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1 Introduction

1.1 About this document

1.1.1 Description of the contents

This document describes the netFIELD App PROFINET Tap from Hilscher.

1.1.2 List of revisions

<table>
<thead>
<tr>
<th>Index</th>
<th>Date</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2023-02-27</td>
<td>Document completely revised</td>
</tr>
</tbody>
</table>

*Table 1: List of revisions*

1.1.3 Conventions in this document

Notes, operation instructions and results of operation steps are marked as follows:

**Notes**

- **Important:**
  <important note>

- **Note:**
  <simple note>

- **<note, where to find further information>**

**Operation instructions**

1. <operational step>
   - <instruction>
   - <instruction>

2. <operational step>
   - <instruction>
   - <instruction>

**Results**

- <intermediate result>
- <final result>
1.2 Brief description

**PROFINET Tap** is an application container that monitors PROFINET traffic and publishes selected machinery process data via MQTT. It allows you to “tap into” the process data and run data analytics applications without interfering neither with your existing network setup nor with your PROFINET data exchange. Because there is no need to change the configuration of your PLC or machinery, it can thus be easily used in “brown-field” plants/automation networks.

The PROFINET Tap features a web-based configuration GUI that can be accessed via HTTP(S) browser connection without having to install any additional software tools. This configuration GUI is described in chapter *Configuration web pages of the PROFINET Tap* [page 18]. The “auto-mapping” function of the PROFINET Tap allows you to assign data semantics and symbols from GSDML and/or AutomationML files conveniently to your configuration.
1.3 General requirements

1.3.1 MQTT broker

The PROFINET Tap container publishes the acquired data via MQTT and thus requires an MQTT broker for operation. The MQTT broker can be running on the same host or on a different host machine in your local IT network.

1.3.2 License

**CodeMeter licensing technology**

The netFIELD App PROFINET Tap is protected by the CodeMeter licensing technology from Wibu-Systems. In order to use the app properly, you need a CodeMeter license server (CodeMeter User Runtime) and the PROFINET Tap license key, which you must download and activate in the license server.

For purchasing the license key, please contact your Hilscher sales representative.

If you are not already a user of the CodeMeter ecosystem and have not implemented a CodeMeter license server yet, you can download the CodeMeter User Runtime from Wibu-Systems under https://www.wibu.com/us/support/user/downloads-user-software.html and install it on a local server/machine/PC that can be reached by the PROFINET Tap via TCP/IP connection. Exemplary instructions on how to install the license server and import and activate the PROFINET Tap license key are provided in section Installing CodeMeter and activating license [page 73].

Note that for you as an end-user, the CodeMeter technology is free-of-charge, you only have to pay for the PROFINET Tap license key from Hilscher.

**Floating license**

The PROFINET Tap license is a “floating” license, which means that it is not bound to an individual instance of the app running on a particular device. Whichever instance of the app "grabs" the license from the CodeMeter server first, can use it until the instance itself closes the connection to the server again (either by the application container being shut down or by deleting the corresponding license server endpoint on the License Server Settings page of the app). Other instances of the PROFINET Tap (e.g. a PROFINET Tap container running on another device) can then “take over” the “freed” license by simply connecting to the corresponding license server.
Maintenance period

Currently, the netFIELD App PROFINET Tap license is a “one-time payment license”, meaning that you can use the container license without time restriction, once you have paid the license fee. The maintenance period, in which you are entitled to deploy software updates of the container, is one year (beginning on the day the license is activated). After this period, you can still use your last deployed container version indefinitely; however, for using higher container versions, you will have to acquire a new or updated license.

License-free demo mode

Without a license, you can still deploy, configure and operate the PROFINET Tap for testing purposes; however, all acquired and published process data values will be invalidated (set to null), except for the first two variables of your Active Publishers list (see section “Publisher Management” tab [page 23]), which will be available with “correct” values for 30 minutes. After 30 minutes, the first two variables will also be set to null.

1.3.3 Memory

The RAM needed by the PROFINET Tap depends on the amount of PROFINET data that you intend to capture and process in your application. We recommend you to provide at least 1 GB of free RAM on your Edge Device/Datacenter (ideally 2 GB or more).
In use cases with a stable amount of little data processing, less than 1 GB RAM might be sufficient.
2 Use cases

2.1 Connecting PROFINET via netX-based interface

2.1.1 Overview

The netX SoC is a multi-protocol communication controller from Hilscher, which is available as single chip, embedded module (like e.g. comX) or cifX PC card. You can use a netX-based Industrial Ethernet interface together with the netANALYZER driver as “capture interface” for your PROFINET Tap container.

The netANALYZER driver is included in the netFIELD Operating System (netFIELD OS), but will also be available as separate driver in the near future.

Being equipped with a netX-based cifX interface and the netFIELD OS (which features the required netANALYZER driver and a container engine), the netFIELD OnPremise edge gateway (NIOT-E-TIJCX-GB-RE/NFLD) is currently the ideal ready-to-use host device for your PROFINET Tap.

2.1.2 Connecting PROFINET via netMIRROR (hardware TAP)

You can use the Hilscher netMIRROR (NMR-TFE-RE, part no. 7340.100) device as a hardware-based “tap” (test access point) for connecting the PROFINET to your host device. The netMIRROR device “mirrors” the Ethernet data traffic with virtually no delay (~1 ns) and without affecting the OT network.

It can be placed easily between your IO Controller and the first IO Device (respectively switch) without further PLC “engineering”.

By using such a hardware mirror, you also avoid the risk of traffic disruption if your host device is turned off or configured, or if a software update is performed on that device. It is therefore the implementation with the lowest risk of network failure.

For technical information about the netMIRROR device, see user manual netMIRROR – NMR-TFE-RE, DOC161104UMxxEN.
The requirements for this use case are:

- netMIRROR device
- Your host device is equipped with a netX-based Industrial Ethernet interface (e.g. cifX in OnPremise edge gateway)
- netFIELD Operating System ("netFIELD OS", includes the required netANALYZER driver)
  or
  3rd party operating system with netANALYZER driver

![Diagram of netX-based interface with netMIRROR](image)

**Figure 1: netX-based interface with netMIRROR**

- Connect one of the **NETWORK** ports of the netMIRROR to the Controller. Connect the other **NETWORK** port of the netMIRROR to the first PROFINET Device.
- Connect both **MIRROR OUT** ports of the netMIRROR to the ports of the netX-based interface.
You can use “patch” or “crossover” cables. Note that you must set the **Crossover Mode** for the ports on the **OT Interface Settings** page accordingly (see section **netX-based OT Capture Interface** [ page 31]). Note also that the signals at MIRROR OUT Port A are already crossed. Therefore you must configure the OT Interface Settings as shown in the figures below:

**Figure 2:** Connecting netMIRROR ports to netX ports: B to 0 and A to 1

**Figure 3:** Connecting netMIRROR ports to netX ports: B to 1 and A to 0
- Set the Link Speed of the netX-based interface to 100 MBit/s fixed. This can be done in the configuration web GUI of the PROFINET Tap (see section netX-based OT Capture Interface [page 31]).

Note that the netX-based interface allows only “passive” data capturing. The PROFINET Tap therefore also needs a “standard” LAN interface on the host for its TCP/IP, HTTP and MQTT communication. This LAN interface is necessary for deploying the container and for accessing its configuration web GUI. If your MQTT broker and your CodeMeter license server are running outside of your host, this interface will also allow the container to publish its MQTT data and to access the CodeMeter license server:

Figure 4: netX-based interface with netMIRROR and LAN connection
2.1.3 Connecting PROFINET as software TAP

You can connect the netX-based Industrial Ethernet interface of your host device directly to the IO Controller, without interposed "hardware mirror". This use case is also known as "software TAP".

Note:
Note the disadvantages of the software TAP: It may disrupt traffic on the OT network in the following events:
– If the host device is turned off or configured
– If the PROFINET Tap container is stopped or restarted
– If the OT network settings of the PROFINET Tap are changed

The requirements for this use case are:

- Your host device is equipped with a netX-based Industrial Ethernet interface (e.g. OnPremise edge gateway with cifX)
- netFIELD Operating System ("netFIELD OS", includes the required netANALYZER driver)
  or
  3rd party operating system with netANALYZER driver

Figure 5: netX without netMIRROR

- Connect the IO Controller to one of the ports of the netX-based interface. Connect the other port of the netX-based interface to the first PROFINET Device.
- Set the port speed (Automatic, 100 MBit/s fixed or 10 MBit/s fixed) of the netX-based interface according to the configuration of the Ethernet ports of the connected IO Devices (typically: Automatic). This can be done in the configuration web GUI of the PROFINET Tap (see section netX-based OT Capture Interface [page 31]).
Note that the netX-based interface allows only “passive” data capturing. The PROFINET Tap therefore also needs a “standard” LAN interface on the host for its TCP/IP, HTTP and MQTT communication. This LAN interface is necessary for deploying the container and for accessing its configuration web GUI. If your MQTT broker and your CodeMeter license server are running outside of your host, this interface will also allow the container to publish its MQTT data and to access the CodeMeter license server:

Figure 6: netX and LAN without netMIRROR
2.2 Connecting PROFINET via standard Ethernet port

You can connect the PROFINET via the mirror port of a PROFINET managed switch to a standard Ethernet port of your host device. This setup requires neither a netX-based Industrial Ethernet interface nor the netFIELD Operating System (netFIELD OS) nor the netANALYZER driver on your host.

Connecting host directly to mirror port of PROFINET managed switch

If you connect the standard Ethernet port of your host directly to the mirror port, you do not need a VLAN:

*Figure 7: Direct connection of standard Ethernet port to PROFINET Managed Switch*
Connecting host to mirror port via VLAN

If you want to route the mirrored data from the PROFINET managed switch via other switches in your IT infrastructure to your host using RSPAN (Remote Switch Port Analyzer), you need a VLAN:

![Connection via VLAN diagram]

*Figure 8: Connection via VLAN*
Note that the capture interface allows only “passive” data capturing. The PROFINET Tap therefore also needs a second LAN interface on the host for its TCP/IP, HTTP and MQTT communication. This second interface is necessary for deploying the container and for accessing its configuration web GUI. If your MQTT broker and your CodeMeter license server are running outside of your host, this interface will also allow the container to publish its MQTT data and to access the CodeMeter license server:

Figure 9: Connection via standard port and VLAN with LAN
3 Start parameters of the container

The start-up parameters and yaml files for the different use cases are provided in the Hilscher Knowledge base.

- Go to the [netFIELD App PROFINET Tap](https://kb.hilscher.com/x/_RUfBw) page.
- On the [netFIELD App PROFINET Tap](https://kb.hilscher.com/x/_RUfBw) page, click on the link under **Current release**.
- On the current release page, you will find the start-up parameters and links to the yaml files under the **Release Notes**.
4 Configuration web pages of the PROFINET Tap

4.1 Overview

The PROFINET Tap container provides a configuration web GUI that can be accessed via port 80 of the container. Note that you have to make sure that this port can be accessed from the outside via web browser. We recommend you to use a reverse proxy or API gateway with HTTPS and authentication support for this. For testing purposes, you can temporarily expose the port, e.g. via Docker port expose.

Note:
If the container is deployed on a host with the netFIELD Operating System (netFIELD OS), the configuration web GUI is automatically plugged-into the Local Device Manager of the netFIELD OS, where it can be accessed via the netFIELD App PROFINET Tap entry in the navigation panel (side bar) of the Local Device Manager.

You can navigate through the configuration options by selecting an item in the navigation tree (1). Further parameters/configuration options can be selected in the tabs in the editor window (2) on the right side of the screen.
4.2 “Status” tab

The **Status** tab shows information about the operating state of the PROFINET Tap, of the PROFINET OT network and of the MQTT connection.

To open the **Status** tab, first select the netFIELD App PROFINET Tap root element in the navigation tree, then the **Status** tab in the Editor window.

Hovering over an entry will display additional information in a tooltip.

![Status page](image)

*Figure 11: Status page*
4.3 “About” tab

The **About** tab shows general information about the container.

To open the **About** tab, first select the **netFIELD App PROFINET Tap** root element in the navigation tree, then the **About** tab in the Editor window.

![Figure 12: About tab](image)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Container name and Container ID</td>
</tr>
<tr>
<td>Version</td>
<td>Container software version</td>
</tr>
<tr>
<td>API Version</td>
<td>Version of the API connecting the GUI to the server</td>
</tr>
<tr>
<td>Description</td>
<td>Brief description of the function of the container</td>
</tr>
<tr>
<td>Dependencies</td>
<td>Other containers or components required for proper operation of the container</td>
</tr>
<tr>
<td>Vendor</td>
<td>Vendor of container</td>
</tr>
<tr>
<td>Licenses</td>
<td>Name of the software license(s), under which the container was published</td>
</tr>
<tr>
<td>Disclaimer</td>
<td>Path/link to the software license(s)</td>
</tr>
</tbody>
</table>

*Table 2: About tab*
4.4 “Configuration Backup” tab

In the **Configuration Backup** tab, you can save the current PROFINET Tap configuration settings to your device via your web browser’s download function. You can also restore a formerly saved configuration by uploading the configuration file via web browser.

To open the **Configuration Backup** tab, first select the **netFIELD App PROFINET Tap** root element in the navigation tree, then the **Configuration Backup** tab in the Editor window.

![Configuration Backup](image)

**Save configuration**

- To save your current configuration, click **Save configuration** button.
- The configuration settings are saved to your device as ZIP file. (The download path depends on the settings of your web browser.)
- The name of the ZIP file is made up by Hardware ID, Container ID and date/time of the download.
**Restore configuration**

To restore a formerly saved configuration, you must first select the configuration ZIP file by dragging and dropping it from your desktop onto the grey field (as an alternative, you can open your browser’s file selection dialog by clicking into the grey field).

After having selected the file, the **Restore configuration** button is enabled, and you can now “load” the configuration by clicking the button.

---

**Important:**

The **Restore configuration** function will overwrite the current configuration settings. We recommend you to save your current configuration before using this function.

---

*Figure 14: Restore configuration*
4.5 “Publisher Management” tab

The Publisher Management tab shows the variables that the PROFINET Tap container publishes to the MQTT Broker.

Note that you cannot define here which variables are to be published. For publishing a variable, you have to select it in the PROFINET Configuration tree and then choose the Publish data option in the PROFINET Variable editor.

You can, however, delete a variable here if you do not want to publish it any longer.

To open the Publisher Management tab, first select the netFIELD App PROFINET Tap root element in the navigation tree, then the Publisher Management tab in the Editor window.

![Publisher Management Element](image)

**Figure 15: Publisher Management**

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Publishers</td>
<td>Shows the number of variables that are being published.</td>
</tr>
<tr>
<td>Published Variable</td>
<td>Name of the variable that is being published. You can select one or multiple</td>
</tr>
<tr>
<td></td>
<td>variables by clicking the checkboxes, and then delete the selected variables</td>
</tr>
<tr>
<td></td>
<td>at once by clicking the delete button. Note: The order of the published</td>
</tr>
<tr>
<td></td>
<td>variables in the list is determined by the chronological order in which</td>
</tr>
<tr>
<td></td>
<td>they were selected for publishing in the PROFINET Variable editor.</td>
</tr>
<tr>
<td>Action</td>
<td>Deletes the variable</td>
</tr>
<tr>
<td></td>
<td>Shows details of the variable (see table below)</td>
</tr>
<tr>
<td></td>
<td>If the list contains more than ten entries, you can scroll here to</td>
</tr>
<tr>
<td></td>
<td>display the next ten items</td>
</tr>
</tbody>
</table>

*Table 3: Elements of Publisher Management tab*
Note:
The maximum allowed size of a JSON message is 100 kB. When this size is reached, the message is sent immediately, disregarding the MQTT publishing interval configured for this variable (i.e. even if the set time interval has not yet been reached).

- Click the button to open a window showing details of the variable like its MQTT Topic string and other configuration parameters.

### Published Variable

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic</td>
<td>Shows the MQTT topic string under which the variable is published. By default, the PROFINET Tap uses the following string: netFIELD/&lt;gateway prefix or user-prefix&gt;/&lt;container id&gt;/&lt;controller name&gt;/&lt;device name&gt;/&lt;slot name&gt;/&lt;subslot name&gt;/&lt;direction&gt;/&lt;variable name&gt;/&lt;node id&gt; (For a more detailed description, see section MQTT message format [page 66].) If you do not want to use the default MQTT Topic string, you can define your own string when you select the variable in the PROFINET Configuration tree for publishing (PROFINET Variable &gt; Publish data option &gt; Topic field). Note that you are free to define the topic hierarchy and name according to your individual needs there. You are only restricted not to use the # and + characters and not to use $ as very first character. You can use the icon to copy the topic string to your clipboard.</td>
</tr>
</tbody>
</table>

![Figure 16: Parameters of PROFINET variable](image-url)
<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Shows data formats of the variable.</td>
</tr>
<tr>
<td>Standardization</td>
<td>Shows standardization settings for the variable.</td>
</tr>
<tr>
<td>Publisher data</td>
<td>Shows the MQTT publication settings for the variable.</td>
</tr>
<tr>
<td>Ok</td>
<td>Click this button to close the window.</td>
</tr>
</tbody>
</table>

*Table 4: Elements Variable’s details window*
4.6 MQTT Client Settings

On the MQTT Client Settings page, you can configure the MQTT client settings of the PROFINET Tap container.

---

**Note:**
If you use the PROFINET Tap container on a host with a netFIELD Operating System (netFIELD OS), this page features the **Use general settings** option, allowing you to use the standard MQTT client settings of the netFIELD OS. These standard MQTT client settings can be viewed (and changed) in the Local Device Manager of the netFIELD OS under **General Settings > Default MQTT Client Settings**.

---

![Figure 17: MQTT Client settings](image)
<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td><strong>MQTT Version</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Keep Alive Interval (Seconds)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Username</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Password</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Connect Timeout (Seconds)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Clean Session</strong></td>
</tr>
<tr>
<td><strong>Server URIs</strong></td>
<td><strong>Server URI of the MQTT broker.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Click this button to add a new server URI.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Click this button to delete an existing server URI.</strong></td>
</tr>
<tr>
<td><strong>Last Will and Testament</strong></td>
<td><strong>Use last will and testament options</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Topic Name</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Retained</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Quality of Service</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Message</strong></td>
</tr>
</tbody>
</table>
### Table 5: MQTT Client Settings

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSL / TLS</td>
<td>Use SSL / TLS Select this option if you want to use SSL/TLS encryption for creating a secure connection to the MQTT broker. <strong>Note:</strong> This option is for expert users only! If the MQTT broker and the PROFINET Tap are running on the same host, a secure SSL/TLS connection is not necessary (because the connection is &quot;internal&quot; and the overhead of the secure connection can thus be avoided). Selecting this option opens the following fields for configuring the SSL / TLS parameters:</td>
</tr>
<tr>
<td></td>
<td>File name and path to private key in PEM format Enter here the complete path to the private key on the device; e.g.: /etc/ssl/private/client-key.pem</td>
</tr>
<tr>
<td></td>
<td>File name and path to certificate chains in PEM format Enter here the complete path to the certificate chains on the device; e.g.: /etc/ssl/services/client-cert.pem</td>
</tr>
<tr>
<td></td>
<td>Override the trusted CA certificates in PEM format Enter here the complete path to override the trusted CA certificates on the device; e.g.: /etc/ssl/services/ca-cert.pem</td>
</tr>
<tr>
<td></td>
<td>Enable verification of the server certificate If this option is disabled, the PROFINET Tap will also accept invalid certificates from the broker (not recommended).</td>
</tr>
</tbody>
</table>

- Click ![Save button](save.png) to save your new MQTT Client Settings.

**Note:**

After changing the settings – e.g. by defining a new MQTT Server (Broker) URI – you can check the state of the new MQTT connection on the **Status** tab (see section "Status" tab [page 19]). For information on the structure of MQTT messages, see section **MQTT message format** [page 66].
4.7 License Server Settings

On the License Server Settings page, you must specify the IP address or host name ("endpoint") of your local license server.

**Note:**
You can specify more than one server endpoint here if multiple local license servers are available, e.g. as backup servers. The app will try to retrieve a valid license from the first server endpoint in the list. If the first server is not available or if there is no valid license on this server, the PROFINET Tap will automatically try the next one, and so forth.

![License Server Settings](image)

*Figure 18: License Server Settings*

1. Specify license server.
   - To specify a license server, click + button.
   - In the **License Server Endpoints** field, enter the IP address or the hostname of the machine on which your license server is running.
   - Click **Save** button.
After the **Succeeded to save license server settings!** message appears, the PROFINET Tap immediately tries to connect to the server and retrieve its license.

![Configuration web pages of the PROFINET Tap](image)

**Figure 19:** License Server Settings saved

2. Check the license state on the **Status** page.

   - To open the **Status** tab, first select the **netFIELD App PROFINET** Tap root element in the navigation tree, then the **Status** tab in the Editor window.

   - Under **Container status**, check the license state:

![Application container](image)

**Figure 20:** Check license status
4.8 PROFINET configuration

4.8.1 OT Interface settings

4.8.1.1 Overview

On the OT Interface settings page, you must configure the interface that you are using to connect your PROFINET Tap to the physical PROFINET network.

Note that the parameters and options displayed on the OT Interface settings page depend on the interface that you are using for connecting the PROFINET Tap to the physical PROFINET; i.e. netX-based Industrial Ethernet interface or standard Ethernet port (via mirror port of PROFINET managed switch).

4.8.1.2 netX-based OT Capture Interface

![Figure 21: OT Interface Settings OnPremise device](image)

Changing these settings during runtime may cause an OT-network restart which may halt the machine when the On-Premise gateway's software TAP is used!
<table>
<thead>
<tr>
<th>Parameter/Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Save" /></td>
<td>Click this button to save your new settings.</td>
</tr>
<tr>
<td>Capture Interface</td>
<td></td>
</tr>
<tr>
<td>cifX OT Interface</td>
<td>Preset to cifX OT interface. Cannot be changed. <strong>Note:</strong> cifX is a netX-based Industrial Ethernet interface card, which is e.g. included in the netFIELD OnPremise edge gateway.</td>
</tr>
<tr>
<td>Link Speed</td>
<td></td>
</tr>
<tr>
<td>Automatic</td>
<td>Automatic synchronization. Use this setting if you have connected the netX-based interface <em>directly</em> to the PROFINET; i.e. if you are <em>not</em> using a “hardware TAP” like e.g. netMIRROR. Note that when using automatic link speed negotiation in combination with a netMIRROR, the PROFINET Tap (due to a little time delay caused by the negotiation process) might miss some of the first frames (and thus some of the configuration data) that are exchanged on the bus during the PROFINET startup phase.</td>
</tr>
<tr>
<td>10 MBit/s fixed</td>
<td>Use this setting if you are using a “hardware TAP” like e.g. netMIRROR and the OT network operates at 10 MBit/s. <strong>Note:</strong> Rarely used.</td>
</tr>
<tr>
<td>100 MBit/s fixed</td>
<td>Use this setting if you are using a “hardware TAP” like e.g. netMIRROR and the OT network operates at 100 MBit/s.</td>
</tr>
<tr>
<td>Crossover Mode</td>
<td></td>
</tr>
<tr>
<td>Port 0 Automatic</td>
<td>Use this setting if you have connected the netX-based interface <em>directly</em> to the PROFINET (i.e. if you are <em>not</em> using a “hardware TAP” like e.g. netMIRROR) and have set the Link Speed to Automatic.</td>
</tr>
<tr>
<td>No Crossover</td>
<td>Use this setting if you are using a “hardware TAP” like e.g. netMIRROR and:</td>
</tr>
<tr>
<td></td>
<td>• If port 0 is connected via “patch” cable to the MIRROR OUT port B</td>
</tr>
<tr>
<td></td>
<td>• If port 0 is connected via “crossover” cable to the MIRROR OUT port A</td>
</tr>
<tr>
<td>Crossover</td>
<td>Use this setting if you are using a “hardware TAP” like e.g. netMIRROR and:</td>
</tr>
<tr>
<td></td>
<td>• If port 0 is connected via “crossover” cable to the MIRROR OUT port B</td>
</tr>
<tr>
<td></td>
<td>• If port 0 is connected via “patch” cable to the MIRROR OUT port A</td>
</tr>
<tr>
<td>Port 1 Automatic</td>
<td>Use this setting if you have connected the netX-based interface directly to the PROFINET (i.e. if you are <em>not</em> using a “hardware TAP” like e.g. netMIRROR) and have set the Link Speed to Automatic.</td>
</tr>
<tr>
<td>No Crossover</td>
<td>Use this setting if you are using a “hardware TAP” like e.g. netMIRROR and:</td>
</tr>
<tr>
<td></td>
<td>• If port 1 is connected via “patch” cable to the MIRROR OUT port B</td>
</tr>
<tr>
<td></td>
<td>• If port 1 is connected via “crossover” cable to the MIRROR OUT port A</td>
</tr>
<tr>
<td>Crossover</td>
<td>Use this setting if you are using a “hardware TAP” like e.g. netMIRROR and:</td>
</tr>
<tr>
<td></td>
<td>• If port 1 is connected via “crossover” cable to the MIRROR OUT port B</td>
</tr>
<tr>
<td></td>
<td>• If port 1 is connected via “patch” cable to the MIRROR OUT port A</td>
</tr>
</tbody>
</table>

*Table 6: Parameters netX-based OT Interface settings*
4.8.1.3 Standard Ethernet OT Capture Interface

Select the virtual Ethernet interface that provides the PROFINET data that you want to capture.

**Important:**
Do not select `eth0` for capturing the PROFINET data. `eth0` is the standard interface that the PROFINET Tap uses for its IT network communication with other applications and/or the user (e.g. for publishing its MQTT data or for its configuration via web GUI). Select the `eth` interface whose IP address matches the IP address of the interface that was mapped to the `macvlan`.

<table>
<thead>
<tr>
<th>Parameter/Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Save</td>
<td>Click this button to save your new settings.</td>
</tr>
<tr>
<td>Capture Interface</td>
<td>Ethernet Interface is preset to Ethernet interface. Cannot be changed.</td>
</tr>
<tr>
<td>Ethernet Interfaces</td>
<td>The list displays the virtual Ethernet interfaces that are mapped into the PROFINET Tap container by your host. The number of interfaces depend on how many VLANs you have connected to the container.</td>
</tr>
<tr>
<td>Interface Name</td>
<td>Assigned to the PROFINET Tap container by the container engine (e.g. Docker).</td>
</tr>
<tr>
<td>MAC Address</td>
<td>Assigned to the PROFINET Tap container by the container engine (e.g. Docker).</td>
</tr>
<tr>
<td>IP Address</td>
<td>Assigned to the PROFINET Tap container by the container engine (e.g. Docker).</td>
</tr>
<tr>
<td>Select</td>
<td>Select here the virtual Ethernet interface that provides the PROFINET data that you want to capture. Note that only one interface can be selected.</td>
</tr>
</tbody>
</table>

Table 7: Parameters OT Interface settings standard Ethernet
4.8.2 PROFINET Configuration node

In order to capture process data and re-publish it via MQTT, the PROFINET Tap must be “acquainted” with the participants, data points and certain parameters of your actual PROFINET network.

There are two ways to provide the necessary information for the Tap:

- Automatically by letting the Tap listen to the communication between IO Controller and IO Devices during the PROFINET start-up phase and by mapping GSDML and/or AutomationML file(s) to the recognized “raw” PROFINET configuration.
- Manually by “rebuilding” the structure of your network by adding the IO Controller, IO Devices and their slots to the PROFINET Configuration tree, and then configure their parameters and variables “by hand”.

The structure of your network and the data points (that the Tap knows of) is represented in the navigation tree under PROFINET Configuration:

![PROFINET Configuration tree](image)

An arrow symbol ➔ in front of an element in the PROFINET navigation tree indicates that the element contains further subordinate elements, like e.g. Submodules under a Module.
Clicking on an element will display the subordinate elements in the navigation tree. Selecting an element will also display its parameters in the Editor window on the right side of the screen, where they can be changed if necessary:

![Figure 24: Parameters of selected PROFINET element in Editor window](image)

The options in the menu bar on top of the Editor window are context sensitive and depend on the element that you have selected in the PROFINET navigation tree:

![Figure 25: Menu bar](image)
In the menu bar, you can save changes that you have made to the parameters of the selected element, or you can delete the selected element altogether. You can also add further elements on the same level (e.g. another Submodule next to a selected Submodule) or new elements on the subordinate level (e.g. a Data Item below a selected Submodule). You can also start an “auto-mapping” process of parameters from GSDML and/or AutomationML files (if available) for the subordinate elements of the currently selected element. Note that must import the appropriate GSDML and AutomationML files in the GSDML Management tab respectively AutomationML Management tab before you can use the Auto-map function (see also sections GSDML Management [page 42] and AutomationML Management [page 45]).

The following table describes the options and parameters of the elements belonging to your PROFINET Configuration. Click on an element in the PROFINET Configuration tree to see the parameters and menu options:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Element</th>
<th>Parameter</th>
<th>Options in menu</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="PROFINET" /></td>
<td>Reload button</td>
<td>Reloads the PROFINET configuration tree. Use this button after a new start-up of the PROFINET or of individual devices. Any new device information detected during start-up will thus be taken-over into the PROFINET configuration.</td>
<td>✪ Add Controller: Adds Controller to the PROFINET configuration. ✡ Auto-map: Auto-map all devices from GSDML: Opens the GSDML mapping wizard. Auto-map all devices from AutomationML: Opens the AutomationML mapping wizard.</td>
</tr>
<tr>
<td><img src="image" alt="Info icon" /></td>
<td>Info icon</td>
<td>Indicates an event that demands a reaction from the user (e.g. the Tap detected a start-up of a new device, which may require you to reload the configuration and/or re-map data semantics from GSDML or AutomationML). Click on the icon to display the information. In the Info window, click Confirm to acknowledge the message, which makes the info icon disappear. If you click Close, the Info window closes but the Info icon remains visible.</td>
<td></td>
</tr>
</tbody>
</table>

### GSDML Management

The PROFINET root element displays the GSDML Management [page 42] tab that allows you to manage the GSDML files of your PROFINET Devices.

### AutomationML Management

The PROFINET root element displays the AutomationML Management [page 45] tab that allows you to manage the AutomationML files.

<p>| Controller | Name | Name of the controller. Can be freely defined by the user, but must not be empty (mandatory field). <strong>Note:</strong> If the configuration was automatically retrieved by the app during start-up phase, the app will use the MAC address as name. | ✪ Save: Saves changed parameters of selected Controller. ✪ Add Controller: Adds new Controller on same level. ✡ Remove Controller: Removes selected Controller. ✪ Add Device: Adds new Device under selected Controller. ✡ Auto-map: Auto-map all devices under this controller from GSDML: Opens the GSDML mapping wizard. Auto-map all devices under this controller from AutomationML: Opens the AutomationML mapping wizard. |
|           | MAC address | MAC Address of the controller. Mandatory field consisting of six groups of two hexadecimal values separated by colons. (E.g. 06:0A:3B:78:05:6C) | |
|           | IP address | IP address of the controller. | |</p>
<table>
<thead>
<tr>
<th>Icon</th>
<th>Element</th>
<th>Parameter</th>
<th>Options in menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>🌐</td>
<td>Device</td>
<td>Name</td>
<td>Name of the device. Can be freely defined by the user, but must not be empty (mandatory field). <strong>Note:</strong> If the configuration was automatically retrieved by the app during start-up phase, the app will use the &quot;name of station&quot; for the name.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAC Address</td>
<td>MAC address of the device. Mandatory field consisting of six groups of two hexadecimal values separated by colons. (E.g. 06:0A:3B:78:05:6C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP address</td>
<td>MAC address of the device. Assigned by the controller.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Name of station</td>
<td>PROFINET &quot;name of station&quot; of the device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vendor ID</td>
<td>ID containing the manufacturer-specific part of the device's PROFINET identification number according to the rules specified in PNO document 2.712 “Application Layer Services”. Mandatory field. Must be a value between 0 and 65535.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Device ID</td>
<td>ID containing the device-specific part of the PROFINET identification number of the PROFINET device. It is defined for each individual device by the manufacturer and uniquely identifies a device amongst all devices of this manufacturer. Mandatory field. Must be a value between 0 and 65535.</td>
</tr>
<tr>
<td></td>
<td>Module</td>
<td>Name</td>
<td>Name of the module. Can be freely defined by the user, but must not be empty (mandatory field).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slot number</td>
<td>Number of the slot this module is plugged in. Mandatory field. Must be unique within the scope of the project and must be a value between 0 and 4294967295</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Module ident number</td>
<td>Identification number of the module. Mandatory field. Must be a value between 0 and 4294967295.</td>
</tr>
</tbody>
</table>

**Save**: Saves changed parameters of selected Device.

**Add Device**: Adds new Device on same level.

**Remove Device**: Removes selected Device.

**Add Module**: Adds new Module below selected Device.

**Auto-map**

- **Auto-map all slots under this device from GSDML**: Opens the GSDML mapping wizard.
- **Auto-map all slots under this device from AutomationML**: Opens the AutomationML mapping wizard.
### Submodule

<table>
<thead>
<tr>
<th>Icon</th>
<th>Element (Output/Input)</th>
<th>Parameter</th>
<th>Options in menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon]</td>
<td>Name</td>
<td>Name of the submodule. Can be freely defined by the user, but must not be empty (mandatory field).</td>
<td><strong>Save</strong>: Saves changed parameters of selected Submodule.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Subslot number</td>
<td>Number of the subslot this submodule is plugged in. Mandatory field. Must be unique within the scope of the project and must be a value between 0 and 65535.</td>
<td><strong>Add Submodule</strong>: Adds new Submodule on same level.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Submodule ident number</td>
<td>Identification number of the submodule. Mandatory field. Must be a value between 0 and 4294967295.</td>
<td><strong>Remove Submodule</strong>: Removes selected Submodule.</td>
</tr>
</tbody>
</table>

### Data Item (Output/Input)

<table>
<thead>
<tr>
<th>Icon</th>
<th>Parameter</th>
<th>Options in menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon]</td>
<td>Name</td>
<td>Name of the PROFINET data item. Can be freely defined by the user, but must not be empty (mandatory field).</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Direction</td>
<td>IO direction of the data item. Select <strong>Output</strong> for the data that the submodule receives from the Controller in order to forward it to an actor. Select <strong>Input</strong> for the data that the submodule receives from a sensor in order to forward it to the Controller.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Frame ID</td>
<td>Identification number of the cyclic PROFINET frame which carries the data item. Mandatory field. Must be a value between 0 and 65535.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Byte offset</td>
<td>Byte offset of the data item within the cyclic PROFINET frame relative to the Ethernet payload start. Mandatory field. Must be a value between 0 and 65535.</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Data length</td>
<td>Length of the PROFINET data item in bytes.</td>
</tr>
<tr>
<td>Icon</td>
<td>Element</td>
<td>Parameter</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>✔</td>
<td>Variable</td>
<td>Name</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Data type**

<table>
<thead>
<tr>
<th>Supported types:</th>
<th>Bit length:</th>
<th>Description/Value range:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boolean</td>
<td>1</td>
<td>‘0’: FALSE ‘1’: TRUE</td>
</tr>
<tr>
<td>Signed 8 Bit Integer</td>
<td>8</td>
<td>-128 ... 127</td>
</tr>
<tr>
<td>Signed 16 Bit Integer</td>
<td>16</td>
<td>-32768 ... 32767</td>
</tr>
<tr>
<td>Signed 32 Bit Integer</td>
<td>32</td>
<td>-2(^{31}) ... +2(^{31}-1)</td>
</tr>
<tr>
<td>Signed 64 Bit Integer</td>
<td>64</td>
<td>-2(^{63}) ... +2(^{63}-1)</td>
</tr>
<tr>
<td>Unsigned 8 Bit Integer</td>
<td>8</td>
<td>0 ... 255</td>
</tr>
<tr>
<td>Unsigned 16 Bit Integer</td>
<td>16</td>
<td>0 ... 65535</td>
</tr>
<tr>
<td>Unsigned 32 Bit Integer</td>
<td>32</td>
<td>0 ... +2(^{32}-1)</td>
</tr>
<tr>
<td>Unsigned 64 Bit Integer</td>
<td>64</td>
<td>0 ... +2(^{64}-1)</td>
</tr>
<tr>
<td>32 Bit Floating Point</td>
<td>32</td>
<td>Single precision floating point range</td>
</tr>
<tr>
<td>64 Bit Floating Point</td>
<td>64</td>
<td>Double precision floating point range</td>
</tr>
<tr>
<td>Visible String</td>
<td>8(n)</td>
<td>UTF-8 / ASCII encoded string</td>
</tr>
<tr>
<td>Octet String</td>
<td>8(n)</td>
<td>String containing a sequence of hex encoded octets in format 01ABF7</td>
</tr>
</tbody>
</table>

**Byte offset**

Offset (in bytes) of the variable relative to the beginning of the Data Item. Must be a value between 0 and 99.

**Bit offset**

Number of bits the variable is shifted at the byte offset of the Data Item. Must be a value between 0 and 7.
<table>
<thead>
<tr>
<th>Icon</th>
<th>Element</th>
<th>Parameter</th>
<th>Options in menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>Variable</td>
<td>Bit length</td>
<td>☀ Save: Saves changed parameters of selected variable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✈ Add Variable: Adds new variable on same level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>← Remove Variable: Removes selected variable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✈ Clone Variable: Adds a copy of the selected variable on same level, which you can use as a “template” for editing a new variable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Save: Saves changed parameters of selected variable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Add Variable: Adds new variable on same level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Remove Variable: Removes selected variable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clone Variable: Adds a copy of the selected variable on same level, which you can use as a “template” for editing a new variable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standardization type</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Keep original value and do not standardize</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scale linear by factor and offset option.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Selecting the Scale linear… option enables the Factor and Offset fields.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The standardization value will be computed according to the formula: raw value * factor + offset</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Note: Standardization is supported only for integer data types.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Byte order</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Swapped</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not swapped</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standardization type</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Keep original value and do not standardize</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scale linear by factor and offset option.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Selecting the Scale linear… option enables the Factor and Offset fields.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The standardization value will be computed according to the formula: raw value * factor + offset</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Note: Standardization is supported only for integer data types.</td>
</tr>
<tr>
<td>Icon</td>
<td>Element</td>
<td>Parameter</td>
<td>Options in menu</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>-----------</td>
<td>----------------</td>
</tr>
<tr>
<td>![Checkmark]</td>
<td>Variable</td>
<td>Publish data</td>
<td>![Save] Saves changed parameters of selected variable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>![Add Variable] Adds new variable on same level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>![Remove Variable] Removes selected variable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>![Clone Variable] Adds a copy of the selected variable on same level, which you can use as a “template” for editing a new variable</td>
</tr>
</tbody>
</table>

Select this option to publish the variable via MQTT. It will also be added to the **PROFINET Variable** list in the **Publisher Management** tab (see section “Publisher Management” tab [page 23]). You can configure the following parameters for publishing the variable:

**Topic**
Enter here the MQTT Topic name string under which the variable will be published. If left empty, the Tap uses the default string (see section MQTT message format [page 66]). Note that you are free to define the topic hierarchy and name according to your individual needs. You are only restricted not to use the # and + characters and not to use $ as the very first character.

**Quality of service**
Select the MQTT QoS from the drop-down list. **Note**: For performance reasons it is recommended to use QoS0 whenever possible. Using QoS1 or QoS2 will increase performance requirements of the application container.

**Publish interval**
Define the publish interval in minutes. **Note**: MQTT messages will be published approximately at this interval. If more than one process data sample has been acquired in this time-span, the message will contain an array of process data points. Note also that the maximum allowed size of a JSON message is 100 kB. When this size is reached, the message is sent immediately, disregarding the publish interval configured for this variable (i.e. even if the set time interval has not yet been reached).

**Data sampling**
Define the conditions for the sampling:
- Only take data if the data source value has changed
- Take data directly as acquired from data source:
  - Note that this option means OT network cycle accurate data sampling and may result in very high amount of data samples in a short time.
  - Sample the acquired data from data source by a fixed sample rate:
    - Opens the **Sample rate in milliseconds** field in which you can specify the sample rate (between 1 and 1000 ms)

**Retained**
“Retained” flag of MQTT message

*Table 8: Elements PROFINET Configuration*
### 4.8.3 GSDML Management

The **GSDML Management** tab allows you to upload the device description files to the PROFINET Tap. The device descriptions contained in these files can be mapped to the devices of your PROFINET configuration (by auto-mapping function).

To open the **GSDML Management** tab, select the **PROFINET Configuration** element in the navigation tree.

![GSDML Management Element](image)

**Figure 26: GSDML Management**

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Name</td>
<td>Name of the GSDML file. You can select one or multiple files by clicking the checkboxes, and then delete the selected file(s) at once by clicking the <strong>Action</strong> button.</td>
</tr>
<tr>
<td>Action</td>
<td>Deletes the GSDML file.</td>
</tr>
<tr>
<td><strong>File Name</strong></td>
<td>Shows the number of GSDML files that have been imported and are available for mapping.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>If the list contains more than ten entries, you can scroll here to display the next ten items.</td>
</tr>
</tbody>
</table>

**Table 9: GSDML Management tab**
Uploading GSDML file(s)

- Click the + button to open the Upload dialog window.

![Upload GSDML file dialog](image)

Figure 27: Upload GSDML file dialog

- Drag and drop your GSDML file from your PC onto the grey area of the dialog window, then click Ok button to start the upload.
- If you want to upload several files at once, click into the grey area to open the file upload dialog of your browser.
- In the File Upload dialog, select all files you want to upload, then click Open button.

![Multiple selection in File upload dialog](image)

Figure 28: Multiple selection in File upload dialog
The three dots in the **Upload GSDML file** dialog indicate that you have selected multiple files for upload:

![Figure 29: Upload GSDML file dialog](image)

- Click **Ok** button to start the upload.
- The uploaded GSDML files are listed in the **GSDML Management** tab and can now be mapped to your PROFINET Configuration.
4.8.4 AutomationML Management

The AutomationML Management tab allows you to upload project engineering file(s) from the TIA Portal in AutomationML format (Automation Markup Language) to the PROFINET Tap. The information contained in the .aml file can then be mapped to the PROFINET configuration by using the Auto-map function.

**Note:**
If your PROFINET line features more than one IO Controller/PLC, you can, of course, import several AutomationML files – each containing the corresponding engineering project of an individual IO Controller/PLC – and map them later to the corresponding IO Controller element in the PROFINET Configuration tree.

To open the AutomationML Management tab, select the PROFINET Configuration element in the navigation tree, then click on the tab in the Editor window.

*Figure 30: AutomationML Management*
### Table 10: AutomationML Management tab

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutomationML Files</td>
<td>Shows the number of .aml files that were imported and are available for mapping.</td>
</tr>
<tr>
<td></td>
<td>Opens dialog for uploading .aml files.</td>
</tr>
<tr>
<td>File Name</td>
<td>Name of the .aml file. You can select one or multiple files by clicking the checkboxes, and then delete the selected file(s) at once by clicking the button.</td>
</tr>
<tr>
<td>Action</td>
<td>Deletes the .aml file.</td>
</tr>
</tbody>
</table>

If the list contains more than ten entries, you can scroll here to display the next ten items.

#### Exporting PROFINET project as AutomationML file from TIA Portal

Before you can upload your AutomationML file to the PROFINET Tap, you must first export it from the TIA Portal.

- To do so, open your PROFINET engineering project in the TIA Portal, then choose **Tools > Export CAx data...** from the menu:

![Figure 31: Export AutomationML file from Tia Portal](image)

**Note:**
You must be logged in as member of the “Siemens TIA Openness” group in order to be allowed to use the **Export CAx data...** function in the TIA Portal.
Uploading AutomationML file(s) to the PROFINET Tap

- Click the button to open the **Upload** dialog window.

![Upload AutomationML file dialog](image)

**Figure 32: Upload AutomationML file dialog**

- Drag and drop your `.aml` file from your PC onto the grey area of the dialog window, then click **Ok** button to start the upload.
- If you want to upload several files at once, click into the grey area to open the file upload dialog of your browser.
- In the **File Upload** dialog, select all files you want to upload, then click **Open** button.

![Multiple selection in File upload dialog](image)

**Figure 33: Multiple selection in File upload dialog**
The three dots in the **Upload AutomationML file** dialog indicate that you have selected multiple files for upload:

![Upload AutomationML file dialog](image)

**Figure 34: Upload AutomationML file dialog**

- Click **Ok** button to start the upload.
- The uploaded files are listed in the **AutomationML Management** tab and can now be mapped to your PROFINET Configuration.
4.8.5 How to configure the PROFINET Tap with GSDML file

This section provides step-by-step instructions for creating a PROFINET Configuration by using GSDML file(s) and for defining a variable to be published via MQTT.

Requirements

- The Edge Device/host on which the PROFINET Tap is running is connected to your PROFINET network.
- You have access to the GSDML files of the IO Devices of your PROFINET network.

Step-by-step instructions

1. Set Link Speed according to your Tap’s connection type (hardware vs. software tap).
   Note: This is applicable for a netX-based capture interface only (cifX OT Interface).
   - In the OT Interface Settings, select the Link Speed.
     - Warning of unsafe system operation!
       When using a “software TAP”, changing this setting may lead to a temporary loss of the bus link and thus of the PROFINET communication. Take precautions that the temporary loss of the bus communication will not affect the safe operation of your plant!
   - Select 100 MBit/s fixed if you are using a “hardware TAP” like e.g. netMIRROR.
   - Select Automatic if you have connected the netX-based interface directly to the PROFINET, i.e. if you are using the built-in “software TAP” of the netX.

2. Gather information from PROFINET start-up.
   - Trigger a start-up of your PROFINET.
     - Warning of unsafe system operation!
       If you have to stop a running PROFINET bus communication for this, take precautions that stopping the bus communication will not affect the safe operation of your plant!
PROFINET Tap listens to the “configuration” messages that are now exchanged between Controller and Devices during the PROFINET start-up phase, and extracts information from it. After a few seconds, all recognized PROFINET participants and their subordinate elements (Modules, Submodules etc.) are listed in the PROFINET Configuration tree:

![PROFINET Configuration tree](image)

**Figure 35: PROFINET configuration recognized during start-up**

---

**Note:**

You may have to reload the page by clicking the 🔄 icon next to the PROFINET Configuration element in order to display the recognized devices in PROFINET Configuration tree.

Note the following about the automatic device recognition during start-up:

- The order in which the devices and elements are represented in the PROFINET Configuration tree relates to the time sequence in which they were recognized; i.e. the first device in the tree is the device that was first recognized during start-up, and so forth. This means that the order of the devices in the tree does not reflect the actual positioning of the devices in the real PROFINET topology.
- The Controller’s name is represented in the tree by its MAC address, because its name is not part of the configuration information that is exchanged during start-up (and can thus not be picked up by the Tap). You can manually change its name later.

- The Tap adds “raw output/input data” as default variables below recognized Data items (i.e. outputs/inputs).

3. Enter name of Controller (optional)
   - Select the Controller element in the tree (followed by MAC Address).
   - The parameters of the selected Controller are displayed in the **PROFINET Controller** tab in the Editor screen.

   ![Figure 36: Change name of Controller](image)

   - Enter a name, e.g. “IO Controller 1A”, then click **Save button**.
The "Succeeded to save data" message appears and the tree now displays the new name of the controller:

![Figure 37: New Controller name](image)

4. Map data semantics from GSDML file(s)
   - Upload GSDML file(s) to the PROFINET Tap (see section GSDML Management [42] page 42 for instructions).
   - In the PROFINET Configuration tree, select the element that you want to map to your GSDML file(s). In this example, select the PROFINET Configuration root element, so that all devices will be mapped in one go.

**Note:**
Note that the mapping process is hierarchical: All sub-elements of a chosen element will also be mapped. This means that if you select e.g. the PROFINET Configuration root element, the auto-mapping wizard will try to map all devices of your PROFINET network to the GSDML files that you have uploaded (respectively to the descriptions it finds in the GSDML files). If you select a Controller in the tree (in case you have more than one Controller in your PROFINET line), all devices under this Controller will be mapped. If you select a Device, all Modules and Submodules of this Device will be mapped, and so forth.

   - In the menu, select **Auto-map** > **Auto-map all devices from GSDML**.
The Auto-map wizards opens and maps the Submodule (a.k.a. Subslot) definitions and variables it finds in the GSDML files to the Submodules of your PROFINET Configuration. Successfully mapped Submodules/Subslots are marked with the green check mark symbol.

Submodules for which the wizard cannot find the corresponding descriptions in the GSDML file(s) are marked with the No matched subslot symbol. (If necessary, you can edit the Submodule and its variables manually later, after the auto-mapping process has been finished.)

**Note:**
The message “There are no data items defined for this submodule, mapping is not possible” could be caused e.g. by an IO-Link Master that has no IO-Link sensor attached to it.
If the wizards cannot map a Submodule (e.g. because a GSDML file contains different Submodule descriptions that have the same Submodule ID), it prompts you to select the applicable Submodule description from a list:

> Click the **Apply** button to select the appropriate GSDML Submodule description for mapping. If you do not know which description to choose, you can select the **Skip** option and edit the Submodule and its variables manually later (after the auto-mapping process has been finished).
After finishing, the wizard shows a summary of the mapping process:

- Click OK button to close the wizard.
- The Devices in the PROFINET Configuration now contain the mapped information/parameters from the GSDML file(s).

5. Select Variables for publishing.
   - In the PROFINET Configuration tree, select the variable that you want to publish.
   - In the Editor screen of the selected variable, select the Publish data option and set the MQTT publication parameters, like Topic, MQTT Quality of Service, sampling rate etc.
Note:
If you do not enter a Topic here, the PROFINET Tap will use the following default string:

```
netFIELD/<gateway prefix or user-prefix>/
<container id>/controller name>/
<device name>/
<slot name>/subslot name>/
<direction>/variable name>/
```

Note also that you are free to define the topic hierarchy and name according to your individual needs. You are only restricted not to use the `#` and `+` characters and not to use `$` as the very first character in the string.

You may also want to change the name of the variable into something that will be more intelligible for the subscribers who will consume the MQTT message, like e.g. "Temperature T1".
➢ After having finished setting the publisher parameters, click **Save** in the menu.

![Image of PROFINET Tap configuration web page]

**Figure 42: Publisher created**

➢ PROFINET Tap immediately starts to publish the variable to the MQTT broker according to your settings.
4.8.6 How to configure the PROFINET Tap with AutomationML file

This section provides step-by-step instructions for creating a PROFINET Configuration by using an AutomationML file and for defining a variable to be published via MQTT.

Requirements

- The Edge Device on which the PROFINET Tap is running is connected to your PROFINET network.
- You have exported your PROFINET engineering project as AutomationML file from the TIA Portal und you have access to the file.

Step-by-step instructions

1. Set Link Speed according to your Tap’s connection type (hardware vs. software tap).
   **Note:** This is applicable for a netX-based capture interface only (cifX OT Interface).
   - In the **OT Interface Settings**, select the Link Speed.
   - **WARNING** *Warning of unsafe system operation!* When using a “software TAP”, changing this setting may lead to a temporary loss of the bus link and thus of the PROFINET communication. Take precautions that the temporary loss of the bus communication will not affect the safe operation of your plant!
   - Select **100 MBit/s fixed** if you are using a “hardware TAP” like e.g. netMIRROR.
   - Select **Automatic** if you have connected the netX-based interface directly to the PROFINET; i.e. if you are using the built-in “software TAP” of the netX.

2. Gather information from PROFINET start-up.
   - Trigger a start-up of your PROFINET.
   - **WARNING** *Warning of unsafe system operation!* If you have to stop a running PROFINET bus communication for this, take precautions that stopping the bus communication will not affect the safe operation of your plant!
PROFINET Tap listens to the “configuration” messages that are now exchanged between Controller and Devices during the PROFINET start-up phase, and extracts information from it. After a few seconds, all recognized PROFINET participants and their subordinate elements (Modules, Submodules etc.) are listed in the PROFINET Configuration tree:

Figure 43: PROFINET configuration recognized during start-up

Note:
You may have to reload the page by clicking the icon next to the PROFINET Configuration element in order to display the recognized devices in PROFINET Configuration tree.

Note the following about the automatic device recognition during start-up:

- The order in which the devices and elements are represented in the PROFINET Configuration tree relates to the time sequence in which they were recognized; i.e. the first device in the tree is the device that was first recognized during start-up, and so forth. This means that the order of the devices in the tree does not reflect the actual positioning of the devices in the real PROFINET topology.

- The Controller’s name is represented in the tree by its MAC address, because its name is not part of the configuration information that is exchanged during start-up (and can thus not be picked up by the Tap). You can manually change its name later.

- The Tap adds “raw output/input data” as default variables below recognized Data items (i.e. outputs/inputs).
   - Upload the AutomationML file to the PROFINET Tap (see section *AutomationML Management* [page 45] for instructions).
   - In the PROFINET Configuration tree, select the element that you want to map to your AutomationML file. In this example, select the PROFINET Configuration root element, so that all devices will be mapped in one go.

   **Note:**
   Note that the mapping process is hierarchical: All sub-elements of a chosen element will also be mapped. This means that if you select e.g. the PROFINET Configuration root element, the auto-mapping wizard will try to map all devices of your PROFINET network to the AutomationML file that you have uploaded (respectively to the descriptions it finds in the file). If you select a Controller in the tree (in case you have more than one Controller in your PROFINET line), all devices under this Controller will be mapped. If you select a Device, all Modules and Submodules of this Device will be mapped, and so forth.

   - In the menu, select 🔗 Auto-map > Auto-map all devices from AutomationML.

   The Auto-map wizards opens and maps the Submodule (a.k.a. Subslot) definitions and variables it finds in the AutomationML file to the PROFINET Configuration. Successfully mapped variables and subslots that do not have variables are marked with the green check mark symbol ✅.

   ![Auto-mapping in progress](image-url)

   **Figure 44:** Auto-mapping in progress
Submodules for which the wizard cannot find the corresponding descriptions in the AutomationML file are marked with the **No matching submodule found** symbol: 😞. (If necessary, you can edit the Submodule and its variables manually later, after the auto-mapping process has been finished.)

After finishing, the wizard shows a summary of the mapping process:

![Auto-map subslot from AutomationML](image)

**Figure 45: Mapping finished**

- Scroll down to the bottom of the wizard, then click **OK** button to close the wizard.
- The Devices in the **PROFINET Configuration** now contain the mapped information/parameters from the AutomationML file.

4. Select Variables for publishing.
   - In the **PROFINET Configuration** tree, select the variable that you want to publish.
   - In the Editor screen of the selected variable, select the **Publish data** option and set the publication parameters, like Topic, MQTT Quality of Service, sampling rate etc.
Note:
If you do not enter a Topic here, the PROFINET Tap will use the following default string:

```
netFIELD/<gateway prefix or user-prefix>/
<container id>/<controller name>/<device name>/
<slot name>/<subslot name>/<direction>/<variable name>/<node id>
```

Note also that you are free to define the topic hierarchy and name according to your individual needs. You are only restricted not to use the `#` and `+` characters and not to use `$` as the very first character in the string.

---

You may also want to change the name of the variable into something that will be more intelligible for the subscribers who will consume the MQTT message, like “TriangulationValue03”
After having finished setting the publisher parameters, click **Save** in the menu.

PROFINET Tap immediately starts to publish the variable to the MQTT broker according to your settings.
5 Good to know...

5.1 Hypervisor-specific switch/bridge configuration settings

**VMware**

If you are using VMware, make sure that the virtual switch that connects to the PROFINET VLAN accepts **Promiscuous mode** and **MAC address change** in its security settings:

```
Figure 48: Security settings of virtual switch in ESXi
```

**Proxmox (KVM)**

Proxmox Linux bridges (vmbr*) act like switches, thus they do not forward all traffic into the virtual machine. To set a bridge to hub-like behavior, do the following:

- Edit `/etc/network/interfaces.new` and add the line `bridge_ageing 0` in the relevant `vmbr*` block:

```
Figure 49: Edit Linux bridge in Proxmox
```
5.2 Replacement of PROFINET Device and Controller

Replacing PROFINET Device

You can replace an IO Device in your PROFINET network without having to adapt the PROFINET Tap configuration.

The only conditions for this are:

- The new device has the same *Name Of Station* and the same IP address.
- You allow the PROFINET Tap to listen to a complete PROFINET startup sequence in which the new device is included.

Replacing PROFINET Controller

In case of Controller replacement, you must adapt its MAC address in the PROFINET Tap configuration before starting up the PROFINET network again.

- Select the Controller in the PROFINET Configuration tree and enter the MAC address of the new Controller, then click **Save**.

[Figure 50: MAC address of Controller]

- You then must allow the PROFINET Tap to listen to a complete PROFINET startup sequence in which the new Controller is included.
5.3 MQTT message format

Structure of MQTT Topic (default)

This section describes the structure of the MQTT Topic string that will be used by default if you do not specify your own Topic string when you select a variable in the PROFINET Configuration tree for publishing (PROFINET Variable > Publish data option > Topic field).

Syntax:

```
netFIELD/<gateway prefix or user-prefix>/<container id>/<controller name>/<device name>/<slot name>/<subslot name>/<direction>/<variable name>/<node id>
```

Elements in topic:

<table>
<thead>
<tr>
<th>Element in topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;gateway prefix&gt;</td>
<td>If the PROFINET Tap container is used on a netFIELD OS, the gateway prefix identifies the &quot;source&quot; (= gateway) of the MQTT message according to global MQTT settings of the netFIELD OS. (Local Device Manager &gt; General Settings &gt; Default MQTT Client Settings &gt; Gateway settings &gt; Gateway prefix). Note: By default, the gateway prefix is automatically determined to be identical with the Hardware ID of the netFIELD OS Device respectively of the netFIELD OS Datacenter.</td>
</tr>
<tr>
<td>&lt;user-prefix&gt;</td>
<td>If the PROFINET Tap container is used on a host without netFIELD OS, the proper gateway_prefix (see above) cannot be automatically determined by the container, and is therefore substituted with the user-prefix default string. Note: In order to properly identify the &quot;source&quot; of the MQTT message, you can replace the default user-prefix string with a meaningful value via the GATEWAY_PREFIX environment variable. To do so, simply add GATEWAY_PREFIX=&lt;my_source&gt; under environment in the Docker Compose file, e.g.: environment: - CONTAINER_ID=netfield-app-profinet-tap - GATEWAY_PREFIX=Tap_machine3</td>
</tr>
<tr>
<td>&lt;container id&gt;</td>
<td>Identifier according to CONTAINER_ID environment variable. Note: By default, the Container ID is netfield-app-profinet-tap, but can be changed by the user. You can change it in the Docker Compose file or – if you are a netFIELD Cloud user – in the netFIELD Portal.</td>
</tr>
<tr>
<td>&lt;controller name&gt;</td>
<td>Name of the IO Controller (may be represented by default by its MAC address)</td>
</tr>
<tr>
<td>&lt;device name&gt;</td>
<td>Name of the IO Device</td>
</tr>
<tr>
<td>&lt;slot name&gt;</td>
<td>Name of the PROFINET Module</td>
</tr>
<tr>
<td>&lt;subslot name&gt;</td>
<td>Name of the PROFINET Submodule</td>
</tr>
<tr>
<td>&lt;direction&gt;</td>
<td>Specifies “inputs” or “outputs”</td>
</tr>
<tr>
<td>&lt;variable name&gt;</td>
<td>Name of the variable</td>
</tr>
<tr>
<td>&lt;node id&gt;</td>
<td>Unique number assigned to the variable when it was created in the configuration tree. Stays the same until deletion of the element (will not be changed by changing the name of the variable in the configuration GUI, or of any other element which is contained in the topic)</td>
</tr>
</tbody>
</table>

Table 11: Descriptions of elements in topic
Example:

```text
wago-765-1104/Slot 1/Subslot 1/outputs/raw output data/251
```

Structure of message content

```json
{
  "schemaVersion": 1,
  "nodeId": "251",
  "messageType": "processdata",
  "dataType": "octetString",
  "data": [
    {
      "state": "valid",
      "value": "0000"
    },
    {
      "timestamp": "2020-05-28T13:28:55.522859992",
      "state": "valid",
      "value": "0100"
    },
    {
      "state": "valid",
      "value": "00AB"
    },
    {
      "state": "valid",
      "value": "FF00"
    },
    {
      "state": "valid",
      "value": "0123"
    }
  ]
}
```

<table>
<thead>
<tr>
<th>Element</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>schemaVersion</td>
<td>Identifies the version of the JSON structure of the message (as depicted in the example above). The current structure version is &quot;1&quot;. If the structure changes in future, the schemaVersion will be incremented.</td>
</tr>
<tr>
<td>nodeId</td>
<td>Is the same node ID as in the topic.</td>
</tr>
<tr>
<td>messageType</td>
<td>Is always &quot;processdata&quot;.</td>
</tr>
<tr>
<td>dataType</td>
<td>Is the data type of the variable as specified in the configuration GUI (&quot;octetString&quot; in this example).</td>
</tr>
<tr>
<td>data</td>
<td>Is the array of one or multiple process data samples contained in this message. The amount may vary according to the sample and publish intervals. Each data element consists of:</td>
</tr>
<tr>
<td></td>
<td>timestamp</td>
</tr>
<tr>
<td></td>
<td>state</td>
</tr>
<tr>
<td></td>
<td>value</td>
</tr>
</tbody>
</table>

*Table 12: Notes on message content*
5.4 Restrictions concerning AutomationML export from TIA Portal and mapping in PROFINET Tap

This section lists the known restrictions concerning the export of project engineering data in AutomationML format from the TIA Portal, and its subsequent import and mapping in the PROFINET Tap.

- The PROFINET Tap supports only AutomationML files exported from the TIA Portal. Support of AutomationML files exported from EPLAN has not been tested or verified.
- You must be logged in as member of the “Siemens TIA Openness” group in order to be allowed to use the Export CAx data... function (= export in AutomationML format) in the TIA Portal.
- The TIA Portal does not support the Export CAx data... function for the following devices/items (therefore auto-mapping of variables for these devices/items by the PROFINET Tap is not possible):
  - Port-Port connections
  - Connections to and between extension racks
  - Multi-CPUs
  - H-devices
  - HMI devices except push button panels and key panels
  - Drives
  - Output mode and range of analog channels
  - Packed addresses
- The TIA Portal does not export the structure of complex data types like the PLC data type “256ByteModuleStructured”. Therefore mapping of complex data types is currently not supported.
- The PROFINET Tap does not support the mapping of variables which exceed the defined address range of a submodule.
5.5 Mapping of TIA Portal data types to PROFINET Tap-supported data types

The following table shows the mapping of data types from the TIA Portal to data types supported by the PROFINET Tap.

**Note:**
For channels where no explicit data type is specified, PROFINET Tap will automatically select an unsigned integer data type of matching size. For example, a channel of size 8 bit will be selected as `unsigned8`, a channel of 32 bit size as `unsigned32`, and so on.

<table>
<thead>
<tr>
<th>Category</th>
<th>TIA Portal data types</th>
<th>PROFINET Tap data types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary</td>
<td>BOOL</td>
<td>boolean</td>
</tr>
<tr>
<td>Bit sequences</td>
<td>BYTE</td>
<td>unsigned8</td>
</tr>
<tr>
<td></td>
<td>WORD</td>
<td>unsigned16</td>
</tr>
<tr>
<td></td>
<td>DWORD</td>
<td>unsigned32</td>
</tr>
<tr>
<td></td>
<td>LWORD</td>
<td>unsigned64</td>
</tr>
<tr>
<td>Integers</td>
<td>SINT</td>
<td>integer8</td>
</tr>
<tr>
<td></td>
<td>INT</td>
<td>integer16</td>
</tr>
<tr>
<td></td>
<td>DINT</td>
<td>integer32</td>
</tr>
<tr>
<td></td>
<td>USINT</td>
<td>unsigned8</td>
</tr>
<tr>
<td></td>
<td>UINT</td>
<td>unsigned16</td>
</tr>
<tr>
<td></td>
<td>UDINT</td>
<td>unsigned32</td>
</tr>
<tr>
<td></td>
<td>LINT</td>
<td>integer64</td>
</tr>
<tr>
<td></td>
<td>ULINT</td>
<td>unsigned64</td>
</tr>
<tr>
<td>Floating point numbers</td>
<td>REAL</td>
<td>real32</td>
</tr>
<tr>
<td></td>
<td>LREAL</td>
<td>real64</td>
</tr>
<tr>
<td>Times</td>
<td>SSTIME</td>
<td>octetString</td>
</tr>
<tr>
<td></td>
<td>TIME</td>
<td>octetString</td>
</tr>
<tr>
<td></td>
<td>LTIME</td>
<td>octetString</td>
</tr>
<tr>
<td>Date and time</td>
<td>DATE</td>
<td>octetString</td>
</tr>
<tr>
<td></td>
<td>(TIME_OF_DAY)</td>
<td>octetString</td>
</tr>
<tr>
<td></td>
<td>LTOD</td>
<td>octetString</td>
</tr>
<tr>
<td></td>
<td>(LTIME_OF_DAY)</td>
<td>octetString</td>
</tr>
<tr>
<td></td>
<td>DT</td>
<td>not supported</td>
</tr>
<tr>
<td></td>
<td>(DATE_AND_TIME)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LDT</td>
<td>octetString</td>
</tr>
<tr>
<td></td>
<td>DTL</td>
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Table 13: Mapping of data types from TIA Portal
5.6 TLS encryption and netFIELD OS

Please note the following if you intend to use SSL/TLS encryption:
The certificates and key files that the MQTT client embedded in the
PROFINET Tap container needs for establishing a secure SSL/TLS
connection to the MQTT broker are not managed by the PROFINET Tap
container itself. Instead, they are to be stored on the Edge Device/
Datacenter and mapped into the container from the operating system.
For this mapping, the following standard directories are mapped into the
container when you use the netFIELD OS and the Docker Compose files
from Hilscher (respectively when you deploy the container via netFIELD
Portal using the default Container Create Options):
/etc/ssl/
/usr/share/ca-certificates/

Note:
If you require different directories for your use case, you may
change the mapping of these “bind mounts” in the Docker Compose
file respectively in the netFIELD Portal before deploying the
container.
Note also that the Docker Compose file for the Linux Datacenter
use case (without netFIELD OS) does not specify any directories
regarding TLS for MQTT by default.

As a user, you can store your required keys and certificates in these
directories. By selecting the SSL / TLS option on the MQTT Client
Settings page, you can allow the MQTT client embedded in the
PROFINET Tap container to use these files for establishing its secure SSL/
TLS connection.
Note that these keys and certificates must be stored in PEM format (a
specific file format for storing this kind of data) and that you have to specify
the full path to the appropriate PEM file in the corresponding fields of the
MQTT Client Settings page. For example:

File name and path to private key in PEM format:
/etc/ssl/private/client-key.pem

File name and path to certificate chains in PEM format:
/etc/ssl/services/client-cert.pem

Override the trusted CA certificates in PEM format:
/etc/ssl/services/ca-cert.pem

Note also that if you intend to use more than one “secure” MQTT broker (as
listed in the Server URIs field), and thus require several different
certificates, you have to store them in one single PEM file. This is because
it is not possible to specify a list of multiple paths to separate PEM files for
individual brokers.
5.7 Container configuration data storage

The configuration data of the container is stored in the `netfield-app-profinet-tap-data` Docker volume.

Your whole application configuration data - such as your PROFINET configuration, activated publishers etc. - is stored here independently of the run state or the version of your netFIELD App PROFINET Tap container. When you stop and restart the container, the configuration will be loaded from this volume again.

Note that the configuration data in this volume will be automatically migrated to the latest version when you deploy a newer version of the netFIELD App PROFINET Tap.

Note also that only upgrading towards higher versions is possible. If you try to start a lower container version with a newer configuration volume, the configuration will not be loaded, but will be cleared instead.
5.8 Installing CodeMeter and activating license

For users who are new to the CodeMeter licensing technology, this section describes how to setup a CodeMeter server in your local network and activate your PROFINET Tap license key, using the CodeMeter User Runtime for Windows as an example.

1. Download license server from Wibu-Systems.
   - Go to the CodeMeter User Software page [link]
   - Under CodeMeter User Download, download the CodeMeter User Runtime according to the operating system of the server/machine/PC on which you want to install your license server, e.g. CodeMeter User Runtime for Windows:

   ![Figure 51: CodeMeter runtime download](image)

2. Install the CodeMeter runtime on your server/machine/PC.
   - Install the license server via the downloaded CodeMeterRuntime.exe installer.
   - In the Custom Setup dialog of the setup wizard, make sure that the Network Server option is enabled:

   ![Figure 52: Enable network server option](image)
After installation, you will find the **CodeMeter Control Center** in the Windows taskbar:

![Figure 53: Installed CodeMeter server in taskbar](image)

3. Obtain license PROFINET Tap license.
   - Contact your local Hilscher sales representative ([www.hilscher.com/company/offices](http://www.hilscher.com/company/offices)) to obtain a license key.
   - After purchasing the license, you will receive a download link for the license key.

4. Activate license key.
   - Open the link using a web browser on the server/machine/PC where the previously installed license server is running.
   - The link leads you to a Wibu-Systems **Available Licenses** web page:

![Figure 54: Activate license web page](image)

   - Make sure that the **netFIELD App PROFINET Tap** is selected (check-marked), then click **Activate Selected Licenses Now** button.
   - The License key is now automatically downloaded, imported and activated in your local CodeMeter license server.
5. Check activation of license (optional).

- To check your license, open the CodeMeter Control Center in the Windows taskbar:

![Open CodeMeter Control Center](image1)

*Figure 55: Open CodeMeter Control Center*

- In the CodeMeter Control Center, you can also open the WebAdmin web interface for more details.

![CodeMeter Control Center](image2)

*Figure 56: CodeMeter Control Center*
In the **WebAdmin** web interface, open **Container tab > Hilscher License Container > Licenses** to display information on the license:

![WebAdmin screen showing license information](image)

**Figure 57: PROFINET Tap in WebAdmin**

- Click on the **Product Code** to open the **Product Item Details** page, where you can find further details, like e.g. the **Maintenance Period**.

![Product Item Details screen](image)

**Figure 58: Click on Product Code**

- The **Maintenance Period** on the **Product Item Details** page tells you for how long you can receive free updates for the app:

![Product Item Details table](image)

**Figure 59: Product Item Details**
6. Configure the CodeMeter license server endpoint in the PROFINET Tap.

- To configure the CodeMeter license server endpoint in the PROFINET Tap, open the **License Server Settings** page of the PROFINET Tap’s configuration web GUI:

![License Server Settings initial screen](image)

- On the **License Server Settings** page, enter the host name or the IP address of the server/machine/PC where the license server is running.

  **Note:**
  
  Note that the required host name and IP address are displayed on the **Dashboard** tab of the CodeMeter **WebAdmin** web interface for reference:

![CodeMeter WebAdmin](image)

- After clicking the **Save** button on the **License Server Settings** page, the PROFINET Tap immediately tries to connect to the server and retrieve its license.
7. Check the license state on the **Status** page.
   ➢ To check the state, first select the **netFIELD App PROFINET Tap** root element in the navigation tree, then open the **Status** tab:

![Figure 61: Check license status](image)

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6  Legal notes

Terms and conditions

Please read the terms and conditions under https://www.netfield.io/termsOfUse.

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