SIEMENS

Edge

Edge app
Data Service for Industrial Edge V1.3

Application Manual

09/2021
A5E50591897-AC

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction 1

1.1 Security information

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement - and continuously maintain - a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit:

https://www.siemens.com/industrialsecurity (https://new.siemens.com/global/en/company/topic-areas/future-of-manufacturing/industrial-security.html)

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under:

https://www.siemens.com/industrialsecurity (https://new.siemens.com/global/en/company/topic-areas/future-of-manufacturing/industrial-security.html)

1.2 Note on EU General Data Protection Regulation

Data protection

Siemens observes the principles of data protection, in particular the principle of data minimization (privacy by design). For the Data Service for Industrial Edge product, this means: the product processes/stores the following personal data: The token from Industrial Edge Management to verify authentication.

No private or intimate data is processed or stored.

The above data are required for the login, the billing function and for the internal user administration (administrator can see the role and the status of other users). The storage of data is appropriate and limited to what is necessary, as it is essential to identify the authorized

operators. The data needs to be maintained manually by you and if necessary, these can also be deleted. If you need support, please contact customer support.

The above data will not be stored anonymously or pseudonymized, because the purpose (identification of the operating personnel) cannot be achieved otherwise.

The above data is protected against loss of integrity and confidentiality by state-of-the-art security measures.

1.3 Security Information for Industrial Edge Apps

Security information (assumptions/constraints) for Industrial Edge Apps is as follows:

- Only authorized internal operators will have access to Industrial Edge Device within a secure network using VPN connection.
- Perimeter firewall configuration responsibility lies with the end customer.
- The security guidelines for usage of USB Flash Drives in the shop floor area are applied accordingly.
- Creating users with appropriate access rights upon commissioning is the responsibility of the operator.
- The customer is responsible for configuring the application on the basis of the system requirements and technical capabilities of the documented App according to the Installation / User Manual such that the automation system performance is not impacted.
- The system is installed in an environment ensuring that physical access is limited to authorized maintenance personnel only. Managing unauthorized attachment of removable devices is the responsibility of the operator.
- The platform including hardware, firmware and operating system is securely configured and maintained by the operator.
- The operator is capable of protecting the environment from malware infection.
- Centralized IT security components (Active Directory, Centralized IT Logging Server) are provided and well secured by the operator and are trustworthy.
- The operator personnel accessing the system is well trained in the usage of the system and general information security aspects like password handling, removable media, etc.
- The operator is responsible for the CIA (Confidentiality, Integrity and Availability) of data stored outside the Industrial Edge Device.
- The operator is responsible for configuring the CPUs with appropriate read/write access levels (legitimization), and for configuring the Industrial Edge Apps using appropriate passwords for data collection from CPUs.
- The customer takes care about the time synchronization of Industrial Edge Management and Industrial Edge Device.

1.4 Overview of Industrial Edge

Siemens Industrial Edge is the next generation of digital automation. With Industrial Edge, you use intelligence and scalability of the cloud directly in your manufacturing - in a simple, high-performance manner and without your data leaving the manufacturing process. Industrial Edge combines local and high-performance data processing directly in automation with the advantages of the cloud: app-based data analysis, data processing and Infrastructure-as-a-Service concepts with central update functionality. In this way, you can quickly integrate apps into manufacturing and manage them with a high degree of automation.

Industrial Edge gives you the opportunity to continuously make changes to your automation components and plants, analyze large volumes of data in automation to realize innovative functions, such as preventive maintenance, and to obtain maximum flexibility and thus productivity over the entire machine life cycle.

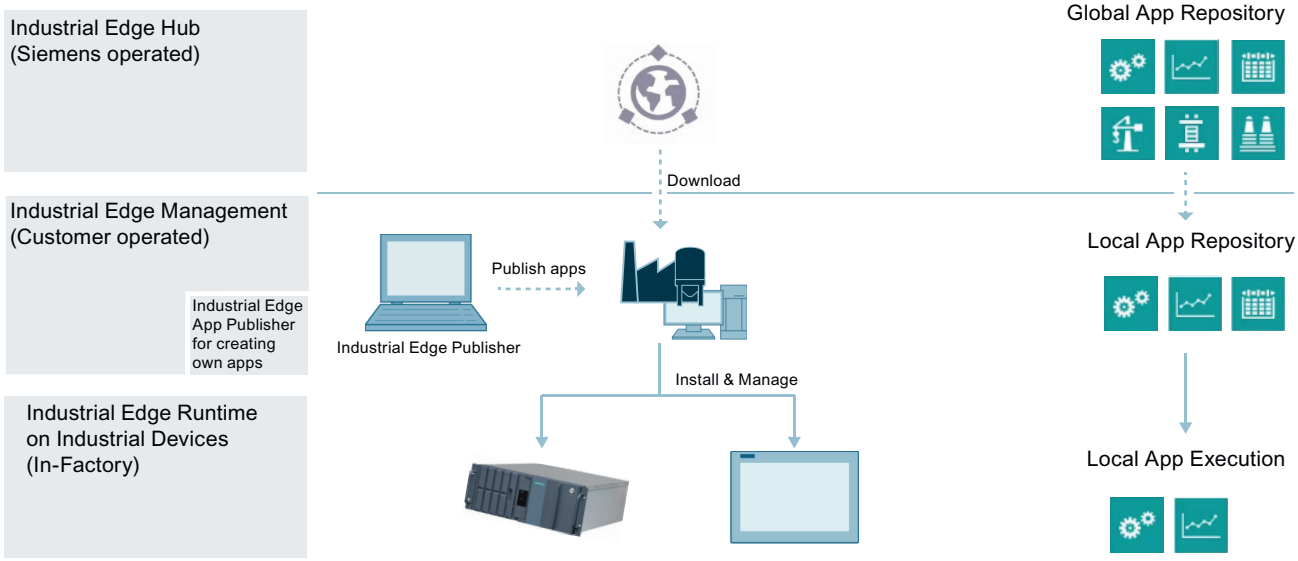
With the Industrial Edge Hub, an App Store is available to you where you can find all Siemens apps and 3rd-party apps. From here, you can manage all licenses for your apps and devices centrally and install updates for security issues, device firmware, apps and Industrial Edge Management.

You can monitor and manage distributed Edge devices centrally in the Industrial Edge Management. In this way, new apps and software functions, for example, can be installed on all connected Edge devices company-wide. Central software management thus minimizes the workload for performing maintenance and updates on individual devices.

On the individual Industrial Edge devices, you can start and run apps and keep statistics on an Edge device, for example.

With the Industrial Edge Publisher, you can develop your own Edge apps and make them available to other users in Industrial Edge Management.

Another component of the Industrial Edge ecosystem is Industrial Edge Runtime, which is installed on Edge Devices (IED) or Unified Comfort Panels (UCP) and on which the system, including all applications, ultimately runs.



Industrial Hub

Central portal for purchasing software and apps and to monitor deployed Management Systems

- Maintain a centralized repository of apps for company-wide standardization
- Manage all used licenses across your installations to better predict costs
- Overview all Management System instances across the globe

Industrial Edge Management

Centralized control plane to manage all devices, applications, and users of a shopfloor

- Deploy the right apps to the right Edge Devices (globally distributed).
- Define governance and specify which person is allowed to do which actions (e.g. app deployment).
- Schedule app and security updates with few clicks.
- Supervise all of your operations with a centralized admin view
- Best usability for IT- and OT-users to increase broad adoption and enable self-service.

Industrial Edge Runtime on Industrial Devices

A software layer to execute containerized applications

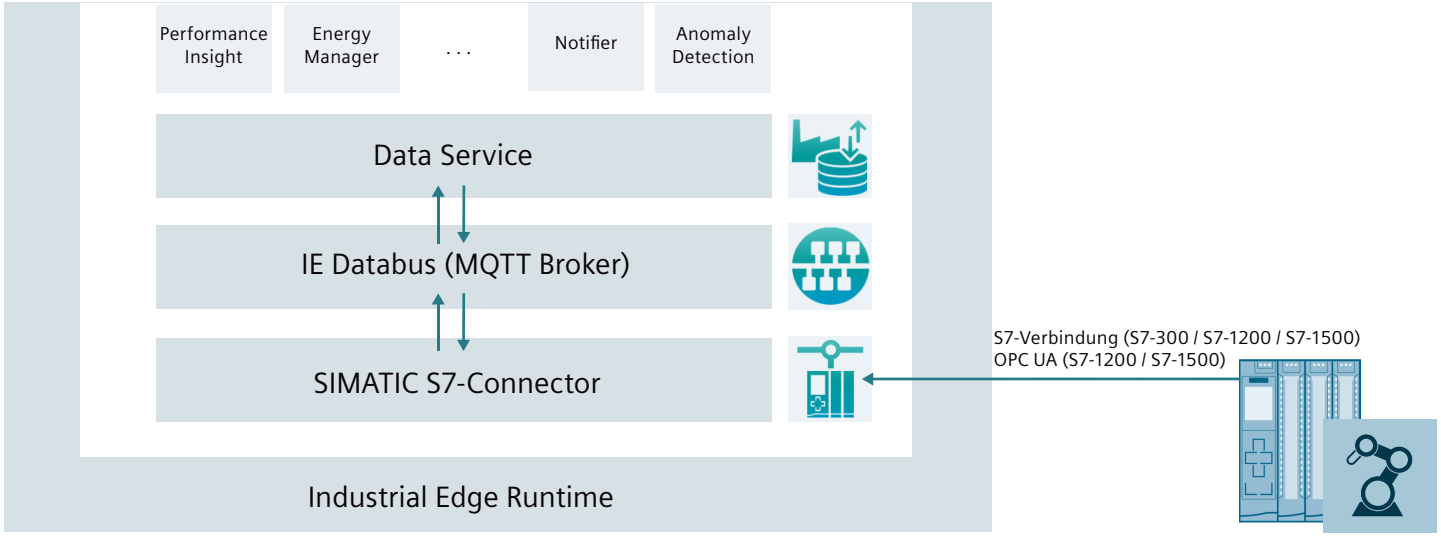
- Run apps in a scalable way on many Edge Devices.
- Tailored to fit in industrial environments by
  - ensuring security and reliability
  - providing a full user management to fulfill machine builder and plant operator business relationships
  - Complying with company policies e.g. user-management integration or IT/fireall rules (w. reverse-proxy)
- Integrated device connectivity to automation and cloud systems.

1.5 Function overview

Using the Data Service app, you connect other apps, such as the Performance Insight, to the IE Databus (MQTT Broker) or to a Unified Comfort Panel (Open Pipe). In the Data Service, you can group the data and save it for a certain time. The IE Databus receives the data directly from the plant with the aid of adapters, such as an S7 Connector.

In the Data Service, the metadata topic is read out from the IE Databus; variables can then be created based on this metadata.

You can model the structure of your industrial process using assets and aspects and divide it into logical units, for example, one asset per machine.



Definition of an asset

An asset is a digital representation of a machine or automation system with one or more automation units (e.g. PLC).

The data that describes an asset is collected and transferred. The data is then made available for further processing and evaluation.

Definition of an aspect

An aspect is a mechanism for data modeling of assets. Aspects group related data points (topics) based on their logical assignment.

Example: A machine has an "Energy consumption" aspect that contains the datapoints "Performance", "Power", "Voltage", etc. The aspect is defined in the Data Service and its name can be freely selected. An aspect can consist of several variables.

Functions of the app

The Data Service app offers the following functions:

- Create and configure assets
- Create aspects and variables for data evaluation
- Link data sources with aspects and variables

Browser recommendation

You require an HTML5-capable Internet browser to run the app.

We recommend the Google Chrome web browser. You should preferably use 1920x1080 resolution.

The app can run on any mobile device with an HTML5-enabled browser. Tablets are recommended.

Internet Explorer is no longer supported as of version 11.

Expiration date of the trial version for the Unified Comfort Panel

The trial version of the Data Service app is free of charge and expires on December 31, 2021. If you want to continue using the app, please order the appropriate license.

1.6 Getting Started

Description

You can find a Getting Started for using the Edge App Data Service here: Getting Started - Data Service (https://github.com/industrial-edge/data-service-getting-started)

You can find a Getting Started for using the Custom Adapter in the Data Service here: Getting Started - Custom Adapter (https://github.com/industrial-edge/how-to-central-data-collection-with-data-service)

Installation 2

2.1 Validity of the documentation

Description

The "Data Service for Industrial Edge" documentation is valid for the installation of the app on an Edge device as well as on a Unified Comfort Panel (UCP).

The differences are highlighted in the respective sections.

2.2 Overview of additional documentation

Overview

The following table lists additional documents that supplement this description, some of which are available on the Internet.

Documentation	Main contents
Industrial Edge Hub (https://iehub.eu1.edge.siemens.cloud)	This page describes the functions of the Siemens Industrial Edge platform (IE Hub) and the functionalities of the Industrial Edge Management (IEM) system.
System overview (https://new.siemens.com/global/en/products/automation/topic-areas/industrial-edge/simatic-edge.html)	This page provides an overview of all Edge solutions.

2.3 System requirements

Note the following system requirements for the installation of the Edge Apps.

Software requirements

The following Internet browsers are required:

- Google Chrome, Version ≥ 72
- Firefox Version ≥ 62

Hardware requirements

- A device on which the Industrial Edge Management (IEM) is running (VM - ISO: Version 1.0.8)
- An Edge device (IED) that is compatible with Industrial Edge Management:
  - IED Model: e.g. SIMATIC IPC 227E Nanobox, SIMATIC IPC 427E or Unified Comfort Panel (UCP)
  - IED Version: ied-os-1.0.0-34-amd64
  - Hard disk: At least 10 GB available
  - RAM: 2 GB available RAM
- The Edge device must be on board the Industrial Edge Management.

IEM, IED, and web browsers must be synchronous in the UTC time zone.

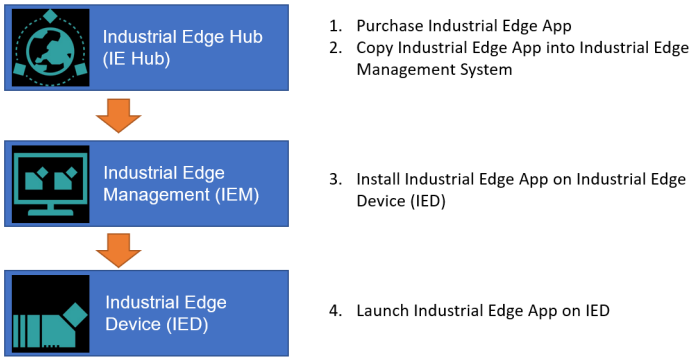
2.4 Installing Data Service on an IED via IE Hub

2.4.1 Overview of the installation process

Description

In the graphic below you can see the steps involved in the installation of an Industrial Edge app on an Industrial Edge device:

Installation process of an Industrial Edge App via Industrial Edge Hub



Note

System app

The Data Service app is a system app, which means you do not need a license. You can copy the app directly in the IE Hub from the "Library" tab to your Industrial Edge Management instance.

Additional information is available here:

1. Copying the Data Service app from the IE Hub to the IEM catalog (Page 13)
2. Installing the Data Service app on the IED (Page 15)
3. Starting the Data Service app on the IED (Page 16)

2.4.2 Copying the Data Service app from the IE Hub to the IEM catalog

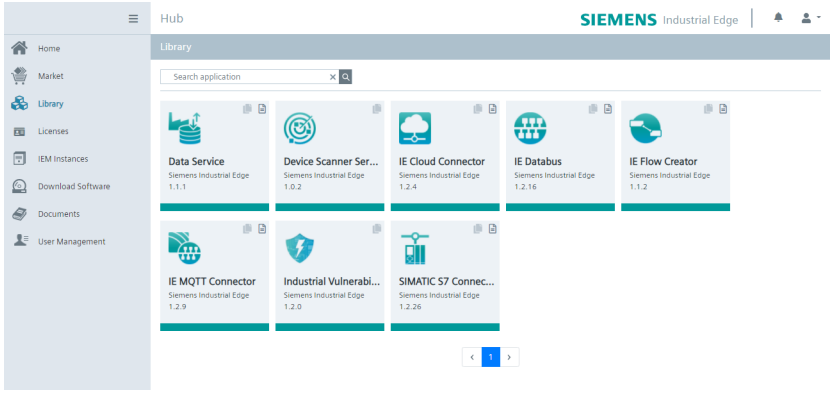
Description

An IEM instance and an Internet connection are required to copy an app into the Industrial Edge Management (IEM) catalog. With this functionality, you can copy the app directly into a catalog of one of your IEM instances.

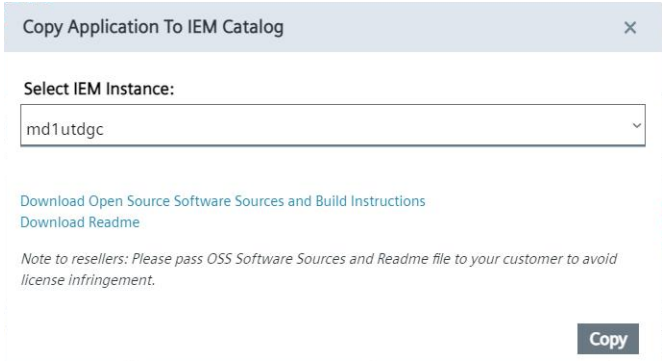
Procedure

To copy an app into the IEM catalog, follow these steps:

1. Open the "Library" tab in the Industrial Edge Hub.



2. Click the icon in the desired app tile.
   The "Copy Application to IEM catalog" dialog box opens:



   The layout of the dialog box depends on whether the app contains links for Open Source Software (OSS) and for the readme. The relevant file is downloaded when you click on one of the links. If the app does not support these links, the dialog box is shown without links.

3. In the "Select IEM Instance" drop-down list, select the IEM instance to which you want to copy the app.
4. Click "Copy".
   The app is copied, and a corresponding job is created. You can follow the status of the job in the status window of the corresponding IEM instance.

User documentation in the IE Hub

In the "Library" tab of the IE Hub, you can jump directly to the Siemens Industry Online Support by using the icon in the tile of an app. There, you can download the user documentation of the respective app.

2.4.3 Installing the Data Service app on the IED

Description

You can install and start the Data Serivce app in the catalog of the Industrial Edge Management (IEM) instance.

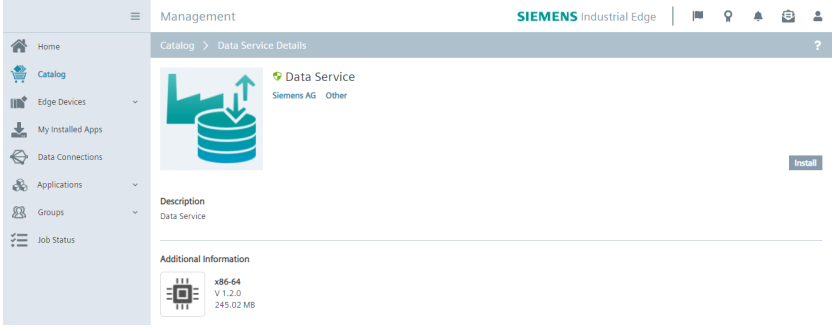
Requirement

- You must be logged into the Industrial Edge Management (IEM).
- The Data Service app was copied to the catalog. You can find additional information here: Copying the Data Service app from the IE Hub to the IEM catalog (Page 13)

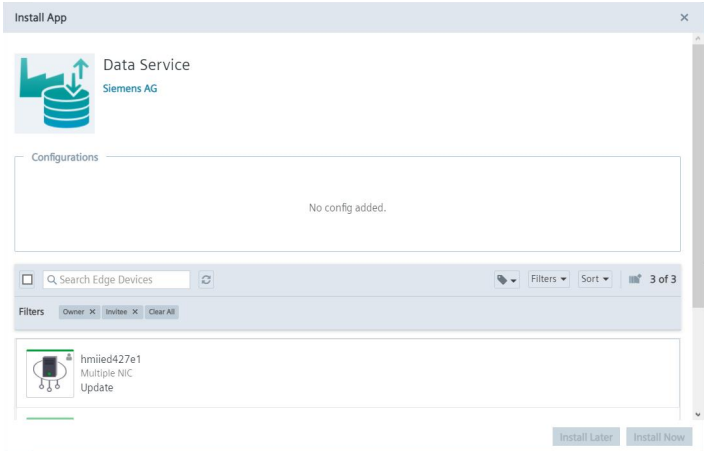
Procedure

To install the Data Service app, follow these steps:

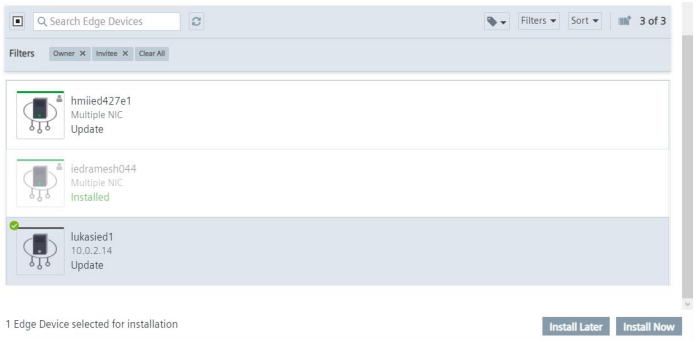
1. Open the "Catalog" tab.
2. Click on the "Data Service" tile.
   The following dialog box opens:



3. Click "Install".
   The "Install App" dialog window is displayed.



4. You can see a table with all associated IEDs. Select one or more IEDs on which you want to install the app:



5. You have two options to continue:
   - Click "Install Later" to schedule the date and time of the installation.
   - Click "Install Now" to install the app immediately.
     When you click "Install Now", you will receive the following message:
6. Click "Allow".
   The installation of the apps is started on the selected IEDs.

Result

The Data Service app is listed in the "My Installed App" tab.

2.4.4 Starting the Data Service app on the IED

After you have installed the Data Service app on the IED, the app is displayed in the "Industrial Edge Management" in the "My Installed Apps" view.

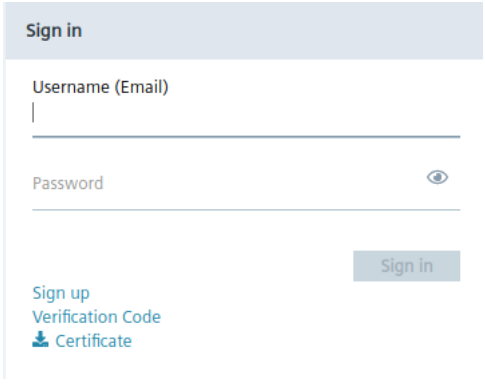
Requirement

The app must be installed on the Industrial Edge Device (IED).

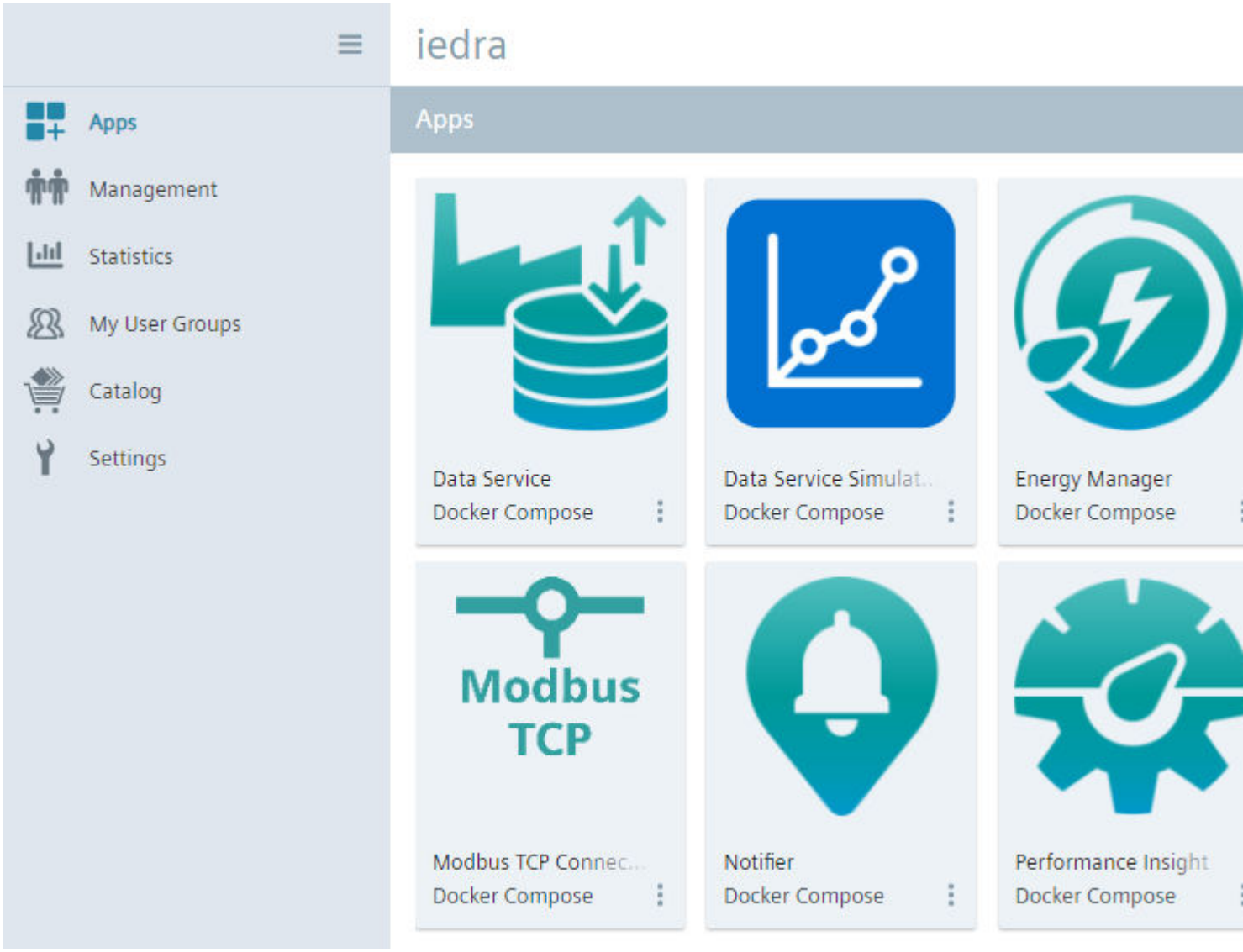
Procedure

To start the Data Service app, follow these steps:

1. Open the start page of the IED by entering the following URL address: "https:\\[IP address of the IED]"
2. Log in with "Username" and "Password":



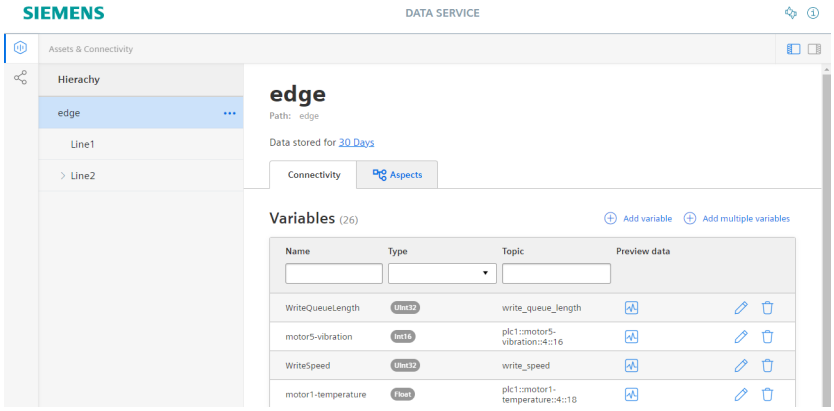
3. Open the "Apps" tab:



4. Click the Data Service tile to open the app in the browser.

Result

The Data Service app opens in the browser:



2.5 Installing the Data Service app on a panel

2.5.1 Downloading and installing the Data Service app

Description

You can install and start the Data Service app on your Unified Comfort Panel (UCP) by downloading the APP files from the Siemens Industry Mall and transferring them to your panel.

Requirement

- You need the APP files of the Data Service app
  With the Data Service app, you model the structure of your industrial process using assets and aspects and create the database for the Performance Insight app, for example.

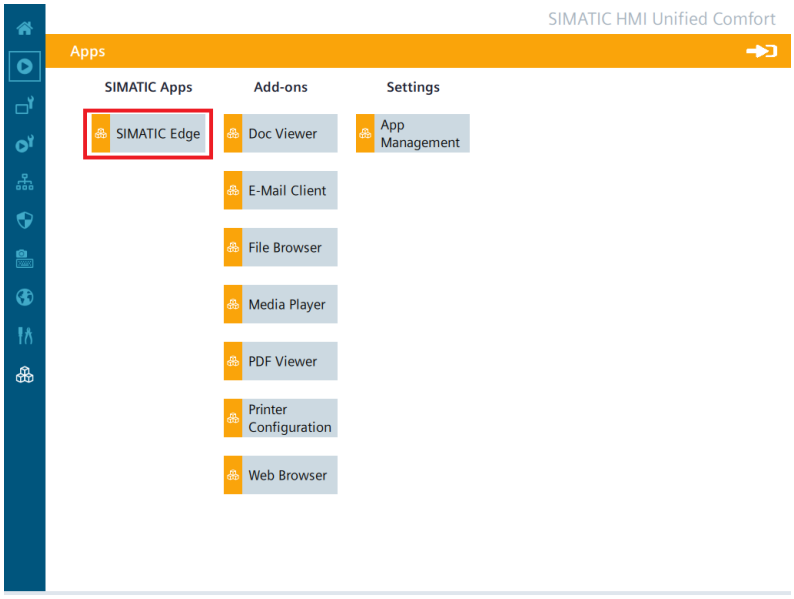
Procedure

To install the Data Service app on your panel, follow these steps:

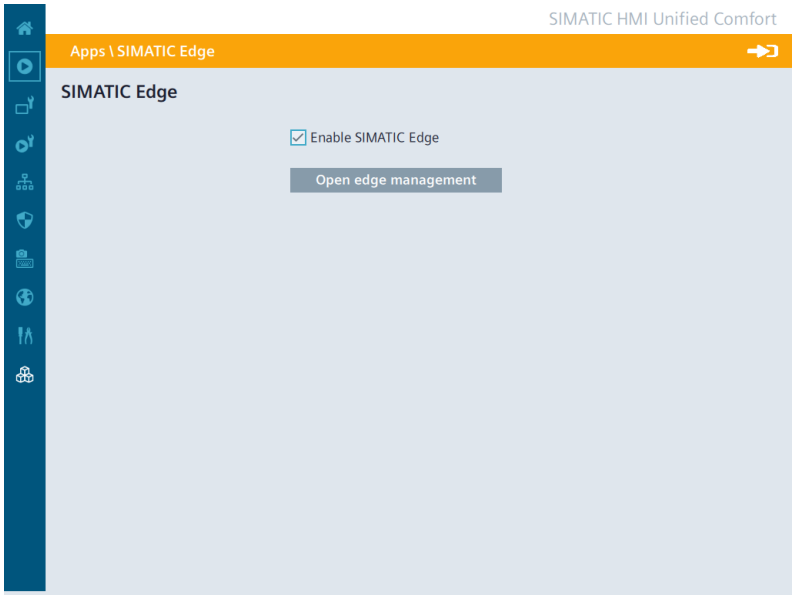
1. Download the app files from the Siemens Industry Online Support (SIOS).
2. Unzip the downloaded ZIP package.
3. Transfer the "DataServicex.x.app" file to your panel, for example, by using a USB flash drive.

4. Click the "Apps" tab or tile on your panel:

5. Click "SIMATIC Edge" under "SIMATIC Apps":

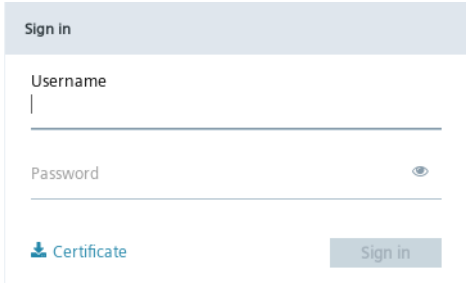


6. Select the "Enable SIMATIC Edge" option and click on "Open edge management":

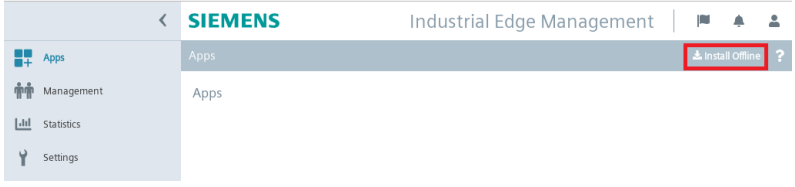


7. Log into the Industrial Edge Management by clicking "Sign in":

8. Log in with "Username" and "Password":



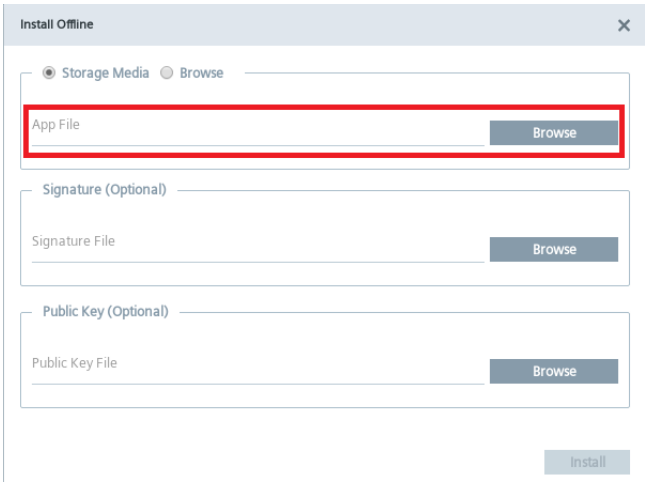
9. Click "Install Offline":



The "Install Offline" window opens.

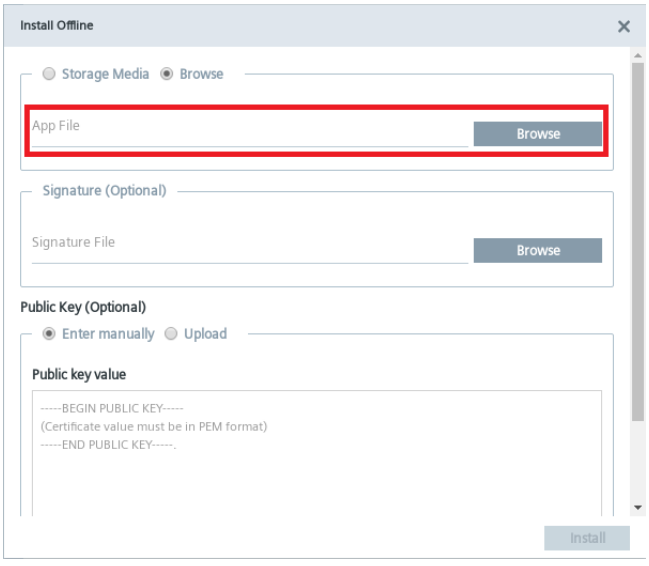
10. You have the following two options for selecting the APP files:

   – If the files on the storage medium, for example a USB stick, then select "Storage Media" and click "Browse" in the "App File" area:



   The storage area on the storage medium opens and you can select the required APP file.

   – If you have copied the files on the storage medium, for example a USB stick, to the system storage on the panel, then select "Browse" and click "Browse" in the "App File" area:

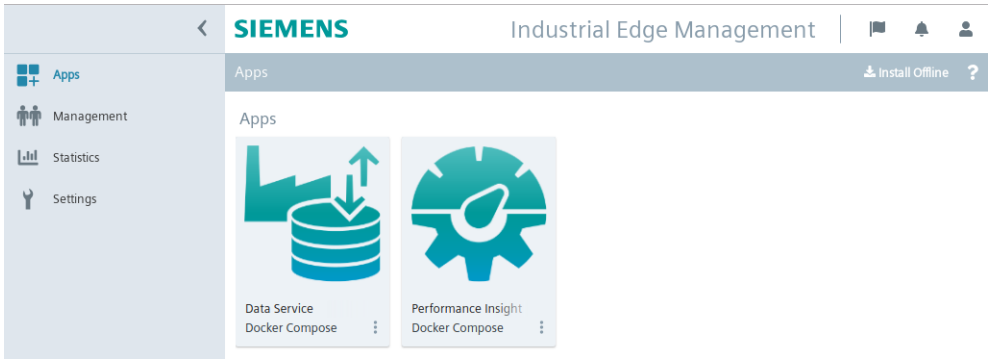


   The system storage of the panel opens and you can select the required APP file.

11. Click "Install".

Result

The Data Service app is installed on the panel:



Structure of the app

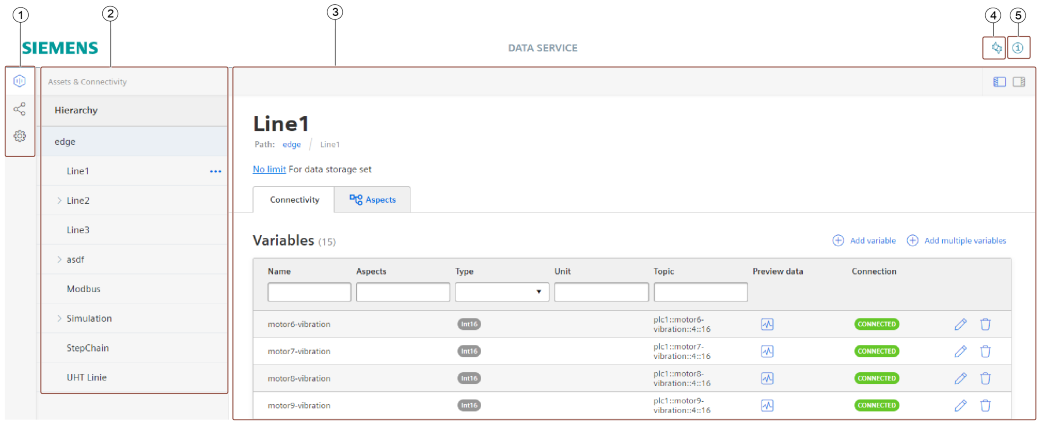
3

Dashboard

The interface of the Data Service app is divided into the following areas:

- (1) Navigation area:
  - Assets & Connection
  - Adapter
  - Settings => Backup and restore settings
- (2) Selection list
- (3) Detail view
- (4) Give feedback
- (5) Further information on the Data Service app

You operate the Data Service by selecting an asset in the selection list, for example, and creating, editing and deleting variables in the "Connectivity" tab:



Note

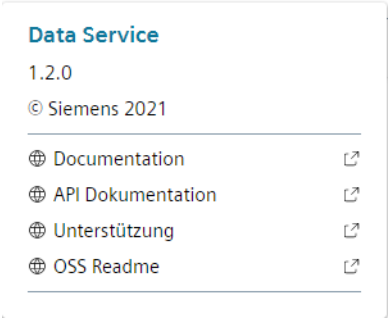
Difference from the view on a panel

On a panel, the topic of the variable is, for example, named as follows:

- plc1::motor4-temperature::4::18 => EITankLevel

Version of the app

Click on the ⓘ icon in the title bar to view the version, copyright, and links to the documentation and to the Industry Online Support:



Quality codes

4

Description

The quality code measures the quality of the connection from a CPU via the adapter to the respective app, for example, Data Service.

There are three different types of qualities:

- GOOD
- UNCERTAIN
- BAD

The Data Service saves all values, regardless of the type of quality, and forwards them to other apps. In the respective apps, the values are then taken into account or ignored according to their quality.

If the quality is GOOD or UNCERTAIN, then the values are taken fully into account in the app.

What does it mean if the value has the quality BAD:

- This value is not taken into account when calculating KPIs, e.g. in Performance Insight or Energy Manager.
- The value is also saved when the raw data is saved in an app.

WinCC UA Standard is used to mark the quality of the values.

From bits 6 and 7 you can read out the quality which a value has. From bits 2 to 5 you can get more information about the quality.

Quality bits 6 and 7

Quality code	Quality	Description
0	BAD	The value is not reliable. You can read out the reasons for this from the bits of sub-status.
1	UNCERTAIN	The quality of the value is worse than usual. It might still be possible to use the value. You can read out the reasons for this from the bits of sub-status.
2	GOOD (non-cascade)	The quality of the value is good.
3	GOOD (cascade)	The quality of the value is good and can be used as a control.

BAD + Sub-status bits 2 to 5

Quality code	Quality	Description
0	Non-specific	There is no information available as to why the value is BAD quality.
1	Configuration error	The value is not useful due to some inconsistencies in the configuration.
2	Not connected	The value is not reliable because the connection to the provider, e.g. to the CPU, was terminated.
4	Sensor failure	The value is not meaningful because it cannot be converted.
5	No communication, with last usable value	The value is not meaningful because communication with the data source has failed. However, the last known value is available.
6	No communication, no usable value	The value is not meaningful because communication with the data source failed or was not set up.
7	Out of service	The value is not reliable because the provider is not active.

UNCERTAIN + Sub-status bits 2 to 5

Quality code	Quality	Description
0	Non-specific	There is no information available as to why the value is UNCERTAIN quality.
1	Last usable value	The connection to the data source still exists, but the data source no longer updates the value.
2	Substitute value	A predefined value is used because the value is invalid due to communication problems.
3	Initial value	A predefined value is used.
5	Range violation	The value is outside the specified limits (min/max values)
6	Sub-normal	A value derived from multiple values has less than the required number of good sources.

Connecting adapters 5

5.1 Overview

Description

Using the adapters, you can, for example, transfer measured value series of selected data points from an automation system to the Industrial Edge Runtime of the respective Industrial Edge Device (IED). The Industrial Edge Runtime sends this data to the Industrial Edge Databus (IE Databus). You can then use the data collected via the IE Databus and Data Service for your Industrial Edge apps, such as Performance Insight, or other applications.

For this purpose, the Data Service subscribes to the metadata of the PROFINET IO Connector, for example, to know the possible tags that the adapter provides. After reading the metadata, the Data Service offers the available tags when creating a variable. The Data Service stores all created variables and makes them available to other apps as a database.

The following adapters are available by default:

- Ethernet IP Connector
- HMIRuntime-Adapter (Unified Comfort Panel)
- Modbus TCP Connector
- Profinet IO Connector
  You can find more information about the documentation here: PROFINET IO Connector (https://support.industry.siemens.com/cs/ww/en/view/109793251)
- SIMATIC S7 Connector
  You can find more information about the documentation here: SIMATIC S7 Connector (https://support.industry.siemens.com/cs/document/109795606/simatic-s7-connector-configurator-?dti=0&pnid=28189&lc=en-WW)
- Simulation Connector
- System Info
  The System Info adapter can be used to save metrics (such as CPU usage, RAM usage, etc.) in the Data Service to monitor it and to have more data available for troubleshooting in the event of an error.
- UnifiedonEdge

Variables of the System Info adapter

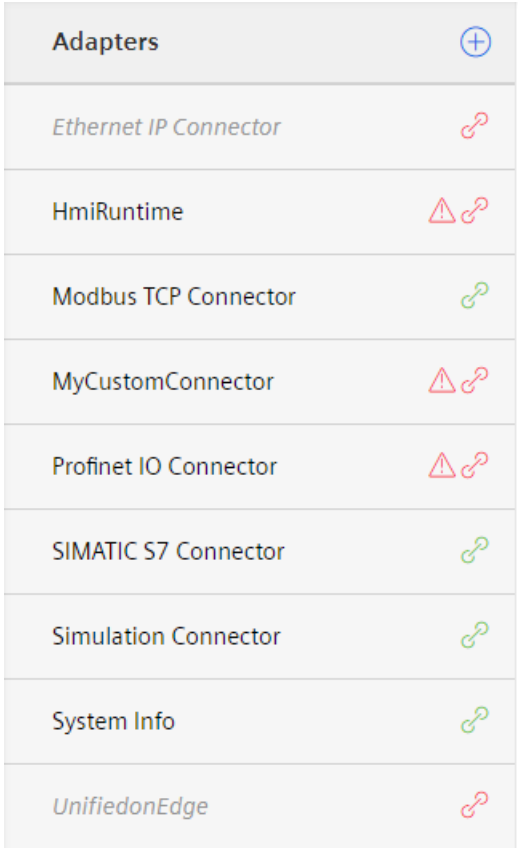
The System Info adapter offers the following variables:

Name	Description
CPU statistics	
CPUUsage	The current CPU usage in %. The value range is from 0 to 100.
Heap statistics (RAM usage)	

Name	Description
TotalHeapSize	The RAM (in MB) that is currently reserved by the app.
UsedHeapSize	The RAM (in MB) currently used by the app.
TotalAvailableSize	The RAM that is currently available (not reserved by any app).
App status - Write These variables are used to monitor the internal status of the app while writing data to the database.	
WriteQueueLength	Number of write commands that are waiting in the write queue.
WriteQueueValueCount	Number of values contained in the write commands that are waiting in the write queue.
WriteSpeed	Number of values written to the database. The value is specified in the unit values per second.
WriteInsertCount	Number of SQL insert instructions that are executed per second on the database.
WriteRequestCount	Number of requests to the database per second. A request can contain multiple SQL insert instructions.
App status - Read raw data These variables are used to monitor the internal status of the app when reading raw data from the database. Reading occurs only when client applications, such as Performance Insight, request data.	
ReadRequestQueueLength	Number of read commands waiting in the read queue.
ReadRequestCount	Number of requests to the database per second.
ReadSpeed	Number of values read per second.
App status - Read aggregated data These variables are used to monitor the internal status of the application when reading aggregated data from the database. The following aggregated data can be retrieved directly from the database: average, sum, min, max, first, last, standard deviation	
AggregateRequestQueueLength	Number of aggregate commands waiting in the aggregate queue.
AggregateRequestCount	Number of requests to the database per second.
AggregateSpeed	Number of aggregated values read per second
App status - Database	
DatabaseSize	The currently reserved size (in MB) for the database.

Status and connection of the adapters

You can see from the icons whether an adapter is connected or not:



Symbol	Meaning
	The adapter is connected to the IE Databus or the topic. This means metadata has been received via the metadata topic.
	The adapter has no connection.
	The adapter is connected (status = active), but no metadata is received via the metadata topic.

Adding self-developed adapters

You can use the icon to add adapters you have developed yourself.

Note

User name and password

The user name and password must be configured in the MQTT broker, or in the IE Databus, and then entered in the adapter.

MQTT adapter

The Ethernet IP Connector, Modbus TCP Connector, Profinet IO Connector, SIMATIC S7 Connector and System Info adapters use the "Message Queue Telemetry Transport" (MQTT) protocol. The connection to the MQTT broker must be configured in the Industrial Edge data bus: IE data bus (https://support.industry.siemens.com/cs/document/109795600/industrial-edge-databus-configurator?dti=0&lc=en-DE)

More general information about the MQTT protocol can be found here: MQTT.org (mqtt.org)

HMTIRuntime adapter (Open Pipe Path)

SIMATIC HMI WinCC Unified Open Pipe is an openness concept based on pipe technology for connecting the Data Service to WinCC Unified RT. Compared to Openness RT (ODK), SIMATIC HMI WinCC Unified Open Pipe provides a limited amount of functionality. As a result, the connection code can be written in any programming language that supports pipe technology. Even batch access to the pipe is possible. The available commands let you communicate with WinCC Unified RT using variables and alarms.

For more information, see the WinCC Unified Open Pipe Manual (https://support.industry.siemens.com/cs/ww/en/view/109778823)

5.2 Add adapter (self-developed)

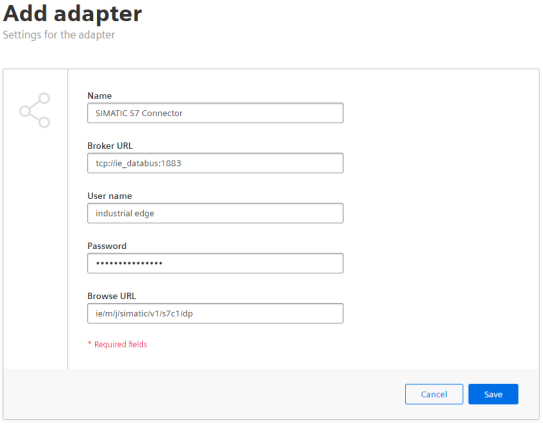
Description

In the "Adapter" tab, you can also add self-developed adapters based on the MQTT protocol.

Procedure

To add an adapter, follow these steps:

1. Click the "Adapter" tab.
2. Click on the ⊕ icon.
   The following view opens:



3. Enter the name.

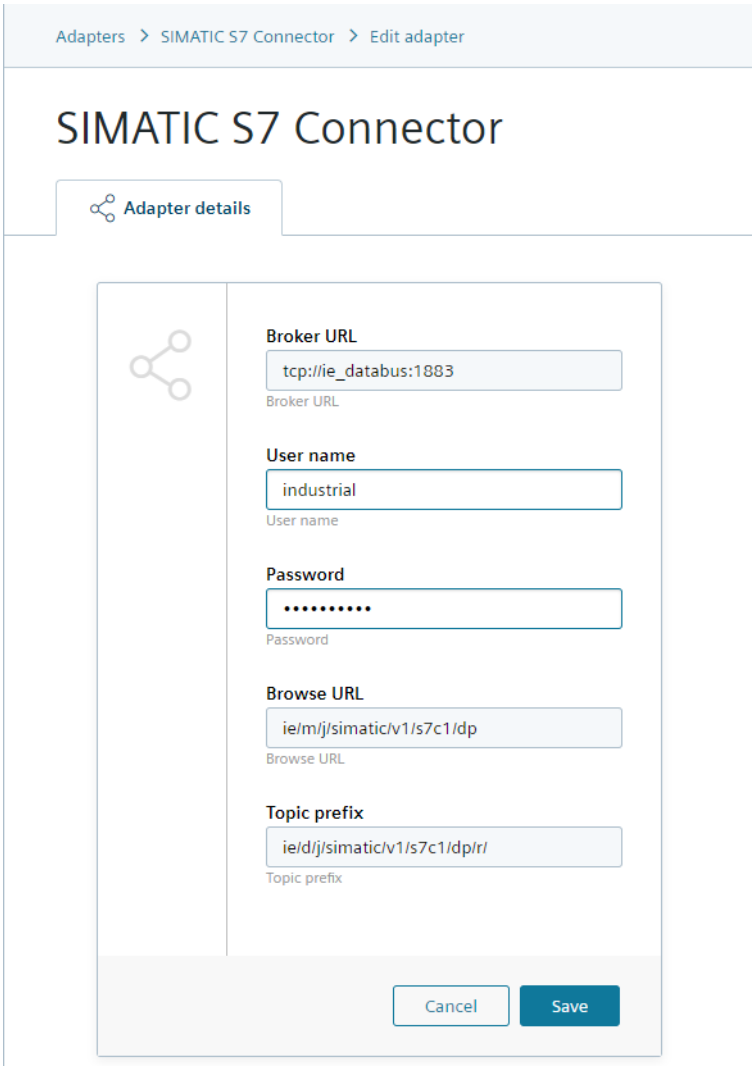
4. Enter the broker URL for data transfer via IE Databus. (MQTT Broker)
5. Enter the user name and password.

Note

User name and password

The user name and password must be configured in the MQTT broker, or in the IE Databus, and then entered in the corresponding adapter and in the Data Service, respectively.

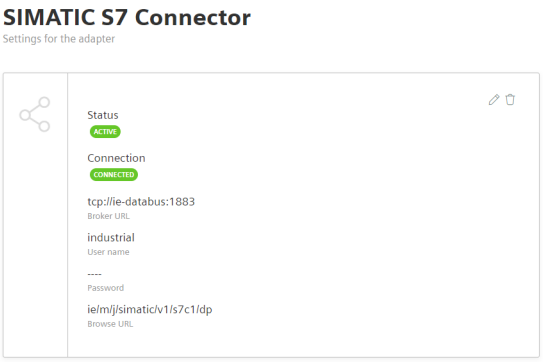
6. Enter the browse URL.
   This is the storage of the metadata; the Data Service needs the information on which tags in which topic are provided by the adapter.
   The information in the "Browse URL" field must match the topic that was configured in the adapter.
7. Click "Save".
8. Click the icon in the detail view.
   The following view opens:



9. Enter the desired "Broker URL".
10. Enter the user name and password and save the setting.

Result

The "SIMATIC S7 Connector" adapter has been added and the connection is activated:



5.3 Activating of deactivating an adapter (default)

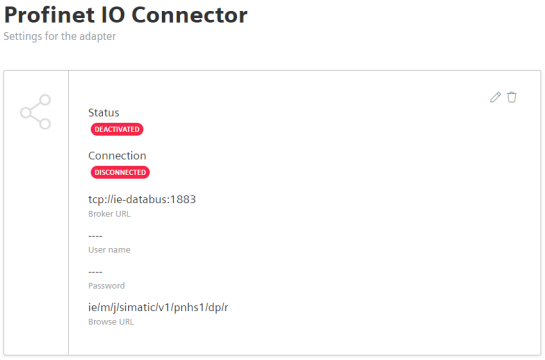
Description

In the "Adapter" tab, you can activate or deactivate existing adapters.

Procedure

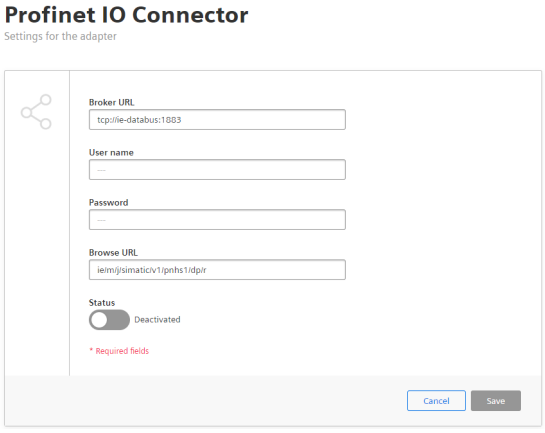
To activate an adapter, follow these steps:

1. In the "Adapter" tab, click on the desired adapter, e.g. Profinet IO Connector.



   In the detail view, the adapter is displayed with the status "DEACTIVATED" and the connection "DISCONNECTED".

2. Click on the ✎ icon.
   The following view opens:



3. Enter the broker URL for data transfer via IE Databus. (MQTT Broker)
4. Enter the user name and password.

   Note

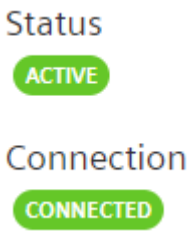
   User name and password

   The user name and password must be configured in the MQTT broker, or in the IE Databus, and then entered in the corresponding adapter and in the Data Service, respectively.

5. Enter the browse URL.
   This is the storage of the metadata; the Data Service needs the information on which tags in which topic are provided by the adapter.
   The information in the "Browse URL" field must match the topic that was configured in the adapter.
6. At the "Status", move the slider to the right to activate the adapter.
7. Click "Save".

Result

The adapter is now activated, and the status of the adapter is displayed in green:



Once the Data Service has successfully received the adapter metadata, the connection turns green, and you can select the appropriate tags when creating variables to save the data.

5.4 Deleting an adapter

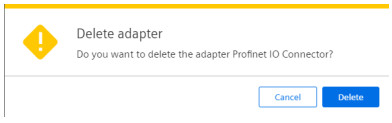
Description

In the "Adapter" tab, you can delete adapters that already exist.

Procedure

To delete an adapter, follow these steps:

1. In the "Adapter" tab, click on the desired adapter, e.g. Profinet IO Connector.
2. Click the icon in the upper right-hand corner.
   The following view appears:



3. Click "Delete".

5.5 Assigning the HMIRuntime adapter (Unified Comfort Panel)

Description

SIMATIC HMI WinCC Unified Open Pipe is an openness concept based on pipe technology for connecting the Data Service to WinCC Unified RT. Compared to Openness RT (ODK), SIMATIC HMI WinCC Unified Open Pipe provides a limited amount of functionality. As a result, the connection code can be written in any programming language that supports pipe technology. Even batch access to the pipe is possible. The available commands let you communicate with WinCC Unified RT using variables and alarms.

For more information, see the WinCC Open Pipe documentation (https://support.industry.siemens.com/cs/ww/en/view/109778823).

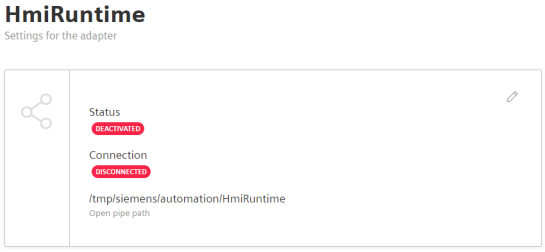
The Data Service connects to the pipe by name:

- Under Windows: "\\.\pipe\HmiRuntime"
- Under Linux: "/tmp/HmiRuntime"

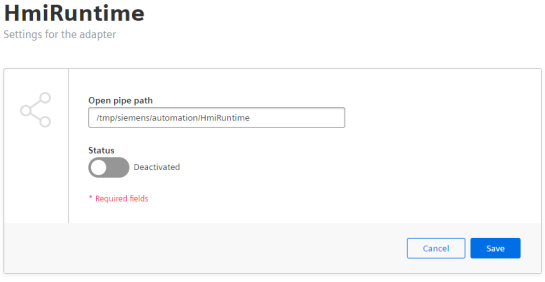
Procedure

To assign an HMIRuntime adapter, follow these steps:

1. In the "Adapter" tab, click the HMIRuntime adapter:



2. Click on the icon:



3. Enter the corresponding open pipe path.
4. Move the slider to the right to activate the HMIRuntime adapter.
5. Click "Save".

Result

As soon as the pipe is open, you can send single line commands that must end with a line break ("\n" or "\r\n"). The response is returned using the same pipe instance.

Creating a system structure (assets)

6

6.1 Creating assets

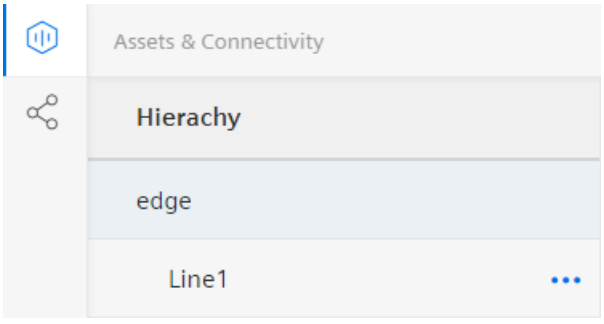
Description

In the "Hierarchy" tab, you can create assets and their child assets. You can use the assets to recreate your system structure and add the corresponding variables.

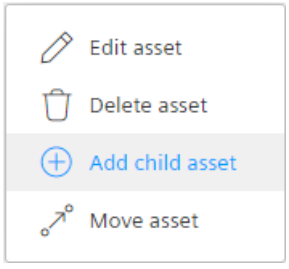
Procedure

To create an asset, follow these steps:

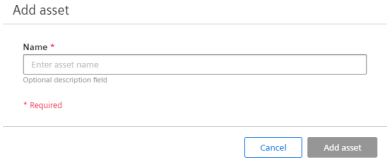
1. Click on the three dots (ellipsis) in the corresponding row:



2. Select "Add child asset" in the selection window that opens:



3. A dialog box is displayed:



4. Fill in the "Name" field of the new asset.
5. Click "Add Asset".

Result

The new asset appears at the correct position in the hierarchy:

Note

Difference from the view on a panel

On a panel, the topic of the variable is, for example, named as follows:

- Variable2 => EITankLevel
- Variable6 => EITemperature

6.2 Moving assets

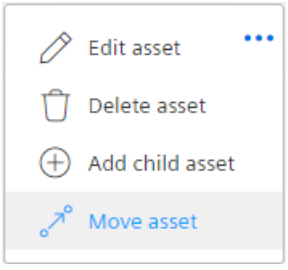
Description

In the "Hierarchy" tab, you can move assets and their child assets in the hierarchy.

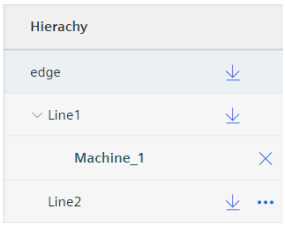
Procedure

To move an asset, follow these steps:

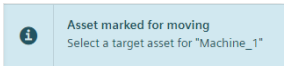
1. Select the asset you want to move. In the example below, "Machine_1".
2. Click on the three dots (ellipsis) in the corresponding row of the selection list.
3. Select "Move asset" in the selection window that opens:



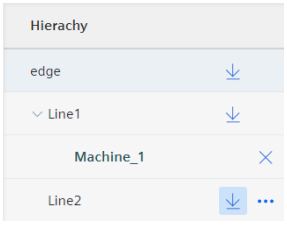
4. All assets to which you can move the selected asset are marked with this blue arrow :



5. A blue information box appears at the bottom left, indicating that the asset can be moved.

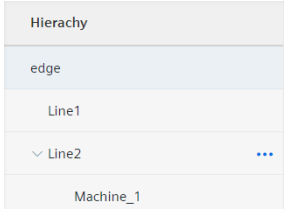


6. Select the target asset and click the blue arrow:



Result

The moved asset is displayed in the desired position:



6.3 Renaming assets

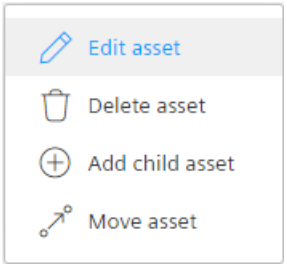
Description

In the "Hierarchy" tab, you can rename assets and their child assets.

Renaming an asset

To rename an asset, follow these steps:

1. Click on the three dots (ellipsis) in the corresponding row of the selection list.
2. Select "Edit asset" in the selection window that opens:



3. A dialog box is displayed.
4. Edit the name or the description of the asset.
5. Click "Update asset".

6.4 Deleting assets

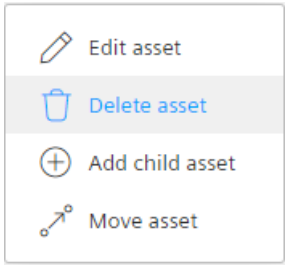
Description

In the "Hierarchy" tab, you can delete assets and their child assets.

Procedure

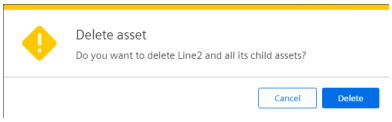
To delete an asset, follow these steps:

1. Click on the three dots (ellipsis) in the corresponding row of the selection list.
2. Select "Delete asset" in the selection window that opens.



3. A warning is displayed.

WARNING
Child assets If you select an asset with child assets, the child assets are also deleted.



4. Click "Delete".

Setting the data retention

7

7.1 Setting data retention for an asset

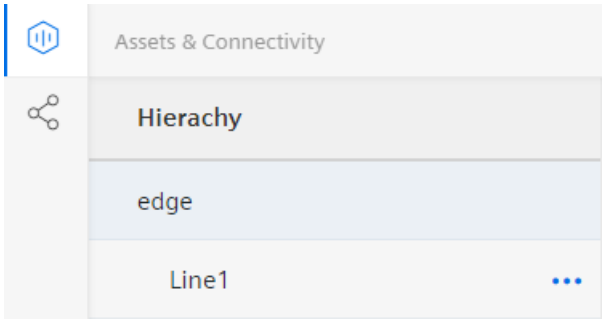
Description

You can set the data retention period for an asset and all of the variables it contains. The data is deleted from the memory after this time.

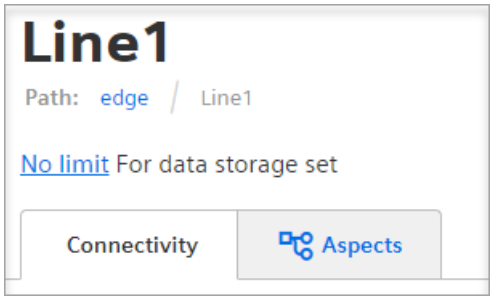
Procedure

To set the time period for the data retention of an asset, follow these steps:

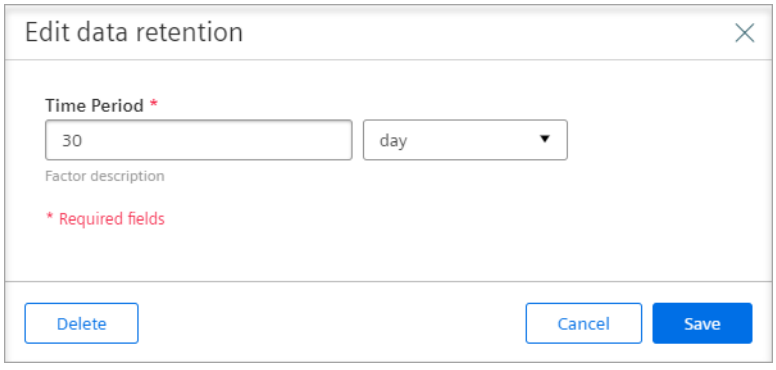
1. Select the corresponding row in the selection list.



2. In the detail view, click on the limit specification in the second row. As long as no data retention has been set the specification is "No limit".



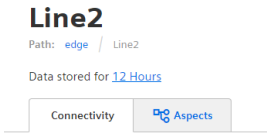
The "Edit data retention" dialog box is displayed:



3. Select a time period. The following options are available: Second, minute, hour, day, week, month, quarter and year.
4. Write the desired number in the "Time period" input field.
5. Click "Save".

Result

The limit information in the detail view is changed. In the example below, "12 Hours".



7.2 Setting data retention for an individual variable

Description

If you do not want to use the data retention period that you have set on the asset for individual variables, you can set a separate time period for each individual variable.

Procedure

To set the data retention for an individual variable, follow these steps:

1. In the detail view, click on the icon in the row of the corresponding variable.
   The "Edit variable" dialog box opens.
2. Enable the "Variable data retention" function under "Use specific data retention for this variable".
3. Set the desired period for the data retention of the variable.
4. Click "Edit variable".

Creating variables

8

8.1 Adding a variable

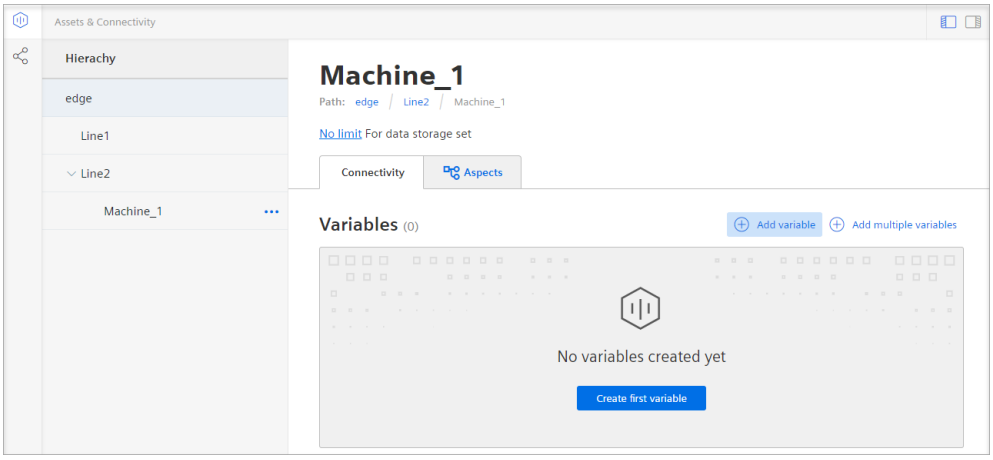
Description

You can add new variables in the Data Service and link them to the desired tag or topic (data point) provided by an adapter.

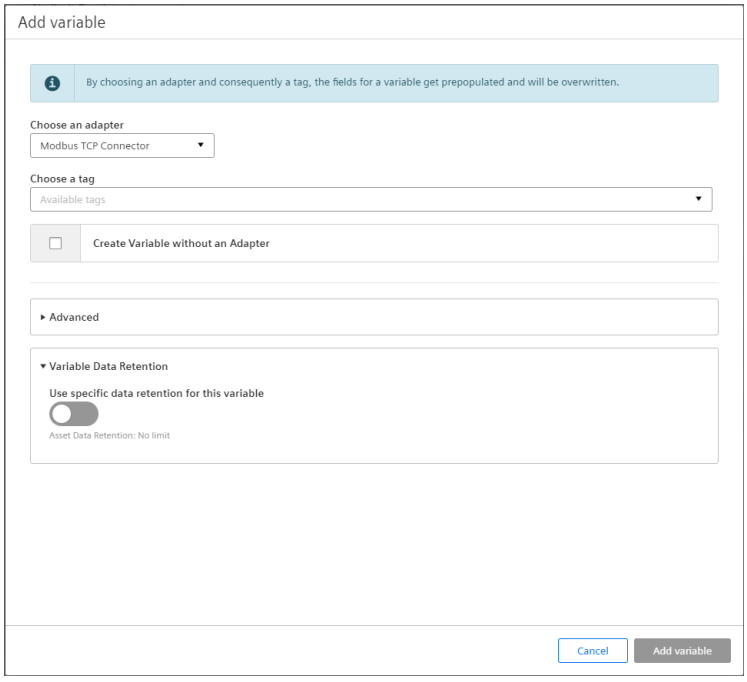
Procedure

To add a variable, follow these steps:

1. In the "Hierarchy" tab, click the corresponding asset.
2. Click on the "Connectivity" tab.



3. Click "Add variable" in the detail view.
   The "Add variable" dialog box is displayed:



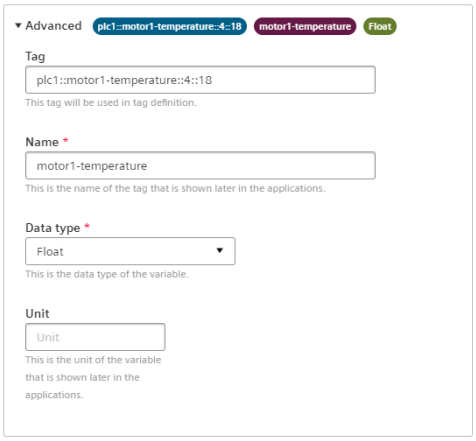
4. Select an adapter.

Note

Adding a variable without adapter

By enabling the "Create variable without adapter" option, you can also add a variable without selecting an adapter.

5. Select a tag or topic.
   Under "Advanced" you can display all information about the selected tag or topic that was transferred from the MQTT broker via metadata:



The types of data that are transmitted via the MQTT broker, e.g. from an S7 CPU, are assigned in the Data Service as follows:

Data type assignment		
MQTT data type		**Data Service data type**
Bool	=>	Bool
SInt	=>	Int8
Int	=>	Int16
DInt	=>	Int32
LInt	=>	Int64
USInt	=>	UInt8
Byte	=>	UInt8
UInt	=>	UInt16
Word	=>	UInt16
UDInt	=>	UInt32
DWord	=>	UInt32
ULInt	=>	UInt64
LWord	=>	UInt64

Data type assignment		
MQTT data type		**Data Service data type**
Real	=>	Float
LReal	=>	Double
String	=>	String
Char	=>	String
TimeSpan	=>	Time

Note

Changing the data type in the Data Service

By default, the data type for a variable is transmitted or assigned via the metadata. You can change the default data type. Make sure that an implicit conversion is possible. Smaller data type can be converted to larger data type.

Implicit conversion:

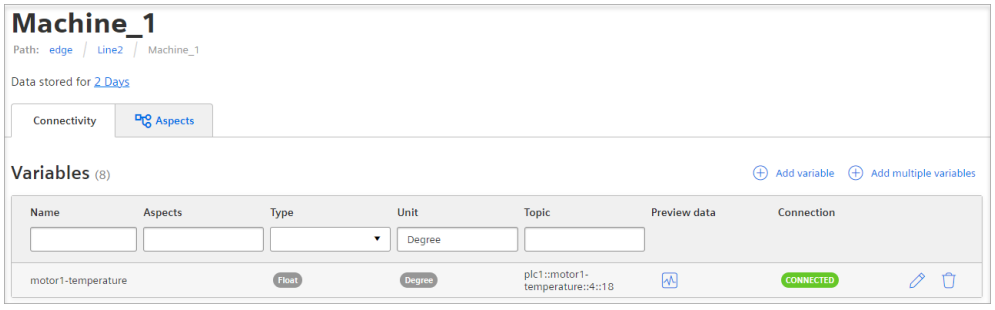
It is only possible to implicitly convert the data type from the topic to the Data Service if no data loss occurs.

The following data types are available for selection: Bool, Integer (Signed und Unsigned; integers), Float (REAL; floating-point numbers), Double (LREAL; floating-point numbers), String (string), TimeSpan (time period)

6. Fill in the "Unit" field.
7. Set the data retention period per variable.
   - If you enable the function "Use specific data retention for this variable", you can define a time period for data retention for each variable.
   - If you do not activate the function, the specified data retention period of the asset will be used.
8. Click "Add variable".

Result

The new variable is displayed in the detail view:



Note

Difference from the view on a panel

On a panel, the topic of the variable is, for example, named as follows:

- plc1::motor2-vibration::4::16 => ElTankLevel

8.2 Adding a variable (Unified Comfort Panel)

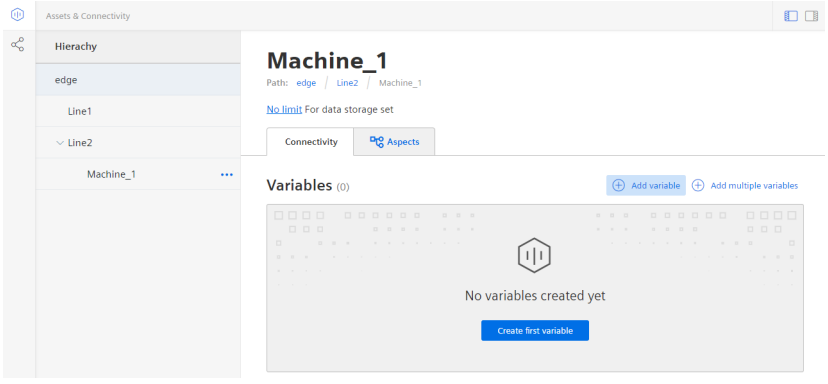
Description

You can add new variables in the Data Service.

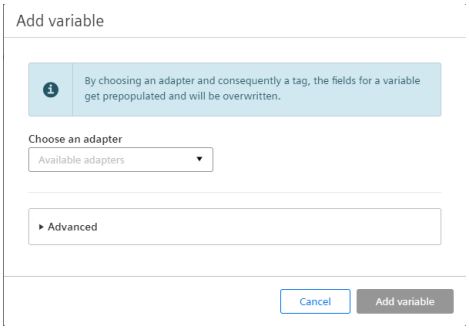
Procedure

To add a new variable, follow these steps:

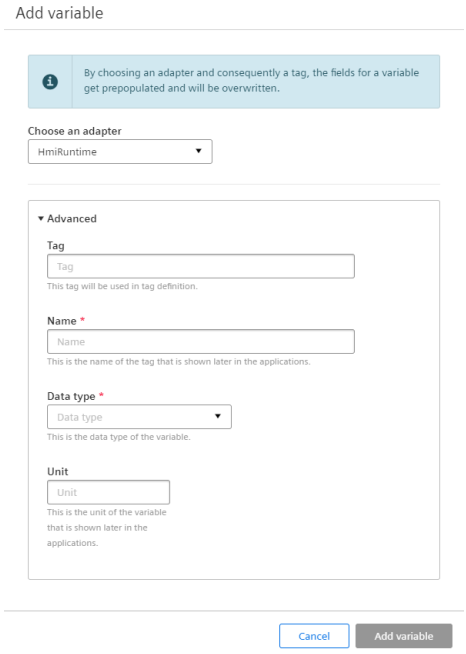
1. In the "Hierarchy" tab, click the corresponding asset.
2. Click on the "Connectivity" tab.



3. Click "Add variable" in the detail view.
   The "Add variable" dialog box is displayed:



4. Select the "HMIRuntime" adapter.



5. Fill in the appropriate information for the variable: Tag, name, data type and unit.
6. Click "Add variable".

8.3 Adding multiple variables at the same time

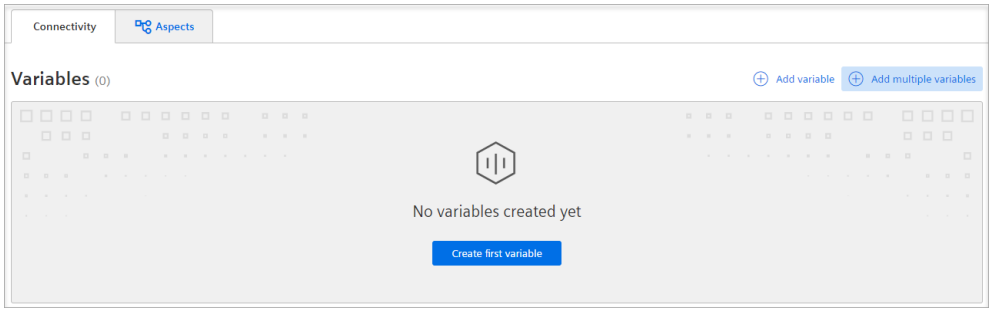
Description

You can also add multiple variables at the same time.

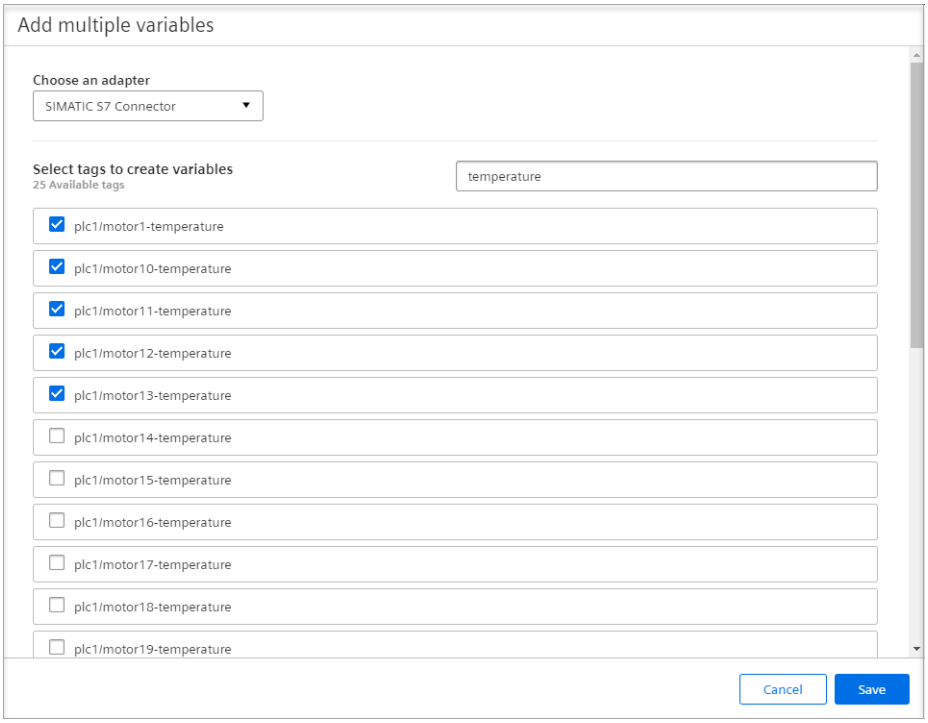
Procedure

To add multiple variables at the same time, follow these steps:

1. In the "Hierarchy" tab, click the corresponding asset.
2. Click on the "Connectivity" tab.

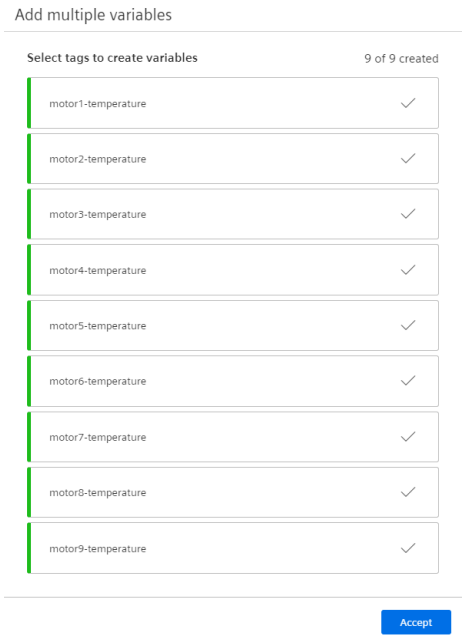


3. Click "Add multiple variables" in the detail view.
   The "Add multiple variables" dialog box is displayed.
4. Select the desired adapter.
   All tags or topics provided by the adapter are displayed:



   You can also filter for variables in the "Search" field.
5. Select all the tags you want.

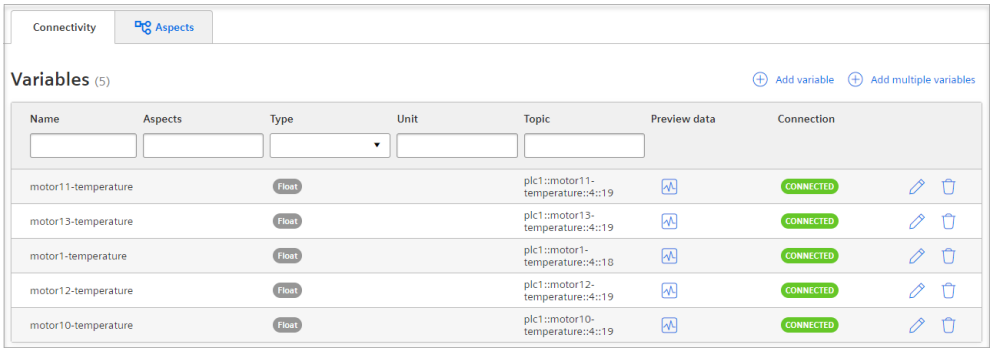
6. Click "Save".
   The "Add multiple variables" dialog box is displayed with all selected tags:



7. Click "Accept".

Result

The added variables are displayed in the detail view:



8.4 Connection status of the variables

Description

Based on the connection status, you can see at a glance if metadata from the IE data bus (MQTT broker) is being transmitted for the variable:

Connection status	Explanation
CONNECTED	The metadata is transferred from the IE data bus (MQTT broker).
DISCONNECTED	No metadata are transferred.

8.5 Displaying the variables preview

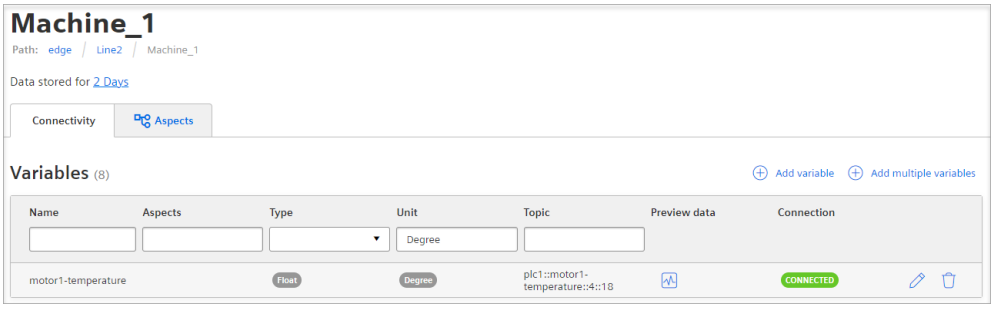
Description

Using the variables preview, you can immediately check whether data is transmitted from the IE Databus.

Procedure

To display the preview, follow these steps:

1. In the "Hierarchy" tab, click the corresponding asset.
2. Click on the "Connectivity" tab.



3. Click the icon in the line of the desired variable.

Result

The preview of the variable "motor3-vibration" is displayed:

You can set the period of the preview and whether you want to see the values aggregated.

8.6 Editing a variable

Description

In the detail view, you can edit already created variables.

Procedure

To edit a variable, follow these steps:

1. In the "Hierarchy" tab, click the corresponding asset.
2. Click on the "Connectivity" tab.
   All created variables are displayed.
3. Click the icon in the line of the corresponding variable you want to change.
   The "Edit variable" dialog box opens.
4. For example, change the assignment to the adapter, the name of the variable, or other settings.
5. Click "Edit variable".

Result

The settings of the variable have been changed accordingly.

8.7 Filtering variables

Description

You can filter the variables of an asset according to various criteria:

- Name
- Aspects
- Data type
- Unit
- Topic

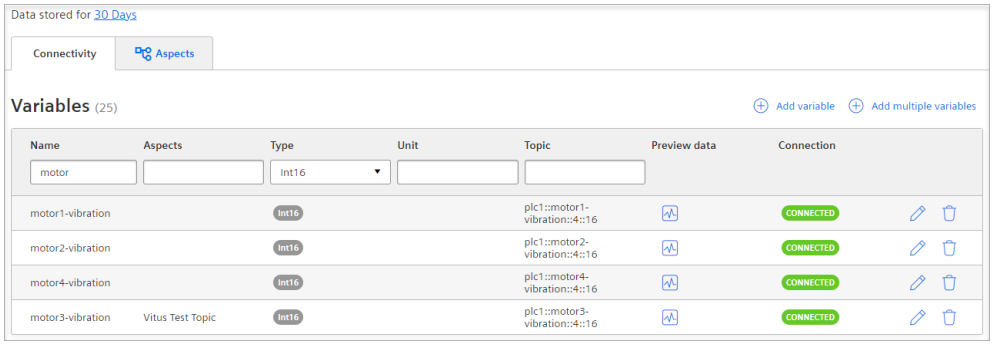
Procedure

To filter the variables, follow these steps:

1. In the "Hierarchy" tab, click the corresponding asset.
2. Click on the "Connectivity" tab.
   All created variables are displayed.
3. Specify one or more filter criteria.

Result

You will only be shown the variables that match the filter criteria you entered. The number in brackets after "Variables" shows you how many variables are actually available on this asset without a filter:



8.8 Deleting a variable

Description

You can delete variables that have already been created in the detail view.

Procedure

To delete a variable, follow these steps:

1. In the "Hierarchy" tab, click the corresponding asset.
2. Click on the "Connectivity" tab.
   All created variables are displayed.
3. Click the icon in the line of the corresponding variable you want to delete.

Result

The variable is deleted.

Creating aspects and grouping variables

9

9.1 Add aspect

Description

You can use aspects to group variables.

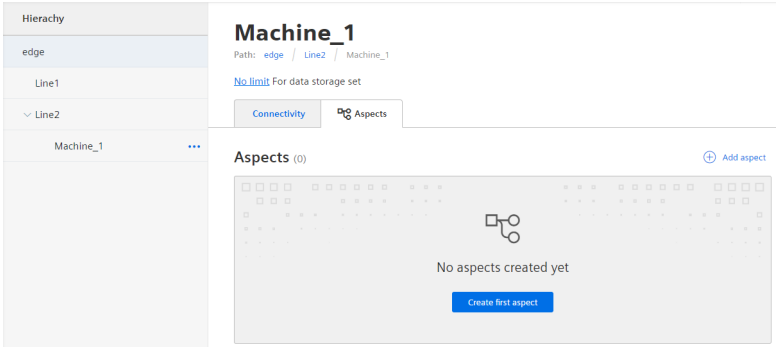
Requirement

At least one variable has already been created for the asset.

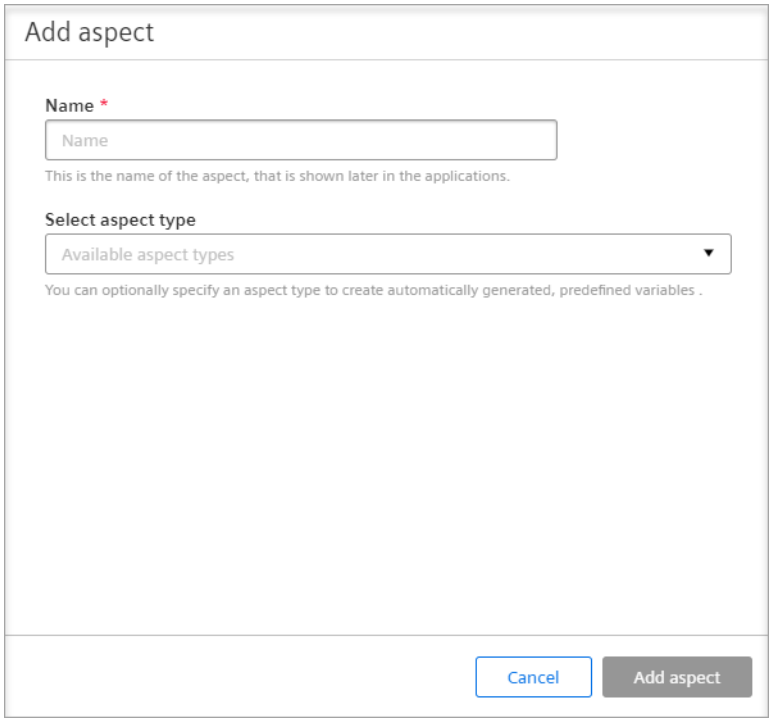
Procedure

To add an aspect, follow these steps:

1. In the "Hierarchy" tab, click the corresponding asset.
2. Click the "Aspects" tab in the detail view.



3. Click "Add aspect" or "Create first aspect".
   The "Add aspect" dialog box is displayed:



4. Enter a name.

Note

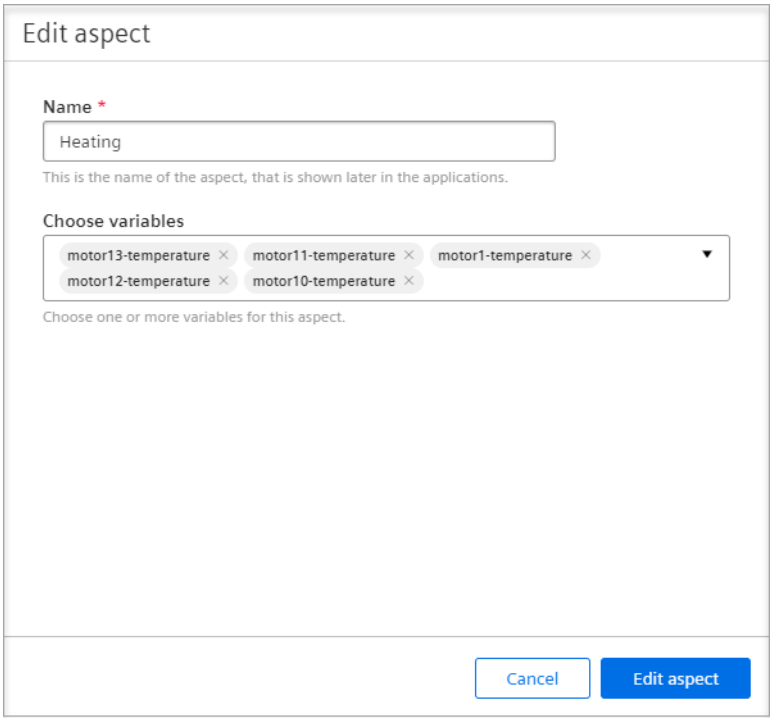
Selecting aspect types

You only need the aspect types if you want to use the sequencer analysis in the Performance Insight app.

To do this, select one of the predefined aspect types from the drop-down list.

5. Click "Add aspect".

6. To assign variables to the created aspect, click "Edit aspect".
   The "Edit aspect" dialog box is displayed:



7. Select one or more of the available variables in the "Choose variables" drop-down list.
   Each variable can be assigned to only one aspect.

Note

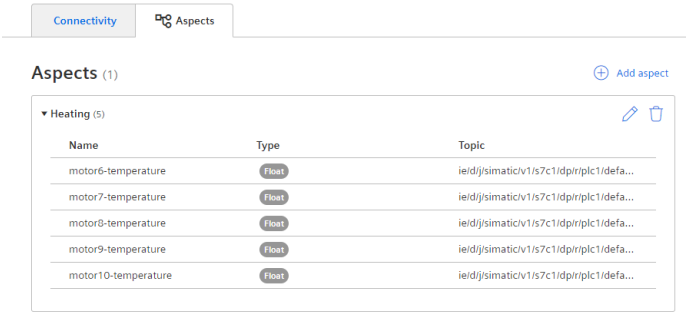
No available variables

If you cannot select any variables, you have not created variables for this asset yet.

8. Click "Edit aspect".

Result

The new aspect "Heating" is displayed in the detail view with all selected variables:



9.2 Adding aspect types for the sequencer analysis (PI)

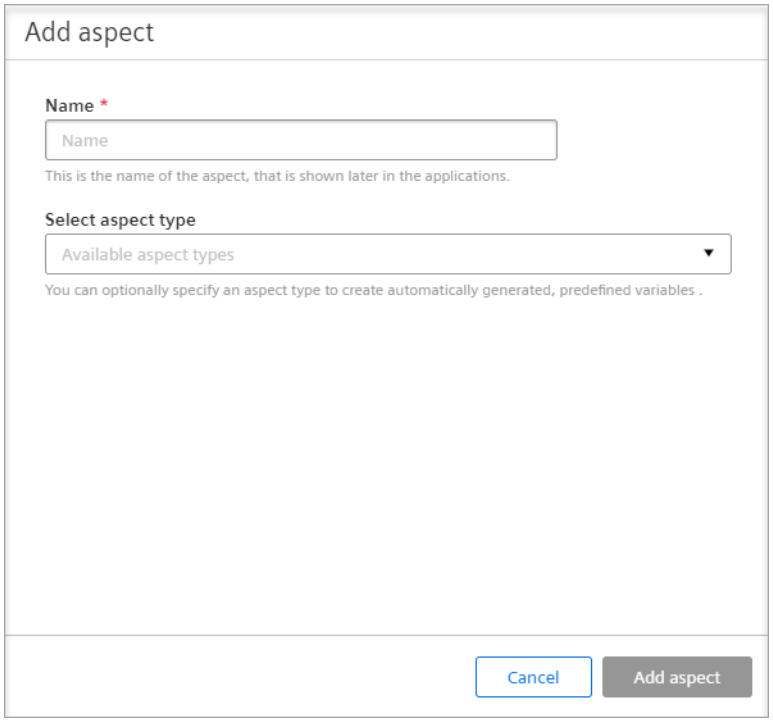
Description

If you want to use the sequencer analysis in the Performance Insight app, you need aspects with predefined aspect types and with permanently assigned variables.

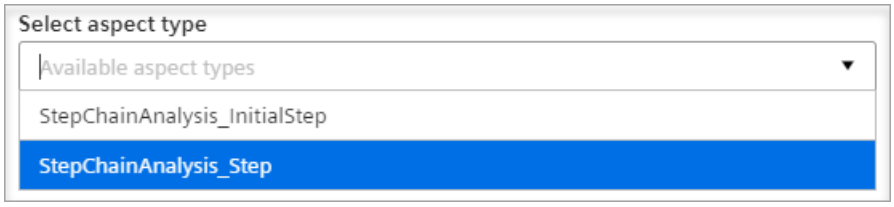
Procedure

To add aspect types for sequencer analysis, follow these steps:

1. In the "Hierarchy" tab, click the corresponding asset.
2. Click the "Aspects" tab in the detail view.
3. Click "Add aspect" or "Create first aspect".
4. The dialog box dialog is displayed:



5. Enter a name.
6. Select one of the two predefined aspect types:



Result

An aspect with the aspect type "StepChainAnalysis_InitialStep" contains two predefined variables:

An aspect with the aspect type "StepChainAnalysis_Step" contains one predefined variable:

Note

Product creation

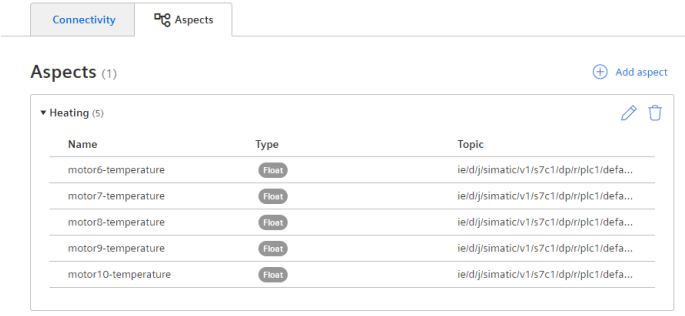
When using the aspect type "StepChainAnalysis_InitialStep", a product is created in the automatic dashboard of the sequencer analysis in Performance Insight. The product name is transmitted via the variable "Product" and can be specified in even more detail in the app using the display name.

9.3 Editing an aspect

Description

You can change the assignment of the variables to an aspect.

In the example, the variable "motor6-10-temperature" is assigned to the aspect "Heating":



Note

Difference from the view on a panel

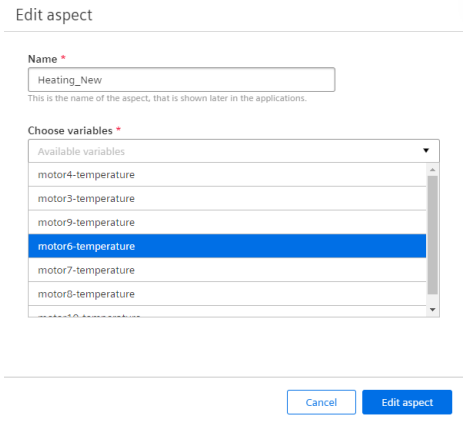
On a panel, the topic of the variable is, for example, named as follows:

- motor6-temperature => EITemperature

Procedure

To assign a variable to another aspect, follow these steps:

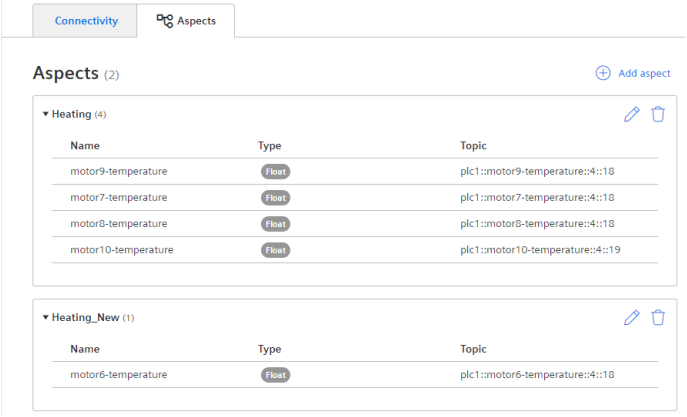
1. In the "Aspects" tab, click the icon next to the desired new aspect in the detail view. The "Edit aspect" dialog box is displayed:



2. Select the variable you want to reassign. In the example, it is the variable motor6-temperature.
3. Click "Edit aspect".

Result

The variable motor6-temperature was moved from the "Heating" aspect to the "Heating_New" aspect:



Note

Assignment of variables

Each variable can only be assigned to one aspect within an asset or subasset.

9.4 Deleting an aspect

Description

In the detail view, you can delete aspects that have already been created.

Procedure

To delete an aspect, follow these steps:

1. In the "Hierarchy" tab, click the corresponding asset.
2. Click the "Aspects" tab.
   All created variables are displayed.
3. Click the icon in the row of the corresponding aspect you want to delete.

Result

The aspect has been deleted.

Backing up and restoring data

10

10.1 Data backup

Description

You can save the configuration and time series data in the Data Service (adapter connections, asset structure, variables, aspects, etc.) and restore it to another IED, for example, or save a backup of your configuration.

Note

Restore backup

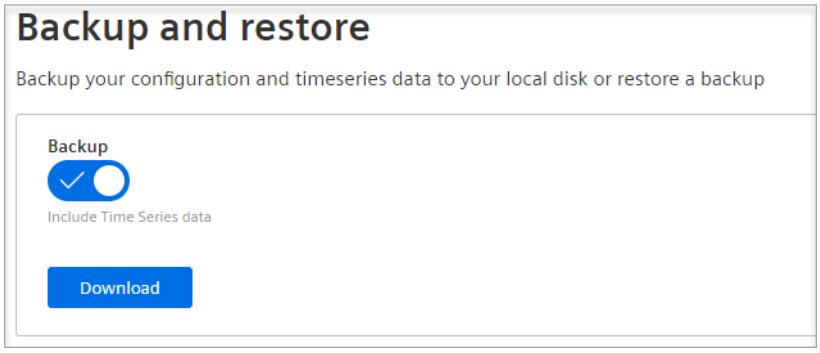
When you restore a backup of your data, only the data that was included at the time of the last backup is restored. Recent changes made in the Data Service after the time of the last backup are lost when the backup is restored.

For this reason, we recommend making regular backups of the data.

Procedure

Proceed as follows to back up the data:

1. In the navigation bar, click on "Settings > Backup and restore".
2. If you only want to back up the configuration files, click directly on "Download".
3. If you also want to save the time series data, enable the function "Include time series data":



4. Click "Download".

5. The data is downloaded locally (in the Downloads folder):
   - For the configuration data: dataservice-backup-config.json
   - For the time series data: dataservice-backup-data.txt

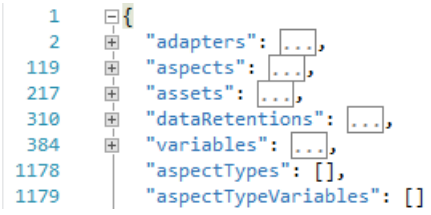
Note
Creating the time series file

It may take a bit longer to create the file.

6. To track the creation process of the files, you can enable the developer tools in the browser (F12 or Ctrl + Shift + I) and open the "Network" tab.

Result

The following data, for example, are backed up in the configuration file:



10.2 Restoring data

Description

You can restore a backup of your configuration or the time series data, or you can fill several other IEDs with the configuration of your Data Service, for example, and therefore do not have to set up any new configurations.

Note
Restore backup

When you restore a backup of your data, only the data that was included at the time of the last backup is restored. Recent changes made in the Data Service after the time of the last backup are lost when the backup is restored.

For this reason, we recommend making regular backups of the data.

Requirement

Existing files:

- For the configuration data: dataservice-backup-config.json
- For the time series data: dataservice-backup-data.txt

Procedure

To upload or restore the configuration data, follow these steps:

1. In the navigation bar, click on "Settings > Backup and restore".
2. Under "Restore backup of the configuration", click on "Select file".
   The selection window opens in the Exporer.
3. Select the file (.json) required for the configuration.
4. Click "Open".
   The file name is displayed.
5. Click "Upload configuration" to upload a configuration file.

   Note

   Data is overwritten

   When you confirm the dialog window, the old data is overwritten.

6. Click "Confirm".

Result

The configuration is restored.

Data Service OpenAPI specification 11

Description

The Data Service OpenAPI specification is a standard for describing REST-compliant programming interfaces (API). With the OpenAPI, you can connect your user-developed app to the Data Service and access the interfaces of the Data Service.

You can find the routes for the Data Service by clicking the ⓘ icon in the title bar under "API Documentation".

The routes remain stable or compatible for at least 1 year. When a route is changed in such a way that existing interfaces have to be adapted (breaking change), this is announced in the OpenAPI specification in the description of the route (deprecated). You have one year to adapt your routes accordingly.

Requirement

The OpenAPI of the Data Service is available in the Industrial Edge Device-wide Docker network "proxy-redirect".

To communicate with the OpenAPI from the Data Service, an app must define this "external" network with the "bridge" driver:

```
networks:
  proxy-redirect:
    external:
     name: proxy-redirect
    driver: bridge
```

Depending on the environment, the Data Service is available there under this URL:

Edge Box: http://edgeappdataservice:4203

Industrial Edge App Publisher

You can find additional information on how to integrate your custom-developed app in Industrial Edge Management here: Industrial Edge App Publisher (https://support.industry.siemens.com/cs/us/en/view/109780392)

Procedure

To set up a connection to the OpenAPI of the Data Service, follow these steps:

1. You can retrieve information, for example, by calling the "getTimeSeries" method.
2. Additional routes can be found in the OpenAPI specification.

Note

Quality of values

If the quality is GOOD or UNCERTAIN, then the values are taken fully into account in the app.

What does it mean if the value has the quality BAD:

- This value is not taken into account when calculating KPIs, for example, in Performance Insight or Energy Manager.
- The value is also saved when the raw data is saved in an app.

Improving performance 12

Description

With the following configuration examples, we can ensure the highest possible performance of the Data Service app:

Write performance

The Data Service app supports 5,000 changes per second. Changes means that a write operation takes place in the database. In the worst case, only one value is written per write operation.

The following scenarios are therefor possible:

- 5,000 variables with a write cycle of 1 s (5,000 * 1,000/1,000 = 5,000 changes)
- 500 variables with a write cycle of 100 ms (500 * 1,000/100 = 5,000 changes)
- 50 variables with a write cycle of 10 ms (50 * 1,000/10 = 5,000 changes)
- etc.

If the values are sent from the adapter in packets, more data can be processed. For example, an adapter sends the values of a variable in packets of 1,000 every second. This means that there is only one write operation per second.

Read performance

The read performance is influenced by many factors. Two examples provide a guide value here:

A variable with a 1 ms write cycle is to be queried over one hour. 1 ms in 1 h = 3.6 million values.

- Aggregated query (e.g. average) = 10 seconds load time
- Raw data query = 30 seconds load time

Database (dashboard configuration in Performance Insight)		
4 counter variables in 1 second resolution		
Widget 1: Chart (diagram)	3 counter variables	No aggregation
Widget 2: Chart (diagram)	3 counter variables	Aggregation: Average
Widget 3: Gauge (pointer diagram)	1st counter variable	Aggregation: Average
Widget 4: Value	2nd counter variable	Aggregation: Average
Widget 5: Heatmap	3rd counter variable	No aggregation

The test runs were performed on a Unified Comfort Panel (UCP) instead (with the minimum hardware equipment).

Load times of the database		
Loading 1 day	10:70 s	777,600 data points
Loading 1 week	58.00 s	5,443,200 data points

Impact of parameters on the test:

Time period		
1 day	10:70 s	777,600 data points
2 days	19:21 s	1,555,200 data points
3 days	28:99 s	2,332,800 data points
4 days	37:09 s	3,110,400 data points
5 days	50:57 s	3,888,000 data points
6 days	61:01 s	4,665,600 data points
7 days	68:00 s	5,443,200 data points
=> Linear influence		

Calculation time period (1 day)		
10 min	11:83 s	777,600 data points
20 min	10:41 s	
30 min	11.03 s	
40 min	11.46 s	
50 min	11.84 s	
60 min	11.68 s	
= has no effect		

Variable cycle (1 day)		
1 s	11.50 s	777,600 data points
2 s	8.50 s	388,800 data points
3 s	4.30 s	259,200 data points
4 s	4.09 s	194,400 data points
5 s	4.23 s	155,520 data points
6 s	3.12 s	129,600 data points
7 s	3.01 s	111,086 data points
8 s	2.52 s	97,200 data points
=> Linear influence		

Aggregation (1 day, all requests use only one specific aggregation)		
Average	3.28 s	777,600 data points
Min	2 s	
Max	2.5 s	
Sum	4 s	
Last	2 s	
Counter	70 s	
Timer	62 s	
=> no influence of the aggregations in the database => major influence of the aggregations in the program code		

Calculation example for data consumption

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Description

You can calculate how many GB of memory are required for which data points.

Calculation formula

The calculation formula is made up as follows:

Number of variables * ValuePerVariable * Data type size

For data types with <= 32-bit values, the data type size is 66 bytes.

And for data types with 64-bit values, the data type size is 70 bytes.

Example

5 millisecond cycle -> 200 values per second

8 hours of storage time -> 200 * (60 * 60 * 8) = 5,760,000 values per variable (5.76 million)

90 integer variables -> 90 * 5,760,000 * 66 = 34,214,400,000 bytes = 32,629 MB = 31,865 GB