non-Publishing Agent](#)
- [Add Multiple Tags to a Non-Publishing Agent](#)

Add a Single Tag to a Publishing Agent

1. In the Project View, select the agent (MQTT Client) to add the tag.
2. Right-click the agent and select **New IoT Item** or click on the **New IoT Item** button in the tool bar.

Server Tag: Enter the full channel.device.name of the tag or browse to locate the single tag.

Scan Rate: the frequency, in milliseconds, at which the tag is checked for updates in value. The valid range is 10 - 99999990 ms. The default is 1000 ms.

Only on Data Changes: sets the agent to only publish data for this tag when the value changes.

Deadband (%): the percentage of value change that must be exceeded before a tag update is included for publication. The value should be a percent change in the full numeric range of the data type assigned to the tag. A deadband of 0 means all data changes are published.

In expression form, this **Deadband (%)** is defined by:

$$\text{Deadband (\%)} = 100 * (\text{ChangeThreshold}/\text{DataTypeFullRange})$$

For example, to obtain an absolute numeric threshold of value 0.1 to a Float data type (64-bit single precision floating point with a numeric range of 6.8e38), the **Deadband (%)** is calculated as:

$$\text{Deadband (\%)} = 100 * (0.1 / 6.8e38) = 1.4705882352941176470588235294118e-38$$

In this example, numerical value changes greater than 0.1 would be published. Any change equal to or less than 0.1 would not be published.

● **Note:** The current deadband implementation compares a new value with last published value, not last value sampled by the driver.

Every Scan: This forces the agent to publish data for this tag to the endpoint even if there was no change in the tag value.

● **Note:** Tags that have a quality of "Bad" send one update with that quality and then no updates are sent until the quality returns to good.

Enabled: allows or prevents data for this tag to be published. Tags that are not enabled still count against the license count.

3. Click **OK**.

Add Multiple Tags to a Publishing Agent

1. In the Project View, select the agent (MQTT Client) to which to add tags.
2. Right-click the agent and select **New IoT Items**. Alternatively, click on the **New IoT Items** button in the tool bar or click **Add IoT Items...** in the Detail View.
3. In the Tag Browser, select the tags to publish by this agent. These tags are only available on this particular agent; not on any others configured.
4. Once the tags are selected, click **Apply**.
5. In the IoT Items dialog, define the properties for the tags being added:

Scan Rate: the frequency, in milliseconds, at which the tag(s) is checked for updates in the value. The valid range is 10 - 99999990 ms. The default is 1000 ms.

Only on Data Changes: sets the agent to only publish data for this tag when the value changes.

Deadband (%) the percentage of value change that must be exceeded before a tag update is included for publication. The value expected in this field is a percent change in the full numeric range of the data type assigned to the tag. A deadband of 0 means all data changes are published.

In expression form, this **Deadband (%)** is defined by:

$$\text{Deadband (\%)} = 100 * (\text{ChangeThreshold}/\text{DataTypeFullRange})$$

For example, to obtain an absolute numeric threshold of value 0.1 to a Float data type (64-bit single precision floating point with a numeric range of 6.8e38), the **Deadband (%)** is calculated as:

$$\text{Deadband (\%)} = 100 * (0.1 / 6.8e38) = 1.4705882352941176470588235294118e-38$$

In this example, numerical value changes greater than 0.1 would be published. Any change equal to or less than 0.1 would not be published.

● **Note:** The current deadband implementation compares a new value with last published value, not last value sampled by the driver.

Every scan: forces the agent to publish data from this tag to the endpoint even if there was no change in the tag value.

Enabled: allows or prevents the tag(s) to be monitored, collected, and published. Tags are enabled by default.

● **Note:** Tags that are not enabled still consume a license count.

6. Once configured, click **OK**. Verify the tags are listed in the upper right pane of the configuration window and in the target agent or broker. (Consult the Event Log for errors if no data appears.)

● **Note:** Tags are configured to publish on only the agent where they are added. To publish the same tag to multiple end points, the tag must be added to each agent.

Add a Single Tag to a Non-Publishing Agent

1. In the Project View, select the agent to add the tag.
2. Right-click the agent and select **New IoT Item** or click on the **New IoT Item** button in the tool bar.

Server Tag: Enter the full channel.device.name of the tag or browse to locate the single tag.

Capture Options: Specify how this tag obtains updates for clients. Allows controlling communications to connected devices.

Scan Tag: Sets the agent to check for data updates at the scan rate interval. The response to a read request for the tag contains the cached value, quality, and timestamp from the last scanned update.

Rate (ms): The frequency, in milliseconds, at which the tag is checked for updates in value. The valid range is 10 - 99999990 ms. The default is 1000 ms.

Explicit Read: This option does not poll for data updates. Client read requests cause an asynchronous read to provide the latest data to the Client.

Enabled: Allows or prevents scanning for data updates and issuing explicit read requests. Tags that are not enabled still count against the license count.

● **Notes:**

1. Depending on the configured scan rate, rate of change of the value, and the read rate, the response that the Client receives could contain stale data. To prevent this, the scan rate should be faster than the item's expected rate of change and the Client read rate should be faster than this scan rate.
 2. Using the explicit read, users can tailor the bandwidth requirements of the server to suit the needs of the application. If, for example, the client is aware of when a data change should have occurred, there is no reason to regularly read the value. However, the Client read response time may increase compared to the response time of reading the scanned cached data.
3. Click **OK**.

Add Multiple Tags to a Non-Publishing Agent

1. In the Project View, select the agent to which to add tags.
2. Right-click the agent and select **New IoT Items**. Alternatively, click on the **New IoT Items** button in the tool bar or click **Add IoT Items...** in the Detail View.
3. In the Tag Browser, select the tags to publish by this agent. These tags are only available on this particular agent; not on any others configured.
4. Once the tags are selected, click **Apply**.

5. In the IoT Items dialog, define the properties for the tags being added:

Capture Options: Specify how this tag obtains updates for clients. Allows controlling communications to connected devices.

Scan Tag: Sets the agent to check for data updates at the scan rate interval. The response to a Client read request for the tag contains the cached value, quality, and timestamp from the last scanned update.

Rate (ms): The frequency, in milliseconds, at which the tag is checked for updates in value. The valid range is 10 - 99999990 ms. The default is 1000 ms.

Explicit Read: This option does not poll for data updates. Client read requests cause an asynchronous read to provide the latest data to the Client.

Enabled: Allows or prevents scanning for data updates and issuing explicit read requests. Tags that are not enabled still count against the license count.

● **Notes:**

1. Depending on the configured scan rate, rate of change of the value, and the Client read rate, the response that the Client receives could contain stale data. To prevent this, the scan rate should be faster than the item's expected rate of change and the Client read rate should be faster than this scan rate.
 2. Using the explicit read, users can tailor the bandwidth requirements of the server to suit the needs of the application. If, for example, the client is aware of when a data change should have occurred, there is no reason to regularly read the value. However, the Client read response time may increase compared to the response time of reading the scanned cached data.
6. Once configured, click **OK**. Verify the tags are listed in the upper right pane of the configuration window and in the target agent or broker. (Consult the Event Log for errors if no data appears.)

System Tags

The IoT Gateway exposes some status information through IoT Gateway system tags. These tags update at a five-second interval. They may be reset to zero by writing any value to them. When configured as a tag under an IoT Gateway agent, system tags count against the overall licensed number of tags.

Tag	Description
_DroppedEvents	The number of tag updates that were not successfully published due to the agent buffer being full. This can occur if the configured endpoint is not up or responding
_PublishesSent	The total number of data push events an agent has successfully made on an endpoint. Each successful publish may encompass a single or many tag updates

Importing / Exporting CSV Files

Configuring tags for each agent may be done through the import of a comma delineated file. This is done on a per agent basis. Exporting the list of tags of an already configured agent may also be done this way. To import or export a list of tags, right click on the agent and select either "Import CSV..." or "Export CSV...". Selecting "Export CSV..." will bring up a dialog box asking what to name and where to save the CSV file. Once saved, edit the CSV file as desired. This file may then be re-imported to this agent or any agent as long as the formatting is maintained. To start with an appropriately formatted file, it is recommended that a single tag is added to an agent. Once added export the CSV file for that agent for use as a template. This provides the format for any added tags.

● **Note:** Importing a CSV file replaces existing tags of the same name under an agent. New tags are added to the agent without affecting existing tags.

Troubleshooting

Event Log

The Event log provides information pertaining to each agent connection and the status of the gateway service.

• Please refer to it and the [message list](#) to resolve issues.

Data Loss

While rare under normal circumstances, errors reported in the event log can indicate dropped data. This can be due to one of the following conditions:

- Continuous incoming data rate is too fast (>100,000 updated tags per second).
- Unable to communicate with the third-party endpoint and the gateway buffer is full.

The gateway buffer is configured on a per-agent basis. Once the buffer maximum has been reached, the gateway drops new data coming in to the gateway for that agent. Older data is retained in the buffer until it may be pushed to the third-party endpoint.

• **Note:** If there are any tags in an agent's buffer when a change is made to its configuration, the tags are lost.

• **See Also:**
[Event Log Messages](#)

Event Log Messages

The following messages may be generated. Click on the link for a description of the message.

[Browse rejected: no user credentials were provided in the request and anonymous requests are currently disabled.](#)

[Browse rejected: the credentials for user <user> are invalid.](#)

[Connection restored to server: <gateway>. Reinitializing server configuration.](#)

[Data change event buffer overrun; dropping updates. Ensure that the IoT Gateway service is running or reduce the volume of data collected.](#)

[Error adding item <tag>. This item already exists in connection <agent name>.](#)

[Error adding item <tag> to connection <agent name>.](#)

[Error importing CSV data. Invalid CSV header.](#)

[Error importing CSV data. No item records found in CSV file.](#)

[Error importing CSV item record <tag>. Update rate <update rate> is out of range, setting to <valid update>.](#)

[Error importing CSV item record <tag>. No update rate found, setting to <update rate>.](#)

[Error importing CSV item record <tag>. Deadband <deadband rate> is invalid. Deadband set to <valid deadband>.](#)

[Error importing CSV item record <tag>. No deadband value found, setting to <valid deadband>.](#)

[Failed to connect to server: <gateway>. Please verify this connection information is correct and that the host can be reached.](#)

[Failed to connect to server: <URL and port>. Please verify this connection information is correct and that the host can be reached.](#)

[Failed to import MQTT client certificate: <certificate path>. Use the Server Administration utility to import a valid certificate.](#)

[Failed to import server instance cert: <agent name>. Please use the Administration utility to re-issue the certificate.](#)

[Failed to initialize the IoT Gateway.](#)

[Failed to load agent <agent name>: invalid payload specification.](#)

[Failed to load project: <agent URL> is not a valid address.](#)

[Failed to load XML project. Item <tag> already exists in connection <agent name>.](#)

[Failed to start IoT Gateway service.](#)

[IoT Gateway failed to start. Failed to bind to port <port>.](#)

[IoT Gateway using JRE at <path to JRE>.](#)

[Item <tag> on connection <agent name> is now licensed and sending data.](#)

[Missing server instance certificate <certificate path>. Re-issue the certificate using the Administration utility.](#)

[Missing MQTT client certificate <certificate path>. Use the Administration utility to import a valid certificate.](#)

[MQTT agent <agent name> disconnected. Reason - Connection lost.](#)

[MQTT agent <agent name> disconnected. Reason - null.](#)

[MQTT agent <agent name> published events buffer is full. Dropping new data change events.](#)

[MQTT agent MqttException <agent name> failed to connect. Reason - <reason>.](#)

[MQTT agent MqttSecurityException <agent name> failed to connect. Reason - <reason>.](#)

[MQTT agent <agent name> failed to connect. Reason - Unable to find valid certificate path to requested target.](#)

[MQTT agent <agent name> failed to parse payload.](#)

[MQTT agent <agent name> failed to parse payload template.](#)

[MQTT agent <agent name> failed to publish. Reason - <Broker URL>.](#)

[MQTT agent <agent name> failed to publish. Reason - Connection reset.](#)

[MQTT agent <agent name> failed to publish. Reason - The template is invalid.](#)

[MQTT agent <agent name> failed to publish. Reason - Unable to connect to server.](#)

MQTT agent <agent name> failed to process write request on topic <MQTT topic>. Reason - <JSON error>.
MQTT agent <agent name> is connected to broker <broker URL>.
MQTT agent <agent name> publish failed. Reason: <reason>.
MQTT client certificate is expired. Use the Administration utility to import a valid certificate.
Read rejected for item <tag>: no user credentials were provided in the request and anonymous requests are currently disabled.
Read rejected for item <tag>: the credentials for user <user> are invalid.
Read rejected for item <tag>. The tag is disabled.
Read rejected for item <tag>. The tag has not been added to the plug-in.
Template error on line <number>: found: <string>.
Unable to send data for item <tag> on connection <agent name>. The licensed item count of <license count> items has been reached.
Write request failed on item <tag>. The write data type <data type> cannot be converted to the tag data type <data type>.
Write rejected for item <tag>. Invalid write format.
Write rejected for item <tag>. No user credentials were provided in the request and anonymous requests are currently disabled.
Write rejected for item <tag>; unsupported data type <type>.
Write rejected for item <tag>. The credentials for user <user> are invalid.
Write rejected for item <tag>. The tag is disabled.
Write rejected for item <tag>. The tag has not been added to the plug-in.

Browse rejected: the credentials for user <user> are invalid.

Message Type:

Security

Possible Cause:

1. The credentials sent with the request are invalid or do not have browse permissions.
2. Anonymous access is disabled, but invalid credentials were sent with the request.

Solution:

Verify the username and password are correct and have adequate rights before trying the request again.

Connection restored to server: <gateway>. Reinitializing server configuration.

Message Type:

Informational

Possible Cause:

This message is logged when the plug-in reconnects to the gateway service, such as when the runtime is re-initialized.

Data change event buffer overrun; dropping updates. Ensure that the gateway service is running or reduce the volume of data collected.

Message Type:

Warning

Possible Cause:

The plug-in is unable to communicate with the gateway service and has started to lose data.

Solution:

1. Verify the gateway service is running.
2. Verify the gateway is not disabled in the Windows Services.
3. Verify the configured gateway port is not in use by another service.

Error adding item <tag> to connection <agent name>.

Message Type:

Error

Possible Cause:

The tag or tag name is invalid.

Solution:

1. Correct the name of the item or tag for which data is desired and re-try the request.
2. Create a new tag with the same address and a different name.

Error adding item <tag>. This item already exists in connection <agent name>.

Message Type:

Error

Possible Cause:

A tag with this name already exists under this agent.

Solution:

1. Verify the name of the item or tag for which data is desired and correct the request.
2. Create a new tag with the same address, but a different name, to import it under the same agent.

Error importing CSV data. Invalid CSV header.

Message Type:

Error

Possible Cause:

The header information or format in the CSV file import is missing data or is invalid.

Solution:

1. Export a new CSV file from an existing agent and use that as a template.
2. Correct the header information or format according to the instructions on headers.

See Also:

[Importing / Exporting CSV Files](#)

Error importing CSV data. No item records found in CSV file.

Message Type:

Error

Possible Cause:

The CSV file was not a valid format or contained no data.

Solution:

1. Export a new CSV file from an existing agent and use that as a template.
2. Correct the information or format of the CSV file.

See Also:

[Importing / Exporting CSV Files](#)

Error importing CSV item record <tag>. Update rate <update rate> is out of range, setting to <valid update>.

Message Type:

Warning

Possible Cause:

Tags in the import file included invalid update rate information.

Solution:

Verify all fields have valid data in the CSV files.

See Also:

[Importing / Exporting CSV Files](#)

Error importing CSV item record <tag>. No update rate found, setting to <update rate>.

Message Type:

Warning

Possible Cause:

Tags in the import file are missing the update rate information.

Solution:

Verify all fields have valid data in the CSV files.

See Also:

[Importing / Exporting CSV Files](#)

Error importing CSV item record <tag>. Deadband <deadband rate> is invalid. Deadband set to <valid deadband>.

Message Type:

Warning

Possible Cause:

Tags in the import file include invalid deadband information.

Solution:

Verify all fields have valid data in the CSV files.

See Also:

[Importing / Exporting CSV Files](#)

Error importing CSV item record <tag>. No deadband value found, setting to <valid deadband>.

Message Type:

Warning

Possible Cause:

Tags in the import file are missing deadband information.

Solution:

Verify all fields have valid data in the CSV files.

See Also:

[Importing / Exporting CSV Files](#)

Failed to connect to server: <gateway>. Please verify this connection information is correct and that the host can be reached.

Message Type:

Error

Possible Cause:

The server cannot communicate with the gateway service.

Solution:

1. Verify the gateway service is running.
2. Verify the configured gateway port is not in use by another service.

Failed to connect to server: <URL and port>. Please verify this connection information is correct and that the host can be reached.

Message Type:

Error

Possible Cause:

The port configured for communications between the plug-in and gateway is in use by another process.

Solution:

Change the connection port in **Administration | Settings | IoT Gateway** tab.

Failed to import MQTT client certificate: <certificate path>. Use the Server Administration utility to import a valid certificate.

Message Type:

Security

Possible Cause:

The MQTT agent SSL certificate is missing or invalid.

Solution:

Re-issue the certificate through **Administration | Settings | IoT Gateway | Manage MQTT Certificates**.

Failed to import server instance cert: <agent name>. Please use the Administration utility to re-issue the certificate.

Message Type:

Security

Possible Cause:

The server SSL certificate could not be imported.

Solution:

Re-issue the certificate through **Administration | Settings | IoT Gateway | Manage Certificates**.

Failed to initialize the IoT Gateway.

Message Type:

Error

Possible Cause:

The IoT Gateway is unable to start.

Solution:

Re-run the installation and choose to repair the setup.

Failed to load agent <agent name>: invalid payload specification.

Message Type:

Error

Possible Cause:

1. The JSON payload contains invalid or disallowed content.
2. Invalid advanced template settings during an XML project import.

Solution:

1. Adjust the payload section of the XML to be a valid data section with correct name-value pairs.
2. Correct the template and re-import the XML project file.

Failed to load project: <agent URL> is not a valid address.

Message Type:

Error

Possible Cause:

The agent specified has an invalid URL format.

Solution:

Correct the URL to a valid format and try importing the file again.

Failed to load XML project. Item <tag> already exists in connection <agent name>.

Message Type:

Warning

Possible Cause:

There is a duplicate tag under an agent in the XML project.

Solution:

Remove or correct the duplicate tag in the XML before attempting to import again.

Failed to start IoT Gateway service.

Message Type:

Error

Possible Cause:The gateway service is set to **Manual**.**Solution:**

1. Under Windows Services, verify that the IoT Gateway service is set to **Manual**.

IoT Gateway using JRE at <path to JRE>.

Message Type:

Informational

Possible Cause:

This message appears when the gateway starts, indicating the JRE being used.

IoT Gateway failed to start. Failed to bind to port <port>.

Message Type:

Error

Possible Cause:

The gateway service was unable to use the port assigned in the Administration tool.

Solution:

Change the port in **Administration | Settings | IoT Gateway** tab to an available unused port.

Item <tag> on connection <agent name> is now licensed and sending data.

Message Type:

Informational

Possible Cause:

The referenced tag was disabled due to license limitation, but is now sending data.

Missing MQTT client certificate <certificate path>. Use the Administration utility to import a valid certificate.

Message Type:

Security

Possible Cause:

The MQTT agent SSL certificate is missing or invalid.

Solution:

Re-issue the certificate through **Administration | Settings | IoT Gateway | Manage MQTT Certificates**.

Missing server instance certificate <certificate path>. Re-issue the certificate using the Administration utility.

Message Type:

Security

Possible Cause:

The server SSL certificate is missing or invalid.

Solution:

Re-issue the certificate through **Administration | Settings | IoT Gateway | Manage Certificates**.

MQTT agent <agent name> disconnected. Reason - Connection lost.

Message Type:

Error

Possible Cause:

The broker is unreachable.

Solution:

1. Verify that the broker is online and the network connection is functioning properly.
2. Check the configured URL for the agent and verify a properly configured broker exists at that address.
3. Verify that communication is not being blocked by a hardware or software firewall or filter.

MQTT agent <agent name> disconnected. Reason - null.

Message Type:

Error

Possible Cause:

There are two clients with the same Client ID connected to the broker.

Solution:

Change the Client ID on one of the clients so they are all unique.

MQTT agent <agent name> published events buffer is full. Dropping new data change events.

Message Type:

Warning

Possible Cause:

1. The broker is unreachable.
2. The rate data is published to the gateway exceeds the rate the gateway can send data to the Broker causing the internal Published Events data buffer to overflow.

Solution:

1. Verify that the broker is online and the network connection is functioning properly.
2. Check the configured URL for the agent and verify a properly configured broker exists at that address.
3. Verify that communication is not being blocked by a hardware or software firewall or filter.
4. Configuration tuning to avoid **data buffer** overflow by increasing the **Max Events per Publish** and/or decreasing the **Rate** at which the agent pushes data to the endpoint.

MQTT agent MqttException <agent name> failed to connect. Reason - <Reason>.

Message Type:

Error

Possible Cause:

The MQTT agent cannot connect to the broker.

● **Note:** If the server has connected to the broker successfully in the past, this is likely a network issue.

Possible Solution:

1. Check network connectivity.
2. Verify the connection settings are correct.

See Also:

Configure Gateway Certificate

[Configuring a Self-Signed Certificate](#)

Importing an MQTT Client Certificate

MQTT agent MqttSecurityException <agent name> failed to connect. Reason - <Reason>.

Message Type:

Error

Possible Cause:

The MQTT agent cannot connect to the broker.

🔍 **Note:** If the server has connected to the broker successfully in the past, this is likely a network issue.

Possible Solution:

1. Check network connectivity.
2. Verify the connection settings are correct.

🔍 See Also:

Configure Gateway Certificate
[Configuring a Self-Signed Certificate](#)
Importing an MQTT Client Certificate

MQTT agent <agent name> failed to connect. Reason - Unable to find valid certificate path to requested target.

Message Type:

Error

Possible Cause:

The MQTT agent and broker SSL configurations are not compatible.

Possible Solution:

1. Configure the broker endpoint with 'ssl' when SSL is required. Otherwise, use tcp.
2. Verify the client certificate is properly configured, and the MQTT agent is configured to use the client certificate.
3. Verify the MQTT agent host machine trusts the server certificate.

🔍 See Also:

Configure Gateway Certificate
[Configuring a Self-Signed Certificate](#)
Importing an MQTT Client Certificate

MQTT agent <agent name> failed to parse payload.

Message Type:

Error

Possible Cause:

The JSON payload has invalid or disallowed content in it.

Solution:

Adjust the Format and Expansion of [VALUES] boxes on the Message tab to remove the incorrect information.

MQTT agent <agent name> failed to parse payload template.

Message Type:

Error

Possible Cause:

The formatting of the advanced template is incorrect or missing characters.

Solution:

Verify no characters are missing and that the template logic is valid. Correct any issues.

See Also:

[Advanced Template Data Format](#)

MQTT agent <agent name> failed to process write request on topic <MQTT topic>. Reason - <JSON error>.

Message Type:

Error

Possible Cause:

The JSON payload has invalid or dis-allowed content in it.

Solution:

Adjust the JSON payload to match the expected format as described under [MQTT Subscriptions](#).

MQTT agent <agent name> failed to publish. Reason - <broker URL>.

Message Type:

Error

Possible Cause:

The broker is unreachable.

Solution:

1. Verify that the broker is online and the network connection is functioning properly.
2. Check the configured URL for the agent and verify a properly configured broker exists at that address.
3. Verify that communication is not being blocked by a hardware or software firewall or filter.

MQTT agent <agent name> failed to publish. Reason - Connection reset.

Message Type:

Error

Possible Cause:

The agent is configured for an SSL connection and the broker does not support SSL or is not configured for SSL connections.

Solution:

1. Check the URL and port that the agent is using and verify that it is an SSL-enabled endpoint.
2. Change the agent URL to use TCP rather than SSL and try again.

MQTT agent <agent name> failed to publish. Reason - Unable to connect to server.

Message Type:

Error

Possible Cause:

No valid MQTT broker at the URL provided or communication is blocked.

Solution:

1. Verify that the broker is online and the network connection is functioning properly.
2. Check the configured URL for the agent and verify a properly configured broker exists at that address.
3. Verify that communication is not being blocked by a hardware or software firewall or filter.

MQTT agent <agent name> publish failed. Reason: <reason>.

Possible Cause:

The MQTT agent cannot connect to the broker.

Possible Solution:

IoT Gateway returns error messages from external components. Refer to <reason> or Paho client (www.eclipse.org) for additional information about errors from the client.

MQTT agent <agent name> publish failed. Reason - The template is invalid.

Message Type:

Error

Possible Cause:

The formatting of the advanced template is incorrect or missing characters.

Solution:

Verify no characters are missing and that the template logic is valid. Correct the issues.

See Also:

[Advanced Template Data Format](#)

MQTT agent <agent name> is connected to broker <broker URL>.

Message Type:

Informational

Possible Cause:

This message is posted once a successful connection is made with an MQTT broker.

Solution:

Proceed.

The MQTT client certificate is expired. Use the Administration utility to import a valid certificate.

Message Type:

Security

Possible Cause:

The MQTT agent SSL certificate is expired or invalid.

Solution:

Re-issue the certificate through **Administration | Settings | IoT Gateway | Manage MQTT Certificates**.

Read rejected for item <tag>: no user credentials were provided in the request and anonymous requests are currently disabled.

Message Type:

Security

Possible Cause:

Anonymous access is disabled or no credentials were sent from the client.

Solution:

1. Enable anonymous access on the server agent.
2. Send valid credentials in the authentication section of GET or POST.

Read rejected for item <tag>: the credentials for user <user> are invalid.

Message Type:

Security

Possible Cause:

1. The credentials sent with the request are invalid or do not have read permissions.
2. Anonymous access is disabled, but invalid credentials were sent with the request.

Solution:

Verify the username and password are correct and have adequate rights before trying the request again.

Read rejected for item <tag>. The tag is disabled.

Message Type:

Error

Possible Cause:

The tag has been added under the IoT Gateway agent, but is disabled.

Solution:

1. Locate the tag under the agent.
2. Right-click on the tag and select **Enable** from the menu.

Read rejected for item <tag>. The tag has not been added to the plug-in.

Message Type:

Error

Possible Cause:

The tag has not been added to the IoT Gateway.

Solution:

Follow the steps under [Adding Tags to an Agent](#).

Template error on line <number>: found: <string>.

Message Type:

Warning

Possible Cause:

The formatting of the advanced template is incorrect or missing characters.

Solution:

Verify no characters are missing and that the template logic is valid. Correct the issues.

See Also:

[Advanced Template Data Format](#)

Unable to send data for item <tag> on connection <agent name>. The licensed item count of <license count> items has been reached.

Message Type:

Warning

Possible Cause:

More tags are configured than the license allows.

Solution:

Remove unused tags from any configured agents or apply a license that allows for more tags.

Write request failed on item <tag>. The write data type <data type> cannot be converted to the tag data type <data type>.

Message Type:

Warning

Possible Cause:

The write payload was of a data type that cannot be written to the selected tag.

Solution:

Verify that the tag data type being written is correct and that the data being written matches acceptable values for that data type.

Write rejected for item <tag>; invalid write format.

Message Type:

Error

Possible Cause:

The data parsed is missing information or formatting.

Solution:

Verify that the data being written is in a valid JSON format and matches the examples in the MQTT server sections of this document.

See Also:

[MQTT Client Message](#)

Write rejected for item <tag>: no user credentials were provided in the request and anonymous requests are currently disabled.

Message Type:

Security

Possible Cause:

Anonymous access is disabled, so credentials must be provided, but none were sent from the client.

Solution:

Enable anonymous access on the server agent or enter a valid username and password.

Write rejected for item <tag>: the credentials for user <user> are invalid.

Message Type:

Security

Possible Cause:

1. The credentials sent with the request are invalid or do not have write permissions.
2. Anonymous access is disabled, but invalid credentials were sent with the request.

Solution:

Verify the username and password are correct and have adequate rights before trying the request again.

Write rejected for item <tag>; unsupported data type <type>.

Message Type:

Error

Possible Cause:

The tag data type does not match the data to be written.

Solution:

1. Verify it is not a string tag as the target to write. Strings are not supported.
2. Verify that the value is within the limits of the data type of the tag.

Write rejected for item <tag>. The tag is disabled.

Message Type:

Error

Possible Cause:

The tag has been added under the IoT Gateway agent, but is disabled.

Solution:

1. Locate the tag under the agent.
2. Right-click on the tag and select **Enable** from the menu.

Write rejected for item <tag>. The tag has not been added to the plug-in.

Message Type:

Error

Possible Cause:

The tag has not been added to the IoT Gateway.

Solution:

Follow the steps under [Adding Tags to an Agent](#).

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