SIEMENS

Industrial Edge

App
Data Service Development Kit for Industrial Edge V1.3

Application Manual

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

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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

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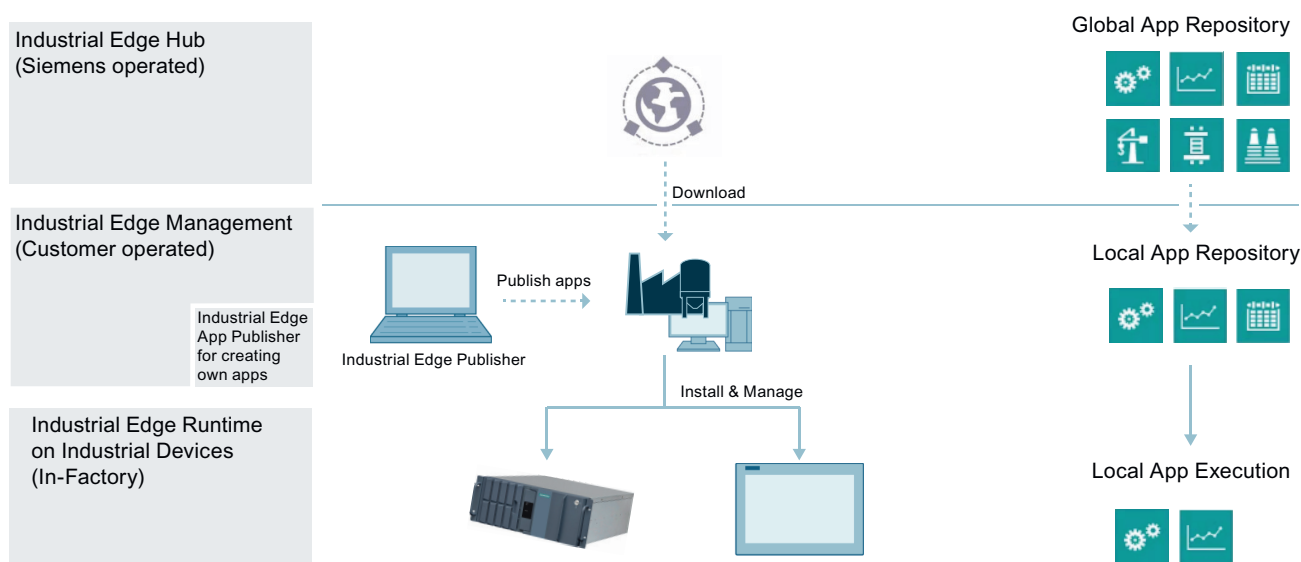
With the Industrial Edge Hub, an App Store is available to you where you can find all Siemens apps and 3rd-party apps. From here, you can manage all licenses for your apps and devices centrally and install updates for security issues, device firmware, apps and Industrial Edge Management.

You can monitor and manage distributed Edge devices centrally in Industrial Edge Management. In this way, for example, new apps and software functions 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 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	Industrial Edge Management	Industrial Edge Runtime on Industrial Devices
Central portal for purchasing software and apps and to monitor deployed Management Systems	Centralized control plane to manage all devices, applications, and users of a shopfloor	A software layer to execute containerized applications
- 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	- 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.	- 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

Description

Using the Data Service Development Kit app you can develop your own apps based on the Data Service and integrate them into the Siemens Industrial Edge Management System.
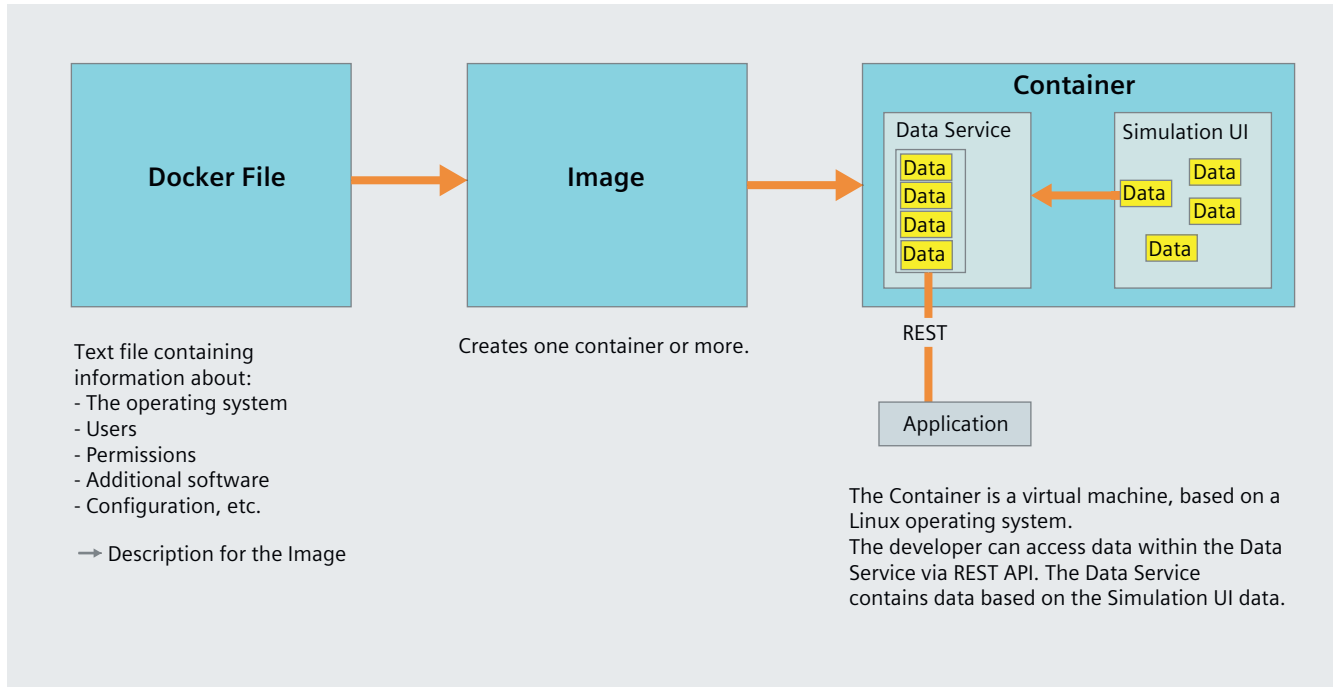
Requirement

- You must be registered in the Siemens Industry Online Support to download the Data Service Development Kit Bundle (SIOS ID 109792717).
  Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/de/view/109792717)

- By default, the data is kept for a maximum of one week.

- Max 20 GB data memory

Docker

Docker simplifies the deployment of apps because defined programs and environments can be transferred to another system with minimal effort.

Docker File

Image

Container

Data Service

Data
Data
Data
Data

Simulation UI

Data
Data
Data
Data

REST

Application

Text file containing information about:
- The operating system
- Users
- Permissions
- Additional software
- Configuration, etc.

→ Description for the Image

Creates one container or more.

The Container is a virtual machine, based on a Linux operating system.
The developer can access data within the Data Service via REST API. The Data Service contains data based on the Simulation UI data.

Explanation of terms

- **Docker file:**
  A text file that describes an image with various commands. These are processed during execution and a single layer is created for each command.

- **Image:**
  A memory dump of a container. The image itself consists of several layers that are read-only and thus cannot be modified. Several containers can always be started from one image.

- **Container:**
  The active instance of an image is referred to as container. This means that the container is currently running and is busy. The container is automatically terminated as soon as the container is not running a program or is finished with its job. As a rule, one application runs per container.

- **Repository:**
  A repository is a set of images of the same name with different tags, mostly versions.

Data Service Development Kit Bundle

You can download the Data Service Development Kit Bundle to your computer from the Siemens Industry Online Support. The bundle includes the following components:

- Docker file: docker-compose.yml
- User documentation
- OpenAPI specification (Page 25)
- Application example (Page 23)

The image is loaded from the Docker Hub:

- Docker image
  – Data simulator
  – MQTT Broker
  – Data Service (with external interface (REST API) for non-Siemens applications)

1.6 Application example - Legal information

Use of application examples

Application examples illustrate the solution of automation tasks through an interaction of several components in the form of text, graphics and/or software modules. The application examples are a free service by Siemens AG and/or a subsidiary of Siemens AG ("Siemens"). They are non-binding and make no claim to completeness or functionality regarding configuration and equipment. The application examples merely offer help with typical tasks; they do not constitute customer-specific solutions. You yourself are responsible for the proper and safe operation of the products in accordance with applicable regulations and must also check the function of the respective application example and customize it for your system.

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Other information

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The Siemens terms of use Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/) shall also apply.

Application example

For additional information on the use of the application example, please visit: Application example (Page 23).

Installation

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Software installation

The following services must be installed:

- Docker (tested with version 20.10.2)
- NodeJS (tested with version 12.18)

Quality codes

<div style="text-align:right">3</div>

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.

Flags				Extended Sub-status				Quality		Sub-status				Limits	
bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

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.

Start Docker Container 4

Requirement

You have downloaded the Data Service Development Kit Bundle from the Siemens Industry Online Support to your computer.

Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/de/view/109792717)

Procedure

To start the Docker container, follow these steps:

1. Open Docker (Docker Compose Solution).

2. Open the "development-kit" folder.
   The following components are contained in it:

   – documentation
     Here you will find, for example, the user documentation and the routes (OpenAPI) for the Data Service.

   – examples
     Here you will find, for example, application examples.

   – docker-compose.yml

   – ...

3. Right-click to call the Docker command line and the "Open in Terminal" menu command.

4. Start the containers by typing: `docker – compose up`
   All service images are downloaded from Docker Hub and launched as defined in the "docker-compose.yml" file. This file specifies which of the services run together, address, communication, etc.

Result

The Docker containers for the Data Service Development Kit have been created.

Use simulation UI

<div style="text-align: right; font-size: 3em; font-weight: bold;">5</div>

Requirement

The Docker containers have been started.

Description

Using the Simulation UI, you can create tags and transfer them to the Data Service via a simulation.

Procedure

To transfer tags to the Data Service, follow these steps:

1. Open a browser.
2. Start the Simulation UI by entering the following address in the browser: `http://localhost:4519` or use the container IP 4519.
3. Add a new aspect:
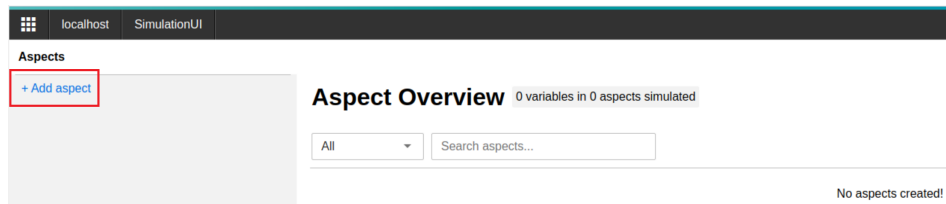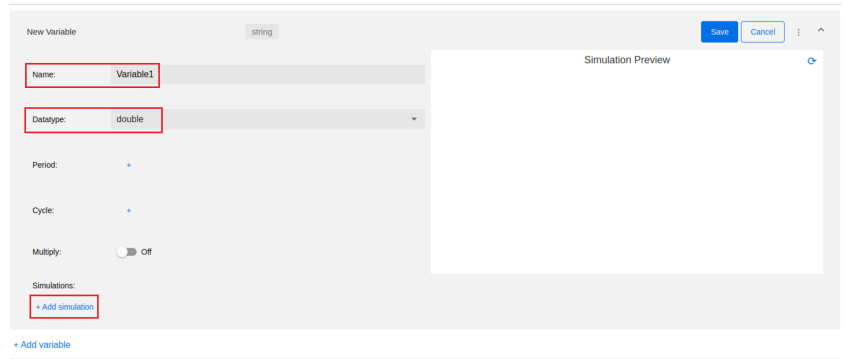
4. Enter the following information:
   – AssetId
   – Period: The period is the length of the repeating pattern.
   – Cycle: The cycle is the frequency of how often the values are generated/written.
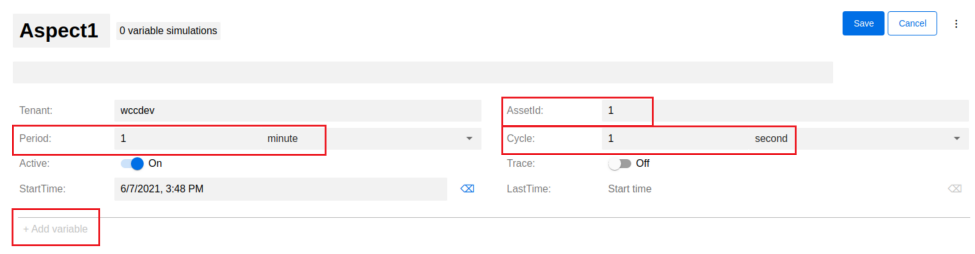
5. Click "Save" (Save).
6. Click "Add variable".
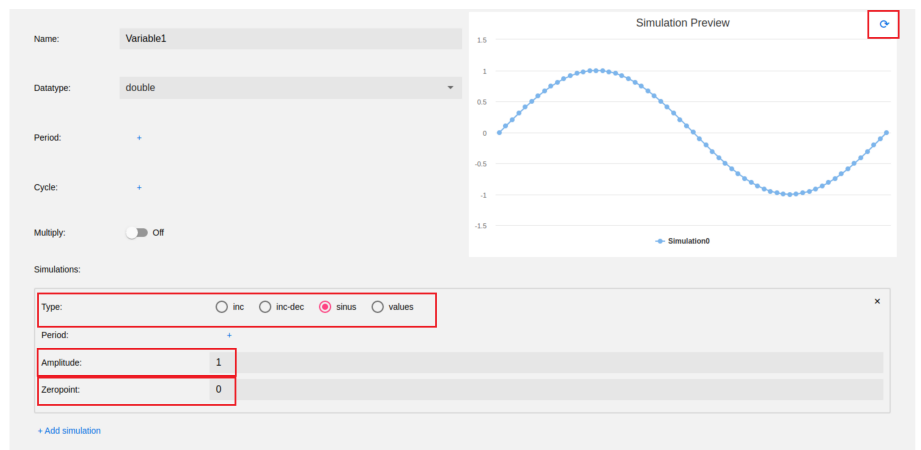
7. Enter the following information:
   - Name (Tag name)
   - Datatype (Data type)

8. Click "Add simulation".

9. Select a simulation type, such as a sine curved with an amplitude and a zero point.

10. Click the ↻ button to continue the update.

11. Click "Save".

12. Now, open the Data Service. You can find additional information here: Using Data Service (Page 21)

Using Data Service

<div style="text-align: right; font-size: 2em;">6</div>

Requirement

The Simulation UI has been prepared.

Description

You can select the "Simulation Connector" adapter and the corresponding simulated tags in the Data Service.

Procedure

To open the Data Service, follow these steps:

1. Open a browser.

2. To start the Data Service, enter the following address: `http://localhost:4203` or use the container IP 4203.

3. Add a new tag.

4. Select the Simulation Connector and the created tag.
   The connection of the Simulation Connector is preconfigured (active and online).

5. Click "Add variable".
   The simulated data are saved in this tag.

Note

Container IP

Access via the container IP is obtained by entering `docker inspect` in the command line.

Limitations

Note

Data retention

By default, the data is kept one week. This cannot be changed.

Note

Adapter

The adapter cannot be created, modified or deleted.

Application example

7

Description

This application example is intended to show you how to grant access to the "Data Service" to your own apps.

You will create a user, request a token and get the assets, tags and time series data from the app.

You must carry out the following steps beforehand:

Build and execute

The application example can be launched both locally and via Docker.

Follow the steps below to start the application example **via Docker**:

1. Open the command line in the folder with the "package.json" file and enter the following command:
   - `docker-compose up`

Follow the steps below to start the application example **locally**:

1. Open the command line in the folder with the "package.json" file and enter the following commands:
- `npm install` (The necessary NodeJS modules are downloaded.)
- `npm run build`
- `npm run start`

Note

Execution of the example

The application example is configured to run via Docker. For local execution, the Data Service URL ("`.\client\dataservice-client.ts`" line 17) must be changed to "`http://localhost:4203`".
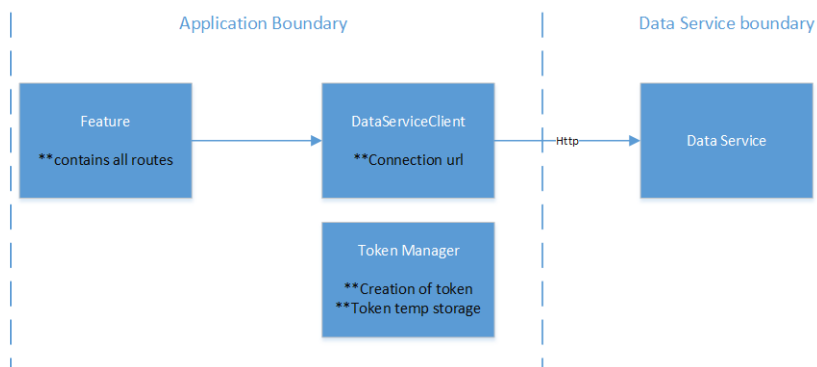

The app is started in the browser with the local host "`https://localhost:5200`".

Requirement

The Data Service app should be executed and the Configuration UI should be running; otherwise, an incorrect connection is provided when accessing the routes below.

Logical view

The logical representation is divided as follows:

- Feature: The routes are provided here and most of the integration for the token and communication with the client is done in this class.

- Token manager: With each call, the token is retrieved from the data service. However, it is advisable to store temporarily until the time it expires (30 minutes). The request to re-save from the token should ideally occur after each expiration.

- Data Service client: This class helps to configure the Data Service URL and establish the connection. The authorization headers for the http request are also managed here.

Creating users and token management

An app can require a user to access the data service. This user provides a token that can be used to make calls to the Data Service. The lifetime of the token is 30 minutes if the user is available during this lifetime. For user creation and token management please use the feature (/User/ create) and the token manager class (getAuthorizationToken()).

Assets, tags and time series information

The same token mentioned above can be used to perform any operation in the Data Service. The tokens that do not expire are retrieved and added to the request header to retrieve a list of all or each of the required assets and tags. To call up time series information, the "getTimeSeries" method is provided in the feature.

OpenAPI specification
8

Description

The OpenAPI specification is a standard for describing REST-compliant application programming interfaces (API).

You will find the routes for the Data Service in the following file: data-service-api-specification.html

```html
1    <!DOCTYPE html>
2    <html lang="en">
3      <head>
4        <meta charset="UTF-8">
5        <title>Data Service API Definition</title>
6        <link rel="stylesheet" type="text/css" href="./src/swagger-ui.css" />
7        <link rel="icon" type="image/png" href="./src/favicon.png" />
8        <style>
9          html
10         {
11           box-sizing: border-box;
12           overflow: -moz-scrollbars-vertical;
13           overflow-y: scroll;
14         }
15
16         *,
17         *:before,
18         *:after
19         {
20           box-sizing: inherit;
21         }
22
23         body
24         {
25           margin:0;
26           background: #fafafa;
27         }
28       </style>
29     </head>
30
31     <body>
32       <div id="swagger-ui"></div>
33
34       <script src="./src/swagger-ui-bundle.js" charset="UTF-8"> </script>
35       <script src="./src/swagger-ui-standalone-preset.js" charset="UTF-8"> </script>
36       <script src="./src/spec.openapi.js" charset="UTF-8"> </script>
37       <script>
38       window.onload = function() {
39         // Begin Swagger UI call region
40         const ui = SwaggerUIBundle({
41           spec: specData(),
42           dom_id: '#swagger-ui',
43           deepLinking: true,
44           presets: [
45             SwaggerUIBundle.presets.apis,
46             SwaggerUIStandalonePreset
47           ],
48           plugins: [
49             SwaggerUIBundle.plugins.DownloadUrl
```

View in browser:

Requirement

The OpenAPI of the Data Service is available in the Inudstrial 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
```

The Data Service is available there under this URL:

```
http://edgeappdataservice:4203
```

Procedure

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

1. Get a token that will not expire using the "getAuthorizationToken()" method.

2. You can then retrieve information, for example, by calling the "getTimeSeries" method.

3. Additional routes can be found in the OpenAPI.

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, e.g. in Performance Insight or Energy Manager.
- The value is also saved when the raw data is saved in an app.

Publishing user-developed app in the IEM 9

Description

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