

CONFIGURATION GUIDE

Setting-Up an Industrial Edge IPC



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1. Introduction

This document is intended as a guide for setting up an Industrial Edge IPC, which allows to access the various types of production asset data, to process this data on-premises and to provide it to IIoT applications on cloud and central platforms using the OPC Unified Architecture (UA) standard. The target is not to discuss all possible different aspects and alternatives, but to provide a straightforward step-by-step approach for finding and installing the individual components required for a working system.

Therefore, the setup of the individual Industrial Edge IPC components doesn't require any specific background knowledge and, for instance, can be performed by qualified technical personnel and system integrators.

2. Recommended Architecture

A key challenge for Industrial IoT applications is the collection of raw data from production assets and its processing, filtering and aggregation so that it can be used in cloud or central computer applications. These tasks are performed by Industrial Edge IPCs, which are located on-site, but, at the same time, are centrally managed and tightly integrated with the higher-level platform. They perform data pre-processing and thus reduce the volume of data transmitted, enable real-time reaction to critical process conditions and ensure to continue work even if the higher-level platform is temporarily unavailable.

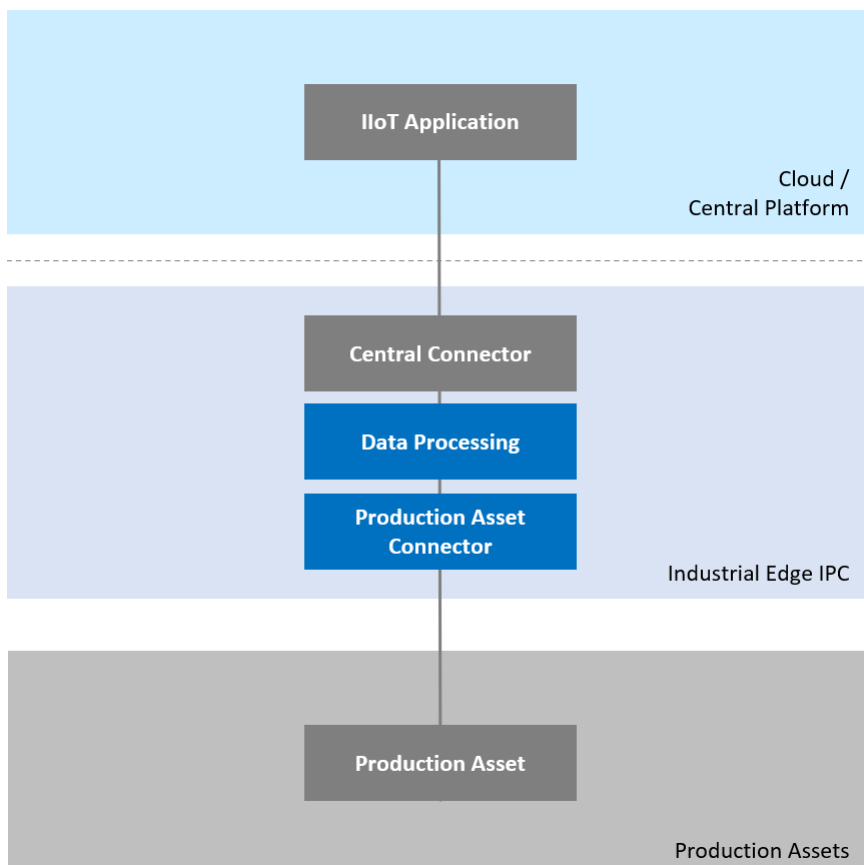


Figure:

The Industrial Edge IPC is a central component of Industrial IoT applications, connecting the production assets with the cloud or central computer platform.

Due to their flexibility, container applications are deployed on the Industrial Edge IPC. These small software modules provide a precisely defined functionality with all required components as a library, allowing to execute these independently of external components and the environment.

3. Required Industrial Edge IPC Hardware and Software

The basic requirements for an Industrial Edge IPC are an AMD64 architecture and a minimum of 275 MB of free disk space.

Further guidelines regarding system requirements and hardware sizing can be derived from the type of IIoT application planned to run on the Industrial Edge IPC. Some typical types of applications are shown in the following table.

IIoT Application	Required Hardware	Required Software
Overall Equipment Effectiveness (OEE) and Data Archiving Small Range (1 PLC, 100 tags, 1,000 ms publishing rate)	Intel Atom, Intel Celeron 2 GB of RAM	1 container application, no additional software
Overall Equipment Effectiveness (OEE) and Data Archiving Large Range (30 PLCs, 10,000 tags, 1,000 ms publishing rate)	Intel Atom, Intel Celeron 4 GB of RAM	2 container applications, no additional software
Predictive Maintenance for CNC Machine Small Range (1 PLC, 100 tags, 50 ms publishing rate)	Intel i3 4 GB of RAM	1 container application, low resource software
Predictive Maintenance for CNC Machine Large Range (1 PLC, 1,000 tags, 10 ms publishing rate)	Intel i5 4 GB of RAM	1 container application, low resource software
Machine Learning, Big Data Analytics Small Range (1 PLC, 1,000 tags, 100 ms publishing rate)	Intel i5 4 GB of RAM	1 container application, heavy resource software
Machine Learning, Big Data Analytics Large Range (100 PLCs, 100,000 tags, 100 ms publishing rate)	Intel i7 16 GB of RAM	5 container applications, heavy resource software

Table 1:
Industrial Edge IPC hardware and software requirements for typical IIoT applications

In general, adjustments to the IIoT application have the following effects on the required hardware configuration of the used Industrial Edge IPC:

Type of Adjustment	Type of Impact
Number of PLCs	CPU performance, RAM consumption
Number of Tags	RAM consumption (mainly)
Complexity of Tags (e.g. Boolean vs. Arrays)	CPU performance, RAM consumption
Publishing Rate	CPU performance (mainly)
Network Load	Communication may turn into bottleneck Increase number of Industrial Edge IPCs, if needed

Table 2:
Types of adjustments to IIoT applications and their impacts on Industrial Edge IPC hardware resources

The following additional requirements apply for the Industrial Edge IPC:

- For connecting the Industrial Edge IPC to Microsoft Azure an Ubuntu Server 18.04 distribution is required.
- The connection of the Industrial Edge IPC to AWS services requires either a Windows or Linux operating system, capable to run the Java 8 development platform and the Docker runtime engine. Further requirements as well as information about supported platforms regarding the usage of the OPC UA standard (and AWS IoT Greengrass) for the data exchange between the Industrial Edge IPC and the AWS services can be found at <https://docs.aws.amazon.com/greengrass/v1/developerguide/what-is-gg.html#gg-platforms>.

4. Setting-Up the Industrial Edge IPC for Microsoft Azure

The following steps install the individual Industrial Edge IPC components for connecting it to Microsoft Azure and to the production assets:

- Follow the steps described at <https://docs.microsoft.com/en-us/azure/iot-edge/how-to-install-iot-edge> to install the Microsoft Azure IoT Edge runtime engine (central connector).
- Deploy the required Azure IoT Edge modules from the Azure portal using the guide at <https://docs.microsoft.com/en-us/azure/iot-edge/how-to-deploy-modules-portal>.

A more specific instruction for deploying the Softing Industrial modules from Azure Marketplace is available at the Softing GitHub page

<https://github.com/SoftingIndustrial/datafeed-edge-connector/blob/master/cloud/azure.md>.

- Install and run the Docker application of the Softing license server for dynamically licensing the Softing modules by following the instructions given at <https://github.com/SoftingIndustrial/datafeed-edge-connector/blob/master/Licenses/SoftingLicenseServer/README.md#license-server-in-containerized-linux>.
- Configure the Softing module including the access to the production assets and its licensing by opening an internet browser using the URL `<IPCDomainName>:8099`.

5. Setting-Up the Industrial Edge IPC for AWS Services

This section describes the installation of the individual Industrial Edge IPC components for connecting it to AWS services using the OPC UA standard and to the production assets.

- Install Docker Engine at the Industrial Edge IPC following the instructions given at <https://docs.docker.com/engine/install/>.
- Use AWS IoT Greengrass Core to establish the Industrial Edge IPC connection to AWS services. (An introduction to AWS IoT Greengrass Core can be found at <https://docs.aws.amazon.com/greengrass/v1/developerguide/what-is-gg.html>.)

This is done by the following steps:

- Install AWS IoT Greengrass Core as a Docker container on the Industrial Edge IPC following the instruction given at <https://docs.aws.amazon.com/greengrass/v1/developerguide/install-ggc.html#gg-docker-support>. (For instance, the latest version of the AWS IoT Greengrass Core Docker image for a Linux x86 64-Bit environment is available at https://hub.docker.com/r/amazon/aws-iot-greengrass/tags?page=1&ordering=last_updated&name=1.11.0-amazonlinux-x86-64.)
- Follow the instructions at <https://docs.aws.amazon.com/greengrass/v1/developerguide/what-is-gg.html#gg-docker-download> to run AWS IoT Greengrass in a Docker container.
- Configure the AWS IoT Greengrass Core based on the instructions at <https://docs.aws.amazon.com/greengrass/v1/developerguide/gg-core.html>. (This step configures the local AWS IoT Greengrass instance at the Industrial Edge IPC for cloud access, including its configuration file, internal settings, etc.)
- Validate that the Industrial Edge IPC satisfies all required AWS IoT Greengrass dependencies by following the instructions at <https://docs.aws.amazon.com/greengrass/v1/developerguide/setup-filter.other.html>.
- Set up the cloud resources in the AWS IoT service to allow the local AWS IoT Greengrass instance at the configured Industrial Edge IPC to talk to its cloud counterpart as described at <https://docs.aws.amazon.com/greengrass/v1/developerguide/gg-config.html>. (This step includes the setup of AWS IoT Greengrass groups and of AWS IoT Greengrass Core as well as the creation of the AWS IoT Greengrass Core certificates.)
- Start AWS IoT Greengrass Core at the Industrial Edge IPC as described at <https://docs.aws.amazon.com/greengrass/v1/developerguide/gg-device-start.html>. (This step starts the communication between the two AWS IoT Greengrass counterparts.)

NOTE:

Once AWS IoT Greengrass Core is installed and running on the Industrial Edge IPC the included connectors can be used. These include:

- IoT SiteWise Connector
(see <https://docs.aws.amazon.com/greengrass/v1/developerguide/iot-sitewise-connector.html>)
The IoT SiteWise connector acts as central connector and allows working as OPC UA Client, for instance for accessing production asset data with Softing Industrial modules. AWS IoT Greengrass Core forwards this data to the AWS IoT SiteWise cloud service and to the IIoT application.
- Docker Application Deployment Connector
(see <https://docs.aws.amazon.com/greengrass/v1/developerguide/docker-app-connector.html>)
The Docker Application Deployment connector can be used for setting up an automated process to pull and start Docker applications, e.g. Softing Industrial modules. It is an optional component, but it may help in scenarios when no other Docker container orchestration tool or online container registry is available or used.
- Select the required Softing Industrial modules at <https://hub.docker.com/u/softingindustrial> and follow the instructions for pulling these from the Softing Industrial Docker Hub site.
- Follow the instructions at <https://hub.docker.com/r/softingindustrial/floating-license-server> to install and run the Docker application of the Softing license server for dynamically licensing the Softing modules.
- Configure the Softing module including the access to the production assets and its licensing by opening an internet browser using the URL `<IPCDomainName>:8099`.

NOTE:

The given URLs have last been checked on Dec 20, 2021.

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