GE VERNOVA

EDGE SOFTWARE & SERVICES

EDGE TURNKEY SOLUTIONS

User Guide

We want to hear from you. If you have any comments, questions, or suggestions about our documentation, send them to the following email address:
doc@ge.com

Contents

Chapter 1. Predix Edge Gateways

Predix Edge Gateway 3002

Predix Edge Gateway 3002 Overview

> ✏️ **Note:**
>
> The Predix Edge Gateway 3002 has reached end-of-life (EOL); support is no longer provided for this product.

The Predix Edge Gateway 3002 is a turnkey appliance that ships with Predix Edge pre-installed. The Predix Edge Gateway 3002 allows production Predix Edge deployments without the use of a hypervisor to host the virtual machine (OVA) version of the software.

Features

The Predix Edge Gateway 3002 comes with two LAN interfaces, labeled 1 and 2. LAN1 is intended to be used for the internal (LAN) side of the device, and LAN2 for external (WAN) communications. To accommodate this:

- Power over Ethernet (PoE) is available through LAN1; a separate DC power connection is not required.
- LAN1 comes preconfigured with a static IP address of 192.168.100.2 to connect to PETC for your first login. Afterwards, LAN1 and LAN2 can both be reassigned static/DHCP addresses as needed.
- The Predix Edge Technician Console (PETC) is available only on LAN1.

> ✏️ **Note:**
>
> Although the Predix Edge Gateway 3002 hardware comes with CANBus and WLAN (WiFi) capabilities, neither of these interfaces are currently supported. In addition, the following are not supported in Predix Edge 2.3.0:
>
> - Bluetooth
> - GPS
> - MicroSD storage
> - USB storage

Specifications

Table 1. Predix Edge Gateway 3002 Specifications

Dimensions	125 mm wide x 125 mm high x 51 mm deep (4.9 x 4.9 x 2 inches)

Form Factor	• Fanless and headless
	• Mounting optimized for 75x75 VESA, wall (standard) mounting and DIN-rail mounting
	• Additional mounting options include:
	   ◦ Perpendicular DIN-rail mount
	   ◦ Quick-release DIN-rail mount
	   ◦ Cable management control bars for standard mounting

Weight	1 kg +/- 0.02 kg (2.2 lbs +/- 0.04 lbs)
Processor	Intel Atom E3805 dual core 1.33 GHz/1 MB L2 cache
Operating System	Predix Edge OS
Memory	2 GB, DDR3L – 1067 MHz Memory Single Channel (soldered on motherboard)
Drive/Storage	• Industrial-grade Micro SD card: 8 GB (Storage Expansion)** • Embedded multi-media controller (eMMC): 8 GB onboard storage
I/O	• 2 x 10/100 Fast Ethernet (RJ-45); main port supports PoE (15.4 W) • Wireless PAN: Bluetooth Low Energy • CANbus/Controller Area Network (CAN2.0 A/B/FD) 1 Mbps (CAN2.0), 5 Mbps (CAN-FD)** • USB: 1x USB 2.0, 1x USB 3.0** • Integrated MEMS: Accelerometer, Pressure, Temperature and Humidity • Integrated GPS module

Table 1. Predix Edge Gateway 3002 Specifications (continued)

	• Integrated Wireless LAN: 2.4 GHz, 802.11b/g/n; Integrated Bluetooth 4.0 BLE** • Antenna ports for WiFi/BLE/GPS**
Power Input	• Phoenix Connector for Power (three-pin CANBus Power with wake/ignition pin). DC-IN or Power over Ethernet (PoE). System power protection. Enables low-power use (ignition wake, wake on LAN). • DC-IN accepts 12/24 V car power system (12 V-57V wide DC input); supports transient low-voltage states (battery crank) ≥6 VDC. Ignition input supports power on/standby/hibernate at 9-32 VDC with a five-second delay. Wake up events: alarm, LAN, USB, ignition or direct ignition. • PoE is 10/100 Mbps and connects via eight-pin RJ45 port; features full-controller compliance with IEEE 802.3.af standard for maximum 15.4 W, with power up to 48 V over existing Ethernet infrastructure, no modifications required. Standard IEEE 802.3 Ethernet interface provided for 100BASE-TX and 10BASE-T applications (802.3, 802.3u, and 802.3ab, 802.3x) 9014 bytes jumbo frame support. PoE supports wake on LAN.
Accessories/Ecosystem	Optional accessories include: • Flexible mounting options • Pre-certified WiFi, GPS, WWAN and ZigBee antennas • Phoenix connectors for serial, CANBus and power • Industrial uSD storage options (up to 64 GB)

Table 1. Predix Edge Gateway 3002 Specifications (continued)

Environmental/Design	• Temp without airflow*:
	  ◦ Operating: -30°C to 70°C
	  ◦ Non-Operating: -40°C to 85°C
	
	• Temp with 0.7 m/s airflow*:
	  ◦ Operating: -30°C to 75°C

Relative Humidity	• Operating: 10% to 90% (non-condensing) @ 40°C • Non-operating: 5% to 95% (non-condensing) @ 40°C
Vibration	• Operating: 0.26 Grms profile (5 Hz with 0.0002 G2/Hz and 350 Hz with 0.0002 G2/Hz) two minutes per axis • Non-Operating: 1.54 Grms profile (10 Hz with 0.003 G2/Hz, 20 Hz with 0.01 G2/Hz, and 250 Hz with 0.01 G2/Hz) 60 minutes per axis
Thermal Shock	150 cycles at system level at spec limits (-40°, 85°C); min. 20C/min ramp and 10 minute dwells
Shock	• Non-Operating: MIL-STD-810G, Method 514.7, Procedure 5 (Shock) - 160G with two msec pulse duration in all axis • Operating: MIL-STD-810G, Method 514.7, Procedure 1 (Shock) - 40G with two msec pulse duration in all axis

Table 1. Predix Edge Gateway 3002 Specifications (continued)

Altitude	• Operating: −15.20 m to 5000 m (−50 ft. to 16,404 ft.)
	✎ **Note:** Maximum operating temperature is derated 1°C/305 m (1000 ft.) above sea level
	• Non-Operating: −15.20 m to 10,668 m (−50 ft. to 35,000 ft.)

*Temperature notes:

- Ambient temperature specification is based on free air environment and recommended mounting
- 2.5 inches (63.5mm) open space around the device is recommended for air circulation
- Actual maximum operating temperature depends on many variables including airflow, mounting, orientation, and software applications
- Temperature measured at the center of the exposed heatsink base surface must not exceed 83°C

**Not currently supported

Resources

- Getting Started Guide
- Installation and Operation Manual

Request a Demo

Contact GE Digital to request a demo of the Predix Edge Gateway 3002.

Getting Started

Connecting the Gateway

This guide will help you configure the Predix Edge Gateway 3002 for your network environment to allow the gateway to be managed by Predix Edge Manager, and to enable the rich functionality of Predix Edge and Predix Cloud.

Before you begin

The following equipment is required to connect the Edge Gateway:

- Ethernet cables.
- Computer.

Before you connect and setup the Edge Gateway, follow the steps in the Getting Started Guide to:

- Mount the Edge Gateway.
- Install the micro SD card.
- Power on the Edge Gateway.

Configuring and Connecting the Edge Gateway

This will allow you to access the Predix Edge Technician Console (PETC) and configure the Edge Gateway to communicate with your networks.

1. Connect the computer to Port 1 on the Edge Gateway with an Ethernet cable (or two Ethernet cables and a switch).
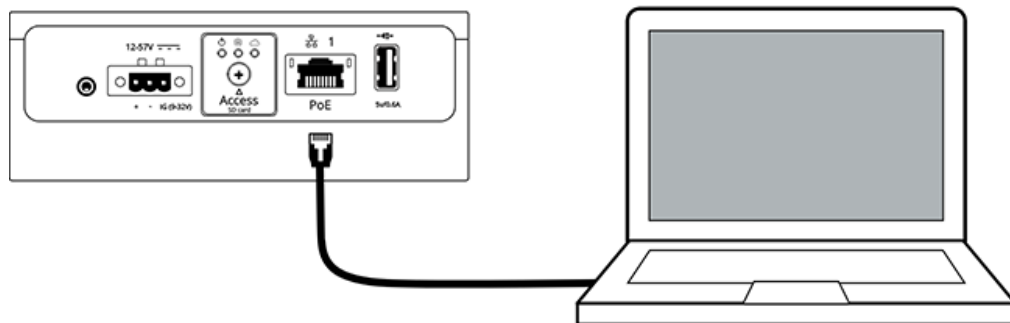
2. The Edge Gateway comes with a pre-configured static IPv4 address (192.168.100.2).
3. Go into your computer's network settings and set your IPv4 address to a static address on the same subnet as the Edge Gateway (e.g., 192.168.100.5).
4. In a web browser, go to https://192.168.100.2, which is the PETC.

What to do next

Follow the steps in:

At this point the Edge Gateway will be configured to communicate with your operations network.

Figure 1. Predix Edge Gateway 3002 Within Network
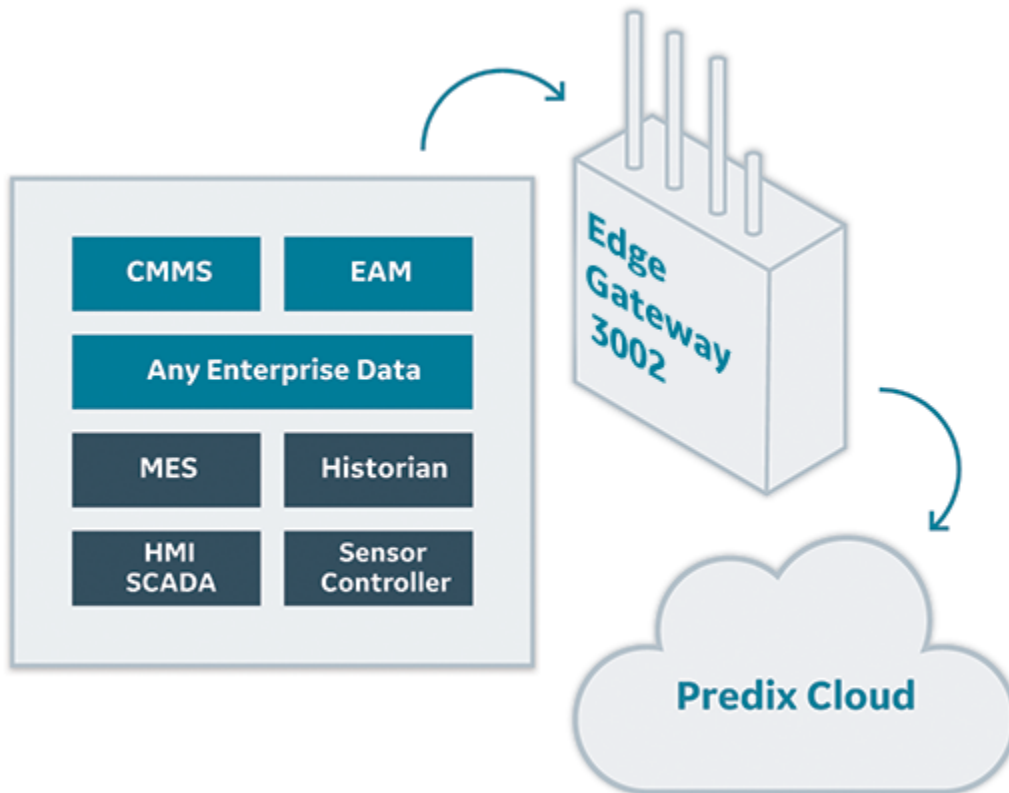
Accessing Predix Edge Technician Console

Use a Web browser to sign into Predix Edge Technician Console.

Before you begin

Predix Edge OS must be running to access the Predix Edge Technician Console.

Procedure

1. Open a Web browser and navigate to https://<predix_edge_OS-ip-address>

> **Note:**
>
> Since the Web Console uses a self-signed certificate, the browser warns that the connection is not private. You can proceed.
>
> On Chrome, click **Advanced**, proceed to_____(unsafe).
>
> On Firefox, select **Advanced > Add Exception > Confirm Certificate Exception**.

2. Enter your user name and password. If this is your first time logging into the Predix Edge Technician Console, use the following default credentials:

   ◦ **User name** – admin
   ◦ **Password** – admin

   a. If this is your first time logging in, you are prompted to changed your password. Enter:

      ▪ **Old password** – Enter your current password.
      ▪ **New Password** – Enter the new password.
      ▪ **Re-enter New Password** – Re-enter the new password.

      To unmask the passwords, click **Show Passwords**.

   > **Note:**
   >
   > Your password must:
   >
   > ▪ Be at least eight characters long and not more than 15 characters long
   > ▪ Contain at least two uppercase letters
   > ▪ Contain at least one lowercase letter
   > ▪ Contain at least two numbers
   > ▪ Contain at least one special character
   > ▪ Not contain the user name
   > ▪ Not contain spaces

   b. Click **Reset Password**.

      After you reset the password, you have to sign into Predix Edge Technician Console again, using your new password.

   You are signed into Predix Edge Technician Console, where the **Device Status** page is displayed. If you have not yet set up the device, some information is not displayed.

Related information

About Device Setup *(on page*)

Configuring the Network and Proxy Settings

Configure the network and proxy settings for the device to enable communication between the device and Predix Edge Manager.

Procedure

1. Sign into the Predix Edge Technician Console.

   The **Device Status** page is displayed.

2. To go to the **Device Setup** page:

   ◦ In the left navigation pane, click **Device Setup**, or

   ◦ In the **Summary > Network** section, click **Edit**.

   The **Device Setup** page is displayed.

3. In the **Network** section, configure the network settings for the device.

Setting	Description	Configurations
Network Adapters	The network adapter settings are automatically populated with the IP address, subnet mask, and default gateway of the Edge OS.	Select: ◦ **DHCP** – select for dynamic host configuration protocol. The IP address for your device is automatically assigned by the server and not configurable by the Predix Edge Technician Console administrator. The IP address may change periodically, or when the device is restarted. **MTU** is configured with a default of 1500 bytes. ◦ **Static** – select if you are using a static IP address for the device. When using a static IP address, only the primary DNS server can be configured. **MTU** is configured with a default of 1500 bytes.

Setting	Description	Configurations
		Note: When the IP address is changed, or when changing from **Static** to **DHCP**, a new tab will automatically pop up. If the popup blocker is enabled on your browser, a notification is displayed at the top of the browser to indicate that a popup has been blocked. You must disable the popup blocker to open the Predix Edge Technician Console in a new tab. ◦ **Disabled** – select to disable a network adapter.

Setting	Description	Configurations
	Host-Level DNS	◦ **Primary DNS** – primary host-level DNS server configuration. ◦ **Alternative DNS** – alternative host-level DNS server configuration.
	Dell 3002-specific settings	For Dell 3002, the following conventions are recommended for network adapter configuration: ◦ lan1 is intended for LAN use. ◦ lan2 is intended for WAN use. It is recommended that you configure the gateway for lan2 (intended for WAN) only.
DNS	The domain name servers are automatically populated with the primary and secondary DNS servers of the network Predix Edge OS is running on. This section contains all the host-level DNS server settings.	This section is view-only.

Proxy	If the network uses a firewall, enter the proxy server information.	◦ **HTTP** – enter the HTTP proxy, for example:
		`http://<host>:<port>`
		◦ **HTTPS** – enter the HTTPS proxy, for example:
		`https://<host>:<port>`

Setting	Description	Configurations
		◦ **No Proxy** – enter the text for no proxy, for example: `<domain>`

4. Click **Save**.

   The **Save Settings** confirmation dialog box appears.

5. To proceed with saving the settings, click **Save and Restart**.

   When you set, or reset, the proxy settings, Predix Edge Technician Console restarts and you are redirected to the sign-in screen.

> **Note:**
>
> Upon restart, a new IP address may be assigned if you are using DHCP.

Configuring the Network Time Service

Enter the NTP servers the device will poll to synchronize its UTC time.

Procedure

1. From the **Device Status** page, click **Device Setup** in the left navigation pane.
2. In the **Device Setup** page, click the **Time Service** tab.
3. In the **NTP** field, enter up to ten addresses for the time servers.

   Typically, the device should be set up to poll at least three servers on different networks to get the most accurate time.

   Use commas, spaces, or returns to separate multiple entries, for example:

   NTP

   ```
   0.pool.ntp.org,
   1.pool.ntp.org,
   2.pool.ntp.org,
   3.pool.ntp.org
   ```

4. Click **Save**.
5. (Optional) Click **Reset** to revert to the last saved configuration.

Installation and Operations

Cloud Device Enrollment

About Predix Cloud Device Enrollment

For cloud enrollment, devices must be added to Predix Edge Manager by an administrator or operator before enrolling the device with the technician console. Enroll devices with Predix Edge Technician Console for devices running Predix Edge Agent.

When the device is initially added to Edge Manager, it has no identity associated with the Predix cloud until an identity is created on the cloud through certificate enrollment and associated with the device using Predix cloud authentication.

Certificate-based device authentication and enrollment allows a device to enroll itself with Edge Manager at startup and obtain a certificate signed by a GE root authority so that no device-specific credentials are required. Once a device is configured with the Edge Manager URL, device ID, and shared secret, it can communicate with the cloud environment at startup and obtain its own certificate and credentials.

Administrator Tasks

1. The administrator creates the technician user with the Technician role in Edge Manager, and provides the technician with Edge Manager login credentials.
2. The administrator or operator adds devices to Edge Manager and enters a shared secret for the device.

Technician Tasks

Task	Description
1. Login to Edge Manager and change password.	The administrator provides initial sign-in credentials and the URL to access Edge Manager to the technician. When the technician logs in for the first time, they are prompted to change their password.
2. Go to **Settings**.	The technician is directed to the **Settings > Enrollment** page and makes note of the appropriate certificate enrollment URL.
3. Sign into the local technician console.	Sign into the technician console.

Task	Description
	For Predix Edge Agent, see Using Predix Edge Technician Console to Enroll Devices with Predix Cloud *(on page 19)*.
4. Finish enrollment process.	The technician finishes enrolling the device with either Predix Edge Technician Console. This creates an identity for the device in the cloud.

Figure 2. Technician Workflow for Predix Edge Technician Console
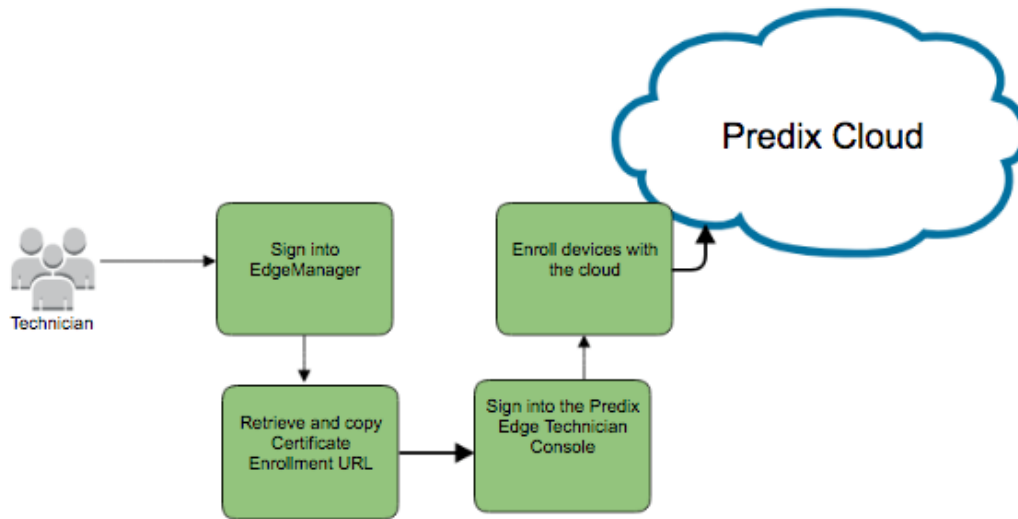
Related information

Adding a Device to Predix Edge Manager *(on page 16)*

Predix Cloud Identity Management Service *(on page   )*

Using Predix Edge Technician Console to Enroll Devices with Predix Cloud *(on page 19)*

Adding a Device to Predix Edge Manager

When you add a device to Edge Manager, information that is specific to the device is added so that when you enroll the device with Predix Edge or Predix Edge Agent, the device can be verified through the security certificate.

Before you begin

Before a device that has Predix Edge or Predix Edge Agent installed can be enrolled and brought online, you must add the device to Edge Manager. This procedure is for adding a single device to Edge Manager. To add multiple devices, see Importing a Device List *(on page   )*.

Procedure

1. Sign into Edge Manager.

2. In the left navigation pane, select **Device Manager > Devices**.

3. In the Device Manager page, select **Action > Add**.

4. In the **Add a Device** dialog box, enter the information for the device:
   - **Device Name** – the name of the device should be unique and descriptive, and can consist of upper and lower case characters and numbers.
   - **Device ID** – used to identify the device with Predix Edge. The device ID must be unique in a Edge Manager tenant. While the Device ID is typically a serial number, another option is using the MAC address of the WAN interface, which is auto-populated on the Predix Cloud Enrollment page in the local technician console.

   > **Note:**
   > The Device ID can consist of lower-case characters and numbers, however, any upper-case characters entered during device creation will be converted to lower-case.

   > **Note:**
   > The device ID must follow these conventions:
   > - Must be a minimum of 3 characters.
   > - Must not exceed 63 characters.
   > - Must start with an alphanumeric character (0-9 or a-z).
   > - The remaining characters can be any combination of alphanumeric, underscore (_), or hyphen (-).
   > - Do not use colons (:).
   > - The Device ID is case-insensitive, but is always stored as lower-case. If you enter upper-case characters in Edge Manager, they are converted to lower-case.

> **✎ Note:**
>
> Write down or copy your Device ID for use when enrolling the device with Predix
> Edge later.

- (Optional) **Group** – Select the target group for the device.
- (Optional) **Technician** – Select a technician to whom to assign the device.
- **Device Model** – Select the device model from the drop-down list.
- (Optional) **Manufacturer Installed BOM** – A manufacturer BOM lists packages installed
  before the device is shipped to the user (the packages are not installed through Edge
  Manager).
  a. Click **Choose BOM**.
  b. Select a BOM from the list, and click **Confirm**.

  > **✎ Note:**
  >
  > Once a manufacturer BOM is installed, it cannot be modified. Any BOMs
  > deployed at a future date are compared against the initial manufacturer
  > installed BOM, and any packages that are already installed as part of the
  > initial manufacturer BOM are skipped.

- (Optional) **Description** – Add a description for the device.
- **Shared Secret** – Enter the **Shared Secret**. The shared secret provides an initial form of
  authentication for a device that otherwise does not have an existing identity when you enroll
  it with Predix Edge. Certificate-based device authentication and enrollment allows a device
  to enroll itself to Edge Manager at startup and obtain a certificate signed by a root authority.
- **Confirm Secret** – Re-enter the shared secret.
- (Optional) Click **Next** to assign a service to the device.
- Click **Finish** to add the device.

5. If you clicked **Next** in the previous step, in the **Assign Service** dialog box, select the service, or
   services, to assign to the device.
   - (Optional) Click **Next** to add location details for the device.
   - Click **Finish** to add the device.
6. (Optional) If you clicked **Next** in the previous step, in the **Location** dialog box, enter location details
   for the device.

> **✎ Note:**
>
> The **Elevation** value must be in meters.

- ◦ Click **Next** to add custom attributes for the device.
- ◦ Click **Finish** to add the device.

7. (Optional) If you clicked **Next** in the previous step, in the **Custom Attributes** dialog box, enter custom attributes as key/value pairs, then click **Finish**.

   Key/value custom attributes can be used to add more details about a device, for example, `Region:West.`

   Click **+** to add more attributes, and **X** to delete attributes.

8. Click **Finish**.

   You receive a confirmation that the device has been successfully added. The device list automatically refreshes and displays the device you added. This may take a moment.

What to do next

Once you have added the devices to Edge Manager and assigned the technician, the technician can enroll them with Predix Edge or Predix Edge Agent. The technician needs to know the following information in order to enroll the devices:

- Device ID
- Certificate enrollment URL (found on the Settings page)
- Shared secret

Related information

Using Predix Edge Technician Console to Enroll Devices with Predix Cloud

Before you begin

You must install Predix Edge Technician Console *(on page   )*.

About this task

For devices running Edge, with connectivity to Predix cloud, you can use the Predix Edge Technician Console to configure the device with the Predix Edge Manager certificate enrollment URL, device ID, and shared secret, so it can communicate with the cloud environment at startup and obtain its own certificate and credentials.

Procedure

1. Sign into Predix Edge Technician Console.
2. In the **Device Status** page, click **Enroll**.
3. In the **Enroll Device** dialog box, enter the following information:
   ◦ **Device ID** – Identifies the device with Predix Edge OS. The device ID you enter must match the device ID assigned when the device was added to Edge Manager by the administrator.
   ◦ **Shared Secret** – Enter the shared secret that was entered with the device was added to Edge Manager.
   ◦ **Certificate Enrollment URL** – URL of the Predix Edge Manager tenant. You can find the correct certificate enrollment URL in the Edge Manager **Settings** page.
4. Click **Enroll**.

   A green banner displays at the top of the Device Status screen confirming enrollment was successful and the device status displays "enrolled."

   In Edge Manager, the device status displays "online" (this may take a moment).

Using Predix Edge Technician Console to Delete Enrollment Information from Devices with Predix Cloud

Before you begin

You must install Predix Edge Technician Console *(on page   )*.

About this task

For devices running Predix Edge, with connectivity to Predix cloud, you can use the Predix Edge Technician Console to delete enrollment settings from the device in order to re-enroll the device.

Procedure

1. Sign into Predix Edge Technician Console.
2. In the **Device Setup** page, click the **Enrollment** tab.
3. Click **Delete Enrollment**.

A message displays with information about deleting enrollment: "This will delete enrollment settings so that the device can be re-enrolled. No other settings, files or deployed applications will be removed. This does not remove the device from Edge Manager."

4. Delete the device from Edge Manager.

Setup Predix Edge Applications

Predix Edge Applications

Predix Edge includes the following applications for acquiring, publishing and storing data at the Edge. The applications are stored in Artifactory.

To access Artifactory downloads, you will require a GE SSO (single sign-on) username and approval to access Artifactory.

Request a GE SSO

Use the following steps to obtain a GE SSO if you do not already have one.

1. Complete the Your GE SSO Account request form. All fields marked with a checkmark are required.
2. Click **Submit**.

> ✎ **Note:**
> The only non-alphanumeric characters allowed in your GE SSO are an underscore (_) and a period (.). Using any other non-alphanumeric characters for your username will result in an invalid authentication in Artifactory.

Request Artifactory Access

Once you have an SSO, use the following steps to request access to Artifactory.

1. Complete the Edge Artifactory Access Requests form.
2. Click **Submit**.

Application Downloads

Application	Description
Cloud Gateway	Sends data from the Predix Edge Broker to Time Series or Event Hub instance(s)

Application	Description
EGD Protocol Adapter	Acquires EGD data and publishes it to the Predix Edge Broker
MQTT Protocol Adapter	Acquires data from an external MQTT broker and publishes it to the Predix Edge Broker
OSI-PI Protocol Adapter	Acquires data from an OSI-PI server and publishes it to the Predix Edge Broker
OPC-UA Protocol Adapter	Acquires data from an OPC-UA server and publishes it to the Predix Edge Broker
Historian and Collectors (licensed separately from Predix Edge)	Historian database and RESTful query engine for storing and extracting data

Installing an Application

Download and install a Predix Edge application.

Procedure

1. Click the application link to download the application to your machine.
2. Upload the file to your Edge Manager Repository as a Predix Edge application.
3. Deploy the application to an enrolled Predix Edge device.

Configuring an Application

Configure a Predix Edge application.

Procedure

1. Download and extract the sample configuration ZIP for the application.
2. Modify the settings in the sample config file for your environment.
3. Re-zip the file.
4. Upload the new ZIP file to the Edge Manager Repository as a Predix Edge configuration.
5. Deploy the configuration to the corresponding application running on your Predix Edge device.

Related information

Predix Edge Protocol Adapters Overview *(on page   )*

About Predix Edge Cloud Gateway *(on page 23)*

Uploading Software and Configuration Packages to the Predix Edge Manager Repository *(on page
)*

Predix Edge Cloud Gateways

About Predix Edge Cloud Gateway

The Cloud Gateway Edge App provides functionality to publish both to Time Series as well as Event Hub from one container. It also features the ability to publish to multiple Time Series or Event Hub instances simultaneously, and it provides detailed logging among other features.

The Cloud Gateway is your single solution to get data from the Edge to the Cloud. This low footprint Edge App can subscribe to multiple topics on a MQTT Broker and forward that data to both Predix Time Series and Predix Event Hub simultaneously. The client ID field is passed directly to the MQTT client, and must be unique across all applications connecting to the same broker. For more information, refer to the Mosquitto MQTT broker documentation.

The following diagram shows a simple use case where data from multiple external data sources is forwarded to the Predix Edge Broker via Protocol Adapters *(on page   )* and then to Time Series and Event Hub using the single Cloud Gateway.
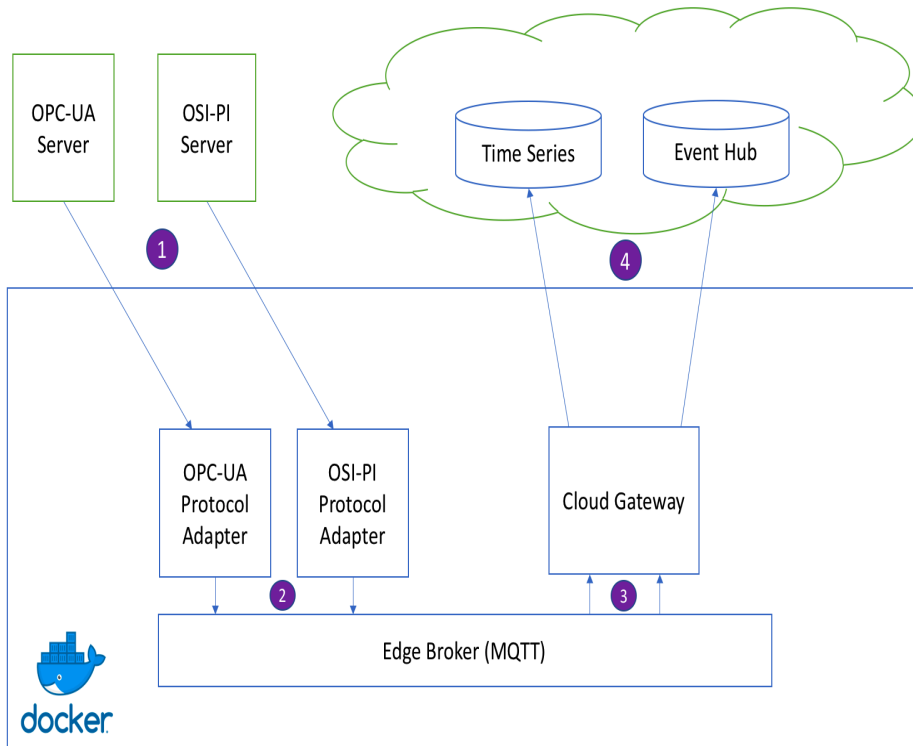
Where Do I Get It?

The Cloud Gateway Edge App and sample configuration in the table below are stored in Artifactory.

To access Artifactory downloads, you will require a GE SSO (single sign-on) username and approval to access Artifactory.

Request a GE SSO

Use the following steps to obtain a GE SSO if you do not already have one.

1. Complete the Your GE SSO Account request form. All fields marked with a checkmark are required.
2. Click **Submit**.

> ✎ **Note:**
> The only non-alphanumeric characters allowed in your GE SSO are an underscore (_) and a period (.). Using any other non-alphanumeric characters for your username will result in an invalid authentication in Artifactory.

Request Artifactory Access

Once you have an SSO, use the following steps to request access to Artifactory.

1. Complete the Edge Artifactory Access Requests form.
2. Click **Submit**.

Cloud Gateway Downloads

The downloadable files for the Cloud Gateway are available here.

Overview of Capabilities

Currently Supported

- Receive data from multiple configured MQTT topics.
- Publish data to:
  ◦ Predix Time Series service (one or more instances).
  ◦ Predix Event Hub service (one or more instances).
  ◦ Both services simultaneously.
- Persist any data that fails to publish in the Time Series Publisher and re-transmit in the background.
- Store (on disk) and forward all data in the Event Hub Publisher.
- Predix UAA Authentication with both the Time Series and Event Hub services.
- Coordination of disk usage between blocks.
- Time Series data validation.
- Detailed logging.

Limitations

- The Cloud Gateway does not transform input data to Predix Time Series format. If the Time Series Publisher is used, it will discard any input data not formatted correctly for Time Series ingestion.
- Any Event Hub topics the Cloud Gateway is configured to publish to must be created in your Predix Event Hub instance *(on page   )* in advance. The Event Hub Publisher does not have the capability to create Event Hub topics on the fly due to potential security risks.
- There is no guarantee of the order in which publish requests will be reflected in their respective cloud endpoints.

Time Series Publisher Capabilities

The Time Series Publisher block can subscribe to multiple MQTT topics, send data to Predix Time Series, and it features detailed logging and input data validation.

See The Blocks Section *(on page 29)* for an explanation of what a "block" is in the Cloud Gateway.

See Time Series Publisher Block Config *(on page 30)* for an explanation of how to configure the Time Series Publisher block.

Time Series Publishing

The Cloud Gateway can send data to any Predix Time Series instance that the device has ingestion permissions for. The Cloud Gateway will automatically authenticate with the Time Series instance it is configured to communicate with as long as its access token has the appropriate Predix Time Series scopes *(on page   )*.

It is also capable of publishing to multiple Predix Time Series instances simultaneously if it has valid permissions for each.

The Time Series Publisher block batches data up before it sends to Time Series to minimize the number of network requests required. You can also configure the maximum interval at which that these batches will be sent.

> **Note:**
> Any data received from MQTT subscriptions must already match the Predix Time Series data format shown in the Data Ingestion Request example *(on page   )*. If data is not properly formatted, the Cloud Gateway will throw that data out.

Time Series MQTT Subscriptions

This block is capable of subscribing to multiple MQTT topics rather than just one at a time. The data from all topics specified in a single Time Series Publisher block will all be forwarded to that block's configured Predix Time Series endpoint.

> **Note:**
> The Time Series Publisher block does NOT currently support wildcard MQTT subscriptions (e.g., `data/#`). Any wildcard subscriptions will not be properly forwarded to Predix Time Series.

This block also supports an optional, configurable quality of service and client ID for its MQTT subscriptions.

> ✏️ **Note:**
>
> One big difference between this block and its `timeseriessink` predecessor in the old Time Series Cloud Gateway is that this block directly subscribes to MQTT topics. The `cdpin` block should NOT be used in this Cloud Gateway to create MQTT subscriptions.

> ✏️ **Note:**
>
> Any data received from MQTT subscriptions must already match the Predix Time Series data format shown in the Data Ingestion Request example *(on page   )*. If data is not properly formatted, the Cloud Gateway will throw that data out.

Time Series Data Storage

The Time Series block stores data on disk only if the publish to Predix Time Series fails or data comes in too quickly to store in memory.

`Store on Failure` uses in-memory queueing and multi-threaded publishing to increase the throughput of the application in situations where data is accumulating faster than the `max batch interval` timer. Data is only stored persistently if the publish request to Time Series fails or if input data is received much more quickly than it can be sent.

For information on the `policy` field in the Cloud Gateway configuration file, see Time Series Publisher Block Config *(on page 30)*.

Event Hub Publisher Capabilities

The Event Hub Publisher block can subscribe to multiple MQTT topics, store your data on disk before you forward it to the cloud, send data to Predix Event Hub, and features detailed logging.

See The Blocks Section *(on page 29)* for an explanation of what a `block` is in the Cloud Gateway.

See Event Hub Publisher Block Config *(on page 34)* for an explanation of how to configure the Event Hub Publisher block.

Event Hub Publishing

The Cloud Gateway can send data to any Predix Event Hub instance that the device has publish permissions for. The Cloud Gateway will automatically authenticate with the Event Hub instance it is configured to communicate with as long as its access token has the appropriate scopes. It will also

format publish requests automatically using gRPC, so there is no need to pre-format data before sending it to the Event Hub Publisher block.

It is also capable of publishing to multiple Predix Event Hub instances simultaneously if it has valid permissions for each.

The Event Hub Publisher block batches data up before it sends to Predix Event Hub to minimize the number of network requests required. You can also configure the maximum interval at which that these batches will be sent.

Event Hub MQTT Subscriptions

This block is capable of subscribing to multiple MQTT topics rather than just one root topic at a time. The data from all topics specified in a single Event Hub Publisher block will all be forwarded to that block's configured Predix Event Hub endpoint. The specific topics that data will be published to are specified in the topic map in the configuration file.

This block also supports an optional, configurable quality of service and client ID for its MQTT subscriptions.

> **Note:**
> The Event Hub Publisher block does NOT currently support wildcard MQTT subscriptions (e.g., `eventhub_data/#`). Any wildcard subscriptions will not be properly forwarded to Predix Event Hub.

> **Note:**
> The way the Event Hub Publisher block handles MQTT subscriptions and what Event Hub topics to publish to is significantly different from the way its predecessor, the Event Hub Cloud Gateway, handled them. Instead of configuring a root MQTT topic to subscribe to in the Cloud Gateway and forcing the adapters to publish to a subtopic of that root topic to determine what Event Hub topic to publish to, the new Event Hub Publisher block specifies a mapping between input MQTT topics and output Event Hub topics in its configuration file. This allows the adapters or any other data sources to be blissfully unaware of what Event Hub topics their data will eventually be published to. The `cdpin` block also should NOT be used in this Cloud Gateway to create MQTT subscriptions.

Event Hub Store and Forward

The Event Hub Publisher block only has one option for store and forward functionality. As soon as a batch of input data is filled (to the maximum Event Hub publish request size) or the maximum batch interval (in the configuration file) has been reached, data will be stored in one of many disk-backed queues. The data is then popped off of these queues once it has been successfully published to Predix Event Hub. In the event of power loss, if some data has not been sent yet, it will still be available on disk, and the Cloud Gateway will pick up where it left off.

How Do I Deploy It?

Refer to the Packaging and Deployment *(on page   )* for instructions on how to deploy an Edge App (e.g., the pre-packaged Cloud Gateway above).

If you wish to modify the `docker-compose.yml` file, refer to Sample Files *(on page 39)*, or in the pre-packaged Cloud Gateway tarball as a starting point and repackage the image with your new file as explained in Packaging and Deployment *(on page   )*.

How Do I Configure It?

The Cloud Gateway requires a single configuration file. A sample configuration file can be found in the Sample Files *(on page 39)*. The name of this configuration file can be changed as long as its name matches the `config` environment variable in the `docker-compose.yml` file.

If you configured one of the Protocol Adapters, the format of the Cloud Gateway's configuration file should feel familiar, but with a few key changes. This configuration file is a JSON file that contains one main `blocks` section with each block's config section within it.

```
{
    "blocks": {

        ...

    }
}
```

See The Blocks Section *(on page 29)* for an explanation of what a "block" is in the Cloud Gateway.

> **Note:**
> The `mappings` section required for the Protocol Adapters is NOT used in the Cloud Gateway's configuration.

The Blocks Section

The `blocks` section is used to initialize the blocks that will be used by the Cloud Gateway. Think of each as a `block` of functionality. There are two main types of blocks in the Cloud Gateway. One that can send data to Predix Time Series service, and one that can send data to Predix Event Hub service.

Every block must have a `type` and `config` field in the configuration file. The `type` field defines what type of block is to be instantiated. The `config` section defines the configuration fields for that block and will look different depending on the `type` of the block. This `config` section is passed to the block when it is instantiated.

In the following example, two blocks are defined; one named `block1` of type `timeseries`, and another named `block2` of type `eventhub`.

```
{
    "blocks": {

        "block1": {

            "type": "timeseries",

            "config": {

                ...

            }

        },

        "block2": {

            "type": "eventhub",

            "config": {

                ...

            }

        },

        ...

    }

}
```

Time Series Publisher Block Config

The Time Series Publisher block can be instantiated by using the block type `timeseries`.

See The Blocks Section for an explanation of what a `block` is in the Cloud Gateway.

The configuration fields (in the `config` portion of the block configuration) for the `timeseries` block are as follows:

Table 2. Configuration Fields

Field	Type	Required	Default
log_name	String	no	<block name>
log_level	String	no	'off'
mqtt/transport_addr	String	no	mqtt-tcp://predix-edge-broker
mqtt/qos	Integer	no	0
mqtt/client_id	String	no	
mqtt/topics	Array of Strings	yes	
policy	String	no	store_on_failure
store_forward	Object	yes	
store_forward/max_store_percent	Integer	no	10
store_forward/max_batch_interval	Integer	no	1000
timeseries/compress	Boolean	no	true
timeseries/transport_addr	String	yes	
timeseries/predix_zone_id	String	yes	
timeseries/token_file	String/Object	no	/edge-agent/access_token
timeseries/proxy_url	String	no	

The following is a sample block config for the `timeseries` block. This should be placed in the `blocks` section of the overall configuration file.

The block below is configured to subscribe to the MQTT topic `input_data` on the Predix Edge Broker and ingest all data received from that topic to a Predix Time Series instance with the Predix Zone ID `xxx-xxx` at the URL `wss://dummy_url.run.aws-usw02-pr.ice.predix.io/v1/stream/messages`.

The block's name in this example is `time_series_sender`, but it can be any string you wish to use.

```
"time_series_sender": {

    "type": "timeseries",

    "config": {

        "log_name": "time_series_block",

        "log_level": "debug",

        "mqtt": {

            "transport_addr": "mqtt-tcp://predix-edge-broker",

            "qos": 2,

            "client_id": "time_series_mqtt_client0",

            "topics": [

                "input_data"

            ]

        },

        "store_forward": {

            "max_store_percent": 30,

            "max_batch_interval": 2000,

            "policy": "store_on_failure"

        },

        "timeseries": {

            "transport_addr": "wss://dummy_url.run.aws-usw02-pr.ice.predix.io/v1/stream/messages",

            "predix_zone_id": "xxx-xxx",

            "token_file": "/edge-agent/access_token",

            "proxy_url": "$http_proxy"

        }

    }

}
```

log_level and log_name

For details on the `log_level` and `log_name` fields of the Time Series Publisher block's `config` section, see Common Block Config Fields *(on page 38)*.

mqtt

For details on fields within the `mqtt` portion of the Time Series Publisher block's `config` section, see Common Block Config Fields *(on page 38)*.

store_forward/max_store_percent and store_forward/max_batch_interval

For details on the `store_forward/max_store_percent` and `store_forward/max_batch_interval` fields of the
Time Series Publisher block's `config` section, see Common Block Config Fields *(on page 38)*.

timeseries/compress

The `timeseries/compress` tag is an optional boolean (true/false) that defaults to 'true'. When enabled,
the Time Series service will receive JSON payloads compressed (GZIP) by the cloud gateway. The size
limit for the actual JSON payload is 512 KB regardless of the ingestion request format. For compressed
payloads, this means the decompressed payload cannot exceed 512 KB.

timeseries/transport_addr

The `transport_addr` field within the `timeseries` section should be set to the URI of whatever Predix Time
Series instance you wish to publish data to.

timeseries/predix_zone_id

The `predix_zone_id` field within the `timeseries` section should be set to the Predix Zone ID of whatever
Predix Time Series instance you wish to publish data to.

timeseries/token_file

The `token_file` field within the `timeseries` section should usually be set to the path to the file on your
Predix Edge device that holds your UAA token for authentication with your Predix Time Series instance.

> **Note:**
> Use the default value for `token_file` path unless your application requires you to change it.

To use a separate UAA other than the one utilized by Edge Manager you may provide a JSON object with
the following keys:

- `uaa_url` - The URL of the host where the UAA service is running. The UAA service provides the
  access token that is subsequently used to push to the Timeseries server. The path `oauth/token` is
  appended and the resulting URL is used to request the access token.
- `client_id` - The client ID associated with an account that has access to the desired Timeseries
  zone.
- `client_secret` - The secret associated with the client_id.
- `proxy_url` - The proxy required to access the UAA URL.

Key	Type	Required	Default
timeseries/token_-file/uaa_url	String	Only if a separate Time Series UAA is used	
timeseries/token_-file/client_id	String	Only if a separate Time Series UAA is used	
timeseries/token_-file/client_secret	String	Only if a separate Time Series UAA is used	
timeseries/token_-file/proxy_url	String	Only if a separate Time Series UAA is used	

timeseries/proxy_url

The `proxy_url` field within the `timeseries` section should be set to the URL of whatever proxy you want to use (if any) to connect to whatever Predix Time Series instance you wish to publish data to. This field can be omitted or set to an empty string if no proxy is desired.

> ✏️ **Note:**
>
> This can be either the Predix Edge OS environment variable `$http_proxy` or a URL in the format `<protocol>://<FQDN or IP Address>:<port>`. The `$http_proxy` variable is set via PETC. See Configuring the Network and Proxy Settings *(on page 10)*.

Event Hub Publisher Block Config

The Event Hub Publisher block can be instantiated by using the block type `eventhub`.

See The Blocks Section *(on page 29)* for an explanation of what a `block` is in the Cloud Gateway.

> ✏️ **Note:**
>
> The Event Hub block's configuration has changed significantly from its earlier iterations.

The configuration fields (in the `config` portion of the block configuration) for the `eventhub` block are as follows:

Table 3. Configuration Fields

Field	Type	Required	Default
log_name	String	no	<block name>
log_level	String	no	'off'
mqtt/transport_addr	String	yes	
mqtt/qos	Integer	no	0
mqtt/client_id	String	no	
mqtt/topics	Array of Strings	yes	
store_forward	Object	yes	
store_forward/max_store_percent	Integer	no	10
store_forward/max_batch_interval	Integer	no	1000
eventhub/transport_addr	String	yes	
eventhub/predix_zone_id	String	yes	
eventhub/token_file	String	yes	
eventhub/topic_map	Array of Objects	yes	

The following is a sample block config for the `eventhub` block. This should be placed in the `blocks` section of the overall configuration file.

The block below is configured to subscribe to the MQTT topic `input_data` on the Predix Edge Broker and publish all data received from that topic to the Event Hub topic `output_data` on a Predix Time Series instance with the Predix Zone ID `xxx-xxx` at the URL `event-hub-aws-usw02.data-services.predix.io:443`.

The block's name in this example is `event_hub_sender`, but it can be any string you wish to use.

```
"event_hub_sender": {

    "type": "eventhub",

    "config": {

        "log_name": "eventhub_block",
```

```
    "log_level": "debug",

    "mqtt": {

        "transport_addr": "mqtt-tcp://predix-edge-broker",

        "qos": 1,

        "client_id": "event_hub_mqtt_client0",

        "topics": [

            "input_data"

        ]

    },

    "store_forward": {

        "max_store_percent": 30,

        "max_batch_interval": 2000

    },

    "eventhub": {

        "transport_addr": "event-hub-aws-usw02.data-services.predix.io:443",

        "predix_zone_id": "xxx-xxx",

        "token_file": "/edge-agent/access_token",

        "topic_map": [

            {

                "eventhub_topic": "output_data",

                "mqtt_topics": [

                    "input_data"

                ]

            }

        ]

    }

  }

}
```

log_level and log_name

For details on the `log_level` and `log_name` fields of the Event Hub Publisher block's `config` section, see Common Block Config Fields *(on page 38)*.

mqtt

For details on fields within the `mqtt` portion of the Event Hub Publisher block's `config` section, see Common Block Config Fields *(on page 38)*.

store_forward/max_store_percent and store_forward/max_batch_interval

For details on the `store_forward/max_store_percent` and `store_forward/max_batch_interval` fields of the
Event Hub Publisher block's `config` section, see Common Block Config Fields *(on page 38)*.

eventhub/transport_addr

The `transport_addr` field within the `eventhub` section should be set to the URI of whatever Predix Event
Hub instance you wish to publish data to.

eventhub/predix_zone_id

The `predix_zone_id` field within the `eventhub` section should be set to the Predix Zone ID of whatever
Predix Event Hub instance you wish to publish data to.

eventhub/token_file

The `token_file` field within the `eventhub` section should be set to the path to the file on your Predix Edge
device that holds your UAA token for authentication with your Predix Event Hub instance.

eventhub/topic_map

The `proxy_url` field within the `eventhub` section specifies how data will be forwarded from input MQTT
topics to output Event Hub topics. This section is an array of objects with the following fields:

Field	Type	Required
eventhub_topic	String	yes
mqtt_topics	Array of Strings	yes

Data received from subscriptions to the topics in the `mqtt_topics` field of one object will be published to
the Event Hub topic in the `eventhub_topic` field of that same object.

> **Note:**
> If an MQTT topic is not specified anywhere in the topic map, it will NOT be subscribed to even if it
> is in the `topics` list in the `mqtt` section of the block's `config` section.

> **Note:**
> The Event Hub block does not currently support forwarding data from one MQTT topic to multiple
> Predix Event Hub topics.

Common Block Config Fields

See The Blocks Section *(on page 29)* for an explanation of what a `block` is in the Cloud Gateway.

log_level

The `log_level` field determines which level of logs to output. If the field is not set to one of the following values, the block will not log anything. The values below are listed in order from most to least verbose:

- `debug`
- `info`
- `warn`
- `err`
- `critical`

log_name

The `log_name` field defines a name to identify the block's logs. This is typically prepended to the log output and can be any string you wish to set it to. If unset, it defaults to the block's name.

mqtt/transport_addr

The `transport_addr` field within the `mqtt` section should be set to the URI of the MQTT broker you wish to receive data from.

> **Note:**
> This field is not required for the Time Series Publisher block (as it defaults to "mqtt-tcp://predix-edge-broker"), but it IS currently required for the Event Hub Publisher block.

> **Note:**
> Supported URI prefixes for the Time Series Publisher block include `mqtt-tcp`, `mqtt`, and `tcp`. However, the Event Hub Publisher block supports only `mqtt-tcp` as the URI prefix for this field.

mqtt/qos

The `qos` field within the `mqtt` section can be set to the desired "quality of service" for the block's MQTT subscriptions.

This field's value can be 0, 1, or 2. These values correspond to "at most once", "at least once", and "exactly once" message delivery from the MQTT broker to the block.

mqtt/client_id

The `cliend_id` field within the `mqtt` section can be set to the desired client ID for the block's MQTT subscriptions.

This client ID helps the MQTT broker to identify the block. If the Cloud Gateway is restarted, and during that restart, data is published to topics the block was subscribed to, the broker will be able to deliver that data to the block after the Cloud Gateway comes back up as long as it uses the same client ID.

mqtt/topics

The `topics` field within the `mqtt` section should be set to an array of strings denoting the topics that the block should subscribe to on the MQTT broker specified by the `transport_addr` field.

store_forward/max_store_percent

The `max_store_percent` field within the `store_forward` section should be set to the max percent of disk space that the block's store and forward functionality is allowed to use.

> ✏️ **Note:**
> This value may be reduced (proportionally to other blocks) at runtime if the total `max_store_percent` set by all of the blocks is too large.

store_forward/max_batch_interval

The `max_batch_interval` field within the `store_forward` section should be set to the desired maximum interval (in milliseconds) between batch publish requests.

If input data is not received quickly enough to fill the maximum batch size for the respective block, the current batch will be completed at this interval (regardless of its size) and stored or sent according to the type of block and store forward functionality.

Sample Files

docker-compose.yml

The following sample file determines how to deploy the Cloud Gateway Edge App.

> ✏️ **Note:**
>
> The `config` environment variable must specify the file path to the configuration file inside the Docker container that will be deployed. If the file name does not match the configuration file applied to the Edge App, the Cloud Gateway will be unable to find it.

```yaml
version: "3"


services:

  cloud-gateway:

    image: "dtr.predix.io/predix-edge/cloud-gateway:amd64-1.1.0"

    environment:

      config: "/config/config-cloud-gateway.json"

    env_file:

      - /etc/environment

    deploy:

      restart_policy:

        condition: on-failure

        delay: 5s

        max_attempts: 5

        window: 30s

    networks:

      - predix-edge-broker_net


networks:

  predix-edge-broker_net:

    external: true
```

config.json

The following sample configuration file can be used to configure the Cloud Gateway to send data to both Predix Time Series and Predix Event Hub.

In this example, data received from the Predix Edge Broker on the MQTT topic `timeseries_data` will be ingested into the Time Series instance with Zone ID `xxx-xxx-xxx`. Data received from the MQTT topics `eventhub_data/osipi_data`, `eventhub_data/opc_ua_data`, `eventhub_data/modbus_data`, and `eventhub_data/egd_data` will be published to the Event Hub topic `topic` in the Event Hub instance with Zone ID `yyy-yyy-yyy`.

```json
{
    "blocks": {
        "time_series_sender": {
            "type": "timeseries",
            "config": {
                "log_name": "time_series_sender",
                "log_level": "debug",
                "mqtt": {
                    "transport_addr": "mqtt-tcp://predix-edge-broker",
                    "qos": 2,
                    "client_id": "time_series_sender_mqtt_client",
                    "topics": [
                        "timeseries_data"
                    ]
                },
                "store_forward": {
                    "policy": "store_on_failure",
                    "max_store_percent": 15,
                    "max_batch_interval": 1000
                },
                "timeseries": {
                    "transport_addr":
"wss://gateway-predix-data-services.run.aws-usw02-pr.ice.predix.io/v1/stream/messages",
                    "predix_zone_id": "xxx-xxx-xxx",
                    "token_file": "/edge-agent/access_token",
                    "proxy_url": "$http_proxy"
                }
            }
        },
        "event_hub_sender": {
            "type": "eventhub",
            "config": {
                "log_name": "event_hub_sender",
                "log_level": "debug",
                "mqtt": {
                    "transport_addr": "mqtt-tcp://predix-edge-broker",
                    "qos": 1,
```

```
                "topics": [

                    "eventhub_data/osipi_data",

                    "eventhub_data/opc_ua_data",

                    "eventhub_data/modbus_data",

                    "eventhub_data/egd_data"

                ]

            },

            "store_forward": {

                "max_store_percent": 60,

                "max_batch_interval": 1000

            },

            "eventhub": {

                "transport_addr" : "event-hub-aws-usw02.data-services.predix.io:443",

                "predix_zone_id" : "yyy-yyy-yyy",

                "token_file": "/edge-agent/access_token",

                "topic_map": [

                    {

                        "eventhub_topic": "topic",

                        "mqtt_topics": [

                            "eventhub_data/osipi_data",

                            "eventhub_data/opc_ua_data",

                            "eventhub_data/modbus_data",

                            "eventhub_data/egd_data"

                        ]

                    }

                ]

            }

        }

    }
}
```

Requesting Support

Prior to contacting GE Technical Support for problems with your Predix Edge Gateway 3002, please have the following information ready:

- Your company name and Customer Service Number (CSN)
- Device ID (Dell Service Tag), found on a black label on the unit
- Purchase date (if known)
- Description of the problem/issue and when it started to occur

Technical Support Options

Website: digitalsupport.ge.com

Table 4. Email Options

Locale	Email	Support Languages
Americas	digitalsupport@ge.com	English
Europe, Middle East and Africa	digitalsupport.emea@ge.com	English, French, German, Italian, Czech, Spanish
Asia Pacific	digitalsupport.apac@ge.com	Chinese, Japanese, English

Resources

- Specifications *(on page 4)*
- Getting Started Guide
- Installation and Operation Manual