

NEXOCRAFT™

graphicx.io

Industrial IoT Platform

BASIC TERMS & FUNCTIONS

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01 BASIC TERMS

The IIoT platform graphicx.io offers highly scalable cloud applications with maximum flexibility. By utilizing state-of-the-art design principles, it is possible to adapt the platform to your operational requirements without any further programming effort. If you have any questions in this regard, please do not hesitate to contact us. In the following, we will first explain the most important terms:

1. Space

A Space is the top organizational level within the platform and represents the scope of an IoT project, e.g. a customer project or proof of concept. A platform user needs an invitation and the associated permissions in order to log into a Space and make changes.

2. Type

In graphicx.io, there are Types of different elements, including Container-Type, Device-Type, Event-Type and Channel-Type. In the following paragraphs, these Types are described in more detail. Generally, a Type is defining standards for platform elements. They are particularly relevant when setting up the platform and should be set up and changed only by technically experienced personnel. As a guideline, Types of elements should be defined by the platform admin. However, the data of the elements themselves can be maintained by other users.

3. Container

Containers are the basic, overarching organizational elements within a Space in the graphicx.io platform. They are used in particular to digitally map organizational structures of real existing objects such as factories, plants, machines or sensors. A container can also be enriched with descriptive data (called metadata), e.g. address, hall number or assembly point. Applicable metadata is defined in the respective container Type. The container logic enables a flexible structuring within the platform and replaces the often insufficient mapping performance of a classical tree structure.

4. Container Type

The Container Type defines with which data a certain container in the platform can be enriched later. For illustration a few examples:

- The container type „Factory“ receives the data fields: name, street, house number, city, postal code
- A container of type factory is enriched with the metadata: Production North, Fabrikstraße, 123, Neustadt, 67054

- ⦿ The container type „Machine“ receives the data fields: Factory assignment, production group, hall number, date of commissioning
- ⦿ A container of type machine is enriched with the metadata: Production north, cold forming, 23, 25.08.2020

5. Device

A device is a real or virtual object that can collect data in a structured way and transfer it to the cloud. Example: A temperature sensor that records and transmits the temperature in degrees Celsius every 15 minutes. Devices are assigned to containers.

6. Device Type

The Device Type defines for the platform which data points (channels) can be captured by the respective Device Type. These channels are assigned the numbers 1-n and are each assigned to a channel type (e.g. temperature). This includes the acquisition category (e.g. measured value), the acquisition unit (e.g. degree Celsius) and the data format (e.g. float).

7. Tags

Tags are additional information that can be added to platform elements without being bound to the structure of the respective element. In principle, they are free text fields that can systematically include additionally required information.

8. Filter

A filter is a search function with which platform elements (e.g. devices, containers, etc.) can be found according to the search criteria entered. This also includes tags.

The most important elements are illustrated in the following figure with sample information:

Space: Plastics Processing Nexus GmbH

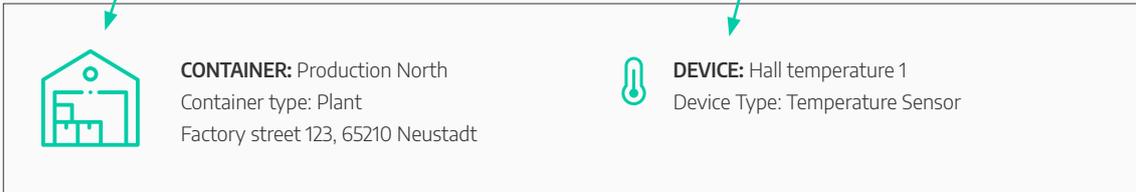
CONTAINER TYPE: Plant

Data fields: Name, Street, House number, city, postal code

DEVICE-TYPE: Temperature Sensor

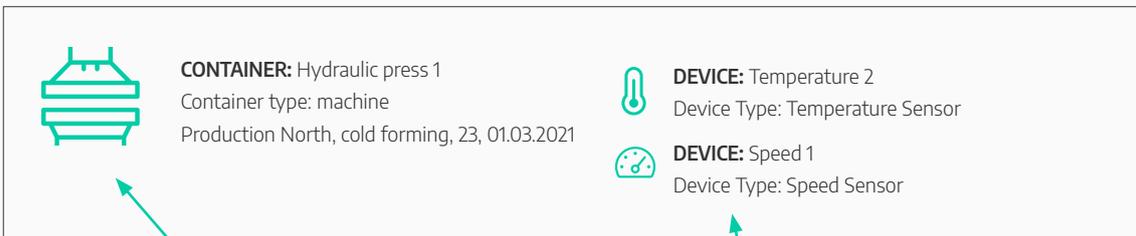
Data Channel: Temperature

Data Channel: Timestamp



CONTAINER: Production North
Container type: Plant
Factory street 123, 65210 Neustadt

DEVICE: Hall temperature 1
Device Type: Temperature Sensor



CONTAINER: Hydraulic press 1
Container type: machine
Production North, cold forming, 23, 01.03.2021

DEVICE: Temperature 2
Device Type: Temperature Sensor

DEVICE: Speed 1
Device Type: Speed Sensor

CONTAINER TYPE: Hydraulic press
Data fields: Plant assignment, production group, hall number, inspection acceptance

DEVICE-TYPE: Speed sensor
Data channel: Speed
Data channel: Timestamp

FIGURE: 1 Conceptual overview of various elements as an exemplary implementation of the IoT platform

02 FUNCTIONS

1. Asset Manager

IN A NUTSHELL: In the Asset Manager you can map organizational structures that best match the real existing objects in your organization. To do this, you first define which data fields (i.e. metadata) you want to enter and then enter the master data for your workshops.

Asset Manager

Spaces **Container Manager** Container Type Manager

50 of 94 results

| Container UUID | Container Name | Container Type Name | Tags |
|--------------------------------------|--------------------------------|---------------------|-------------------------------|
| f8b0fe39-e22c-422a-907e-66c9a76c245c | [ES 11] Relative Humidity | Device | 421.0 trockenabsaugung 134/3 |
| d474fa3f-6d9f-4aa3-8c72-f0fe2d664ff2 | DPS 14 | Device | 910100030205 mms-absaugung |
| 00cc5b99-1b6b-4d28-8f99-f98b8f0d925 | ACS 12 | Device | 910100030205 trockenabsaugung |
| 0436647c-d8e6-4944-a1f8-16b5fca34b7e | [PS 16] Particulate Matter 1.0 | Device | 421.0 ps mms-absaugung 134/3 |
| 086dd143-94bd-4616-9489-173682a0c577 | TIS 14 | Device | 910100030205 trockenabsaugung |
| 67c6855c-2ad7-46f2-8664-9bf63baa48c6 | [ACS 13] Sound Pressure | Device | acs 421.0 mms-absaugung 134/3 |
| c6ca5564-4695-4dee-b5bc-0668f2e11680 | DPS 10 | Device | 910100030205 |

FIGURE: 2 Asset Manager of the IoT platform with a list of all containers and extensive search function

FURTHER INFORMATION: In the graphicx.io IIoT platform, assets are managed using a container logic. Consequently, you first define the container types of your organization that are relevant for you in the Asset Manager. Container types are the essential elements of your organization or IoT project. Typical examples of container types are factory, hall, production line, region, branch office or subsidiary. Once the appropriate container types have been defined, the corresponding containers can be created and metadata can be entered. For example, all containers of the Container Type Region would then be created and maintained with the metadata „North“, „East“, „Middle“, „South“, „West“.

The user can also view the properties, rights, tags and metadata of a container type as well as define relationships between containers using filters and customizing these filters.

2. Device Manager

IN A NUTSHELL: With the Device Manager you manage the devices that record your measurement data. The devices can be registered and assigned to the containers created in the Asset Manager. In the Device Manager you also define which information and data streams you want to transmit from your devices to the platform. In this way, you lay the foundation for performing certain functions in the platform, such as monitoring via a dashboard.

FURTHER INFORMATION: In the Device Manager you first define the Channel Types available on your devices. A channel type describes a parameter (e.g. temperature) that you want to stream from your devices to the platform. You use this information to define Device Types. For example, Device Type „A“ includes the

channel types „Temperature“ and „Voltage“. Now you can add all devices of Device Type „A“ as a list here and have a transparent and flexible structure of your devices and all parameters you need. One or more Devices are later combined in a container in the Asset Manager. Each Device can be tagged, searched and filtered with any number of tags. For example, all Devices can be listed with the tag „Metallpresse_136“.

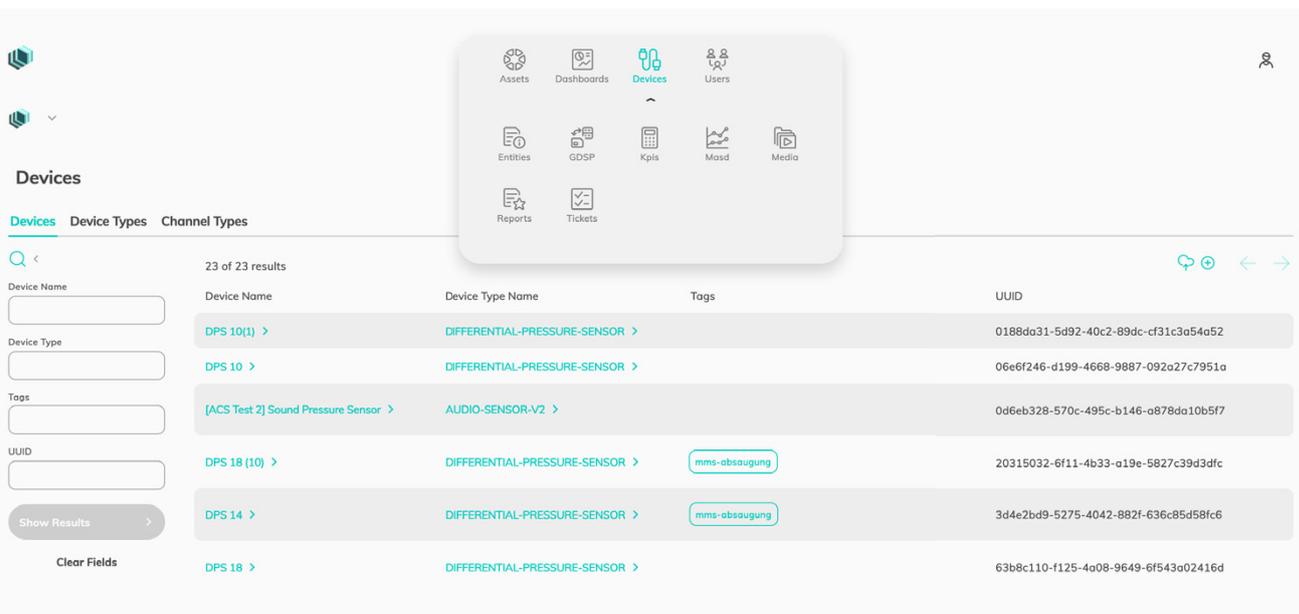


FIGURE: 3 Device Manager of the IoT platform with a list of all devices, tags and the search function

3. User Manager

IN A NUTSHELL: The User Manager is used to manage user accounts and access rights. New users are created in the platform by sending an e-mail invitation and must confirm a link received in the message to activate their account in the platform. Afterwards the e-mail address is assigned to the user account in the platform.

FURTHER INFORMATION: The procedure described above means that each user account must always be associated with a valid e-mail address. The password assigned to the account is managed by the user himself and is not stored in clear text by NEXOCRAFT™.

Basically, user accounts are assigned to a „Space“ in the platform, i.e. a logical organizational unit (see Asset Manager). The User Manager offers functions to assign user accounts within the platform with permissions. This is done via roles, i.e. the platform uses role-based access control.

Administrators of an organizational unit are free in the definition and assignment of roles and their rights, whereby a simple system of rights is initially implemented. This differentiates between read, write and ownership rights. The latter grants full access to individual resources within the platform. The system is

technically expandable and can be equipped with specific authorizations on module level via a customer-specific requirement.

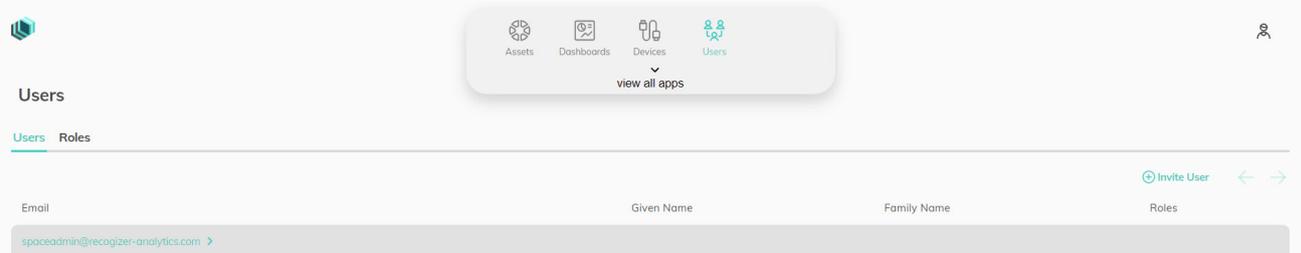


FIGURE: 4 User Manager of the IoT platform with freely configurable users and roles

4. Dashboard Manager

IN A NUTSHELL: The Dashboard Manager enables the visualization of data recorded in the platform. For this purpose, Dashboard Templates are created to present the data via a selection of visualization types and layouts.

FURTHER INFORMATION: A grouping element can be selected for each template, which supports the automatic creation of dashboards. For example, dashboards can be automatically generated per machine or per location. The following visualization types are currently available as standard:

- Line Chart (display of time series as line chart)
- Bar Chart (bar chart)
- Pie Chart (cake chart)
- Gauge Chart (speedometer diagram)

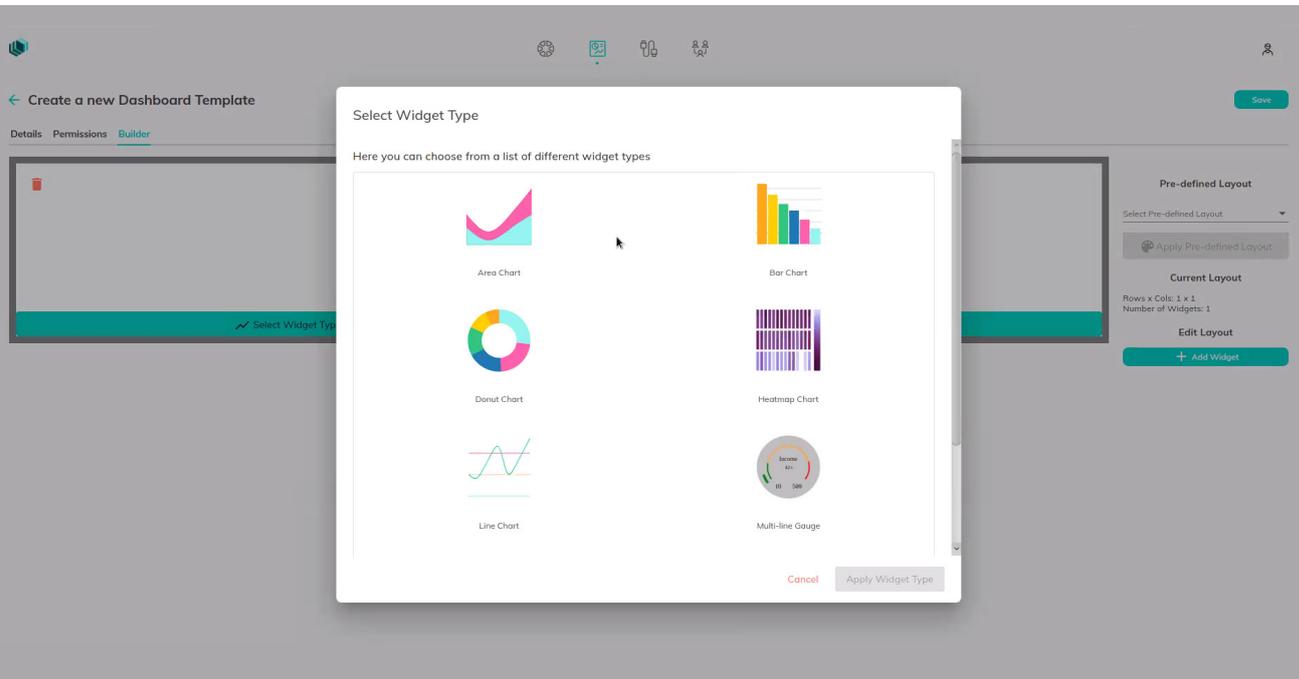


FIGURE 5 Example Dashboard for visualization of transferred data with a wide range of widgets

The placement of the data is done directly in the browser: Visualization elements from predefined layouts are set with a variable number of rows and columns. The template can be saved. The platform will then independently apply it to future objects of the selected grouping element. As a result, the newly created dashboards are immediately available.



FIGURE: 6 Dashboard Template Builder for designing and arranging dashboards and widgets

5. KPIs and Alarms

IN A NUTSHELL: The KPI Manager allows you to create calculations with any existing data points or parameters such as temperature data. You can create your own functions to perform intelligent analyses such as automatically calculating an average temperature.

FURTHER INFORMATION: For the creation of functions „built-in“ computational elements can be used and custom-made computational elements can be implemented on request. In addition, the graphicx.io IoT platform supports the possibility of implementing individual calculation algorithms for engineers and data scientists by providing an API.

Furthermore, rules and triggers for alarms can be configured and linked to the integrated ticket system. This will inform you about the triggering of an alarm in the fastest way via ticket and e-mail. Tickets can also be created manually if required. For a structured working method, tickets can be provided with different processing stages, descriptions, urgencies and responsible persons.

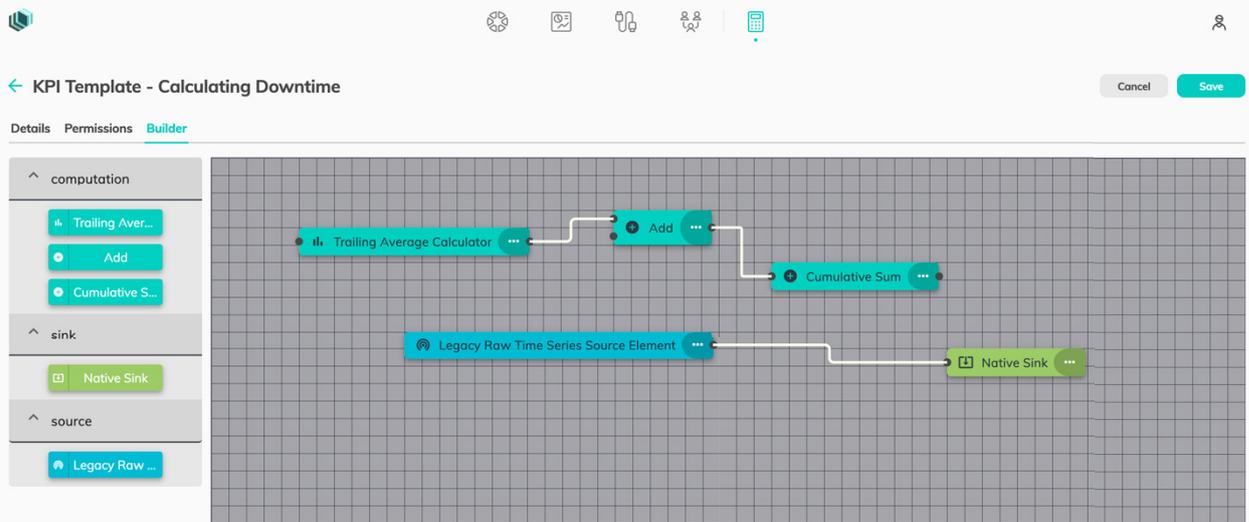


FIGURE: 7 View of the KPI Manager's Template Builder with flexible mathematical elements

6. Report Manager

IN A NUTSHELL: Similar to the Dashboard Manager, the Report Manager also allows for the creation of templates for the presentation of data. The functional difference is the generation of documents is based on configurable templates. These are generated by the platform at regular intervals and are then available to the users of the platform. This feature allows monitoring and benchmarking of data over previously configured time periods.

FURTHER INFORMATION: The documents are generated as PDF files and can be viewed and downloaded on the platform. At the same time, the platform operator can configure a maximum lifetime for the documents, after which they automatically expire and are thus deleted.

Additionally, it is possible to store complex document templates for the report documents. However, this function is not directly available to the user in the browser, but as a service request via the platform operator.

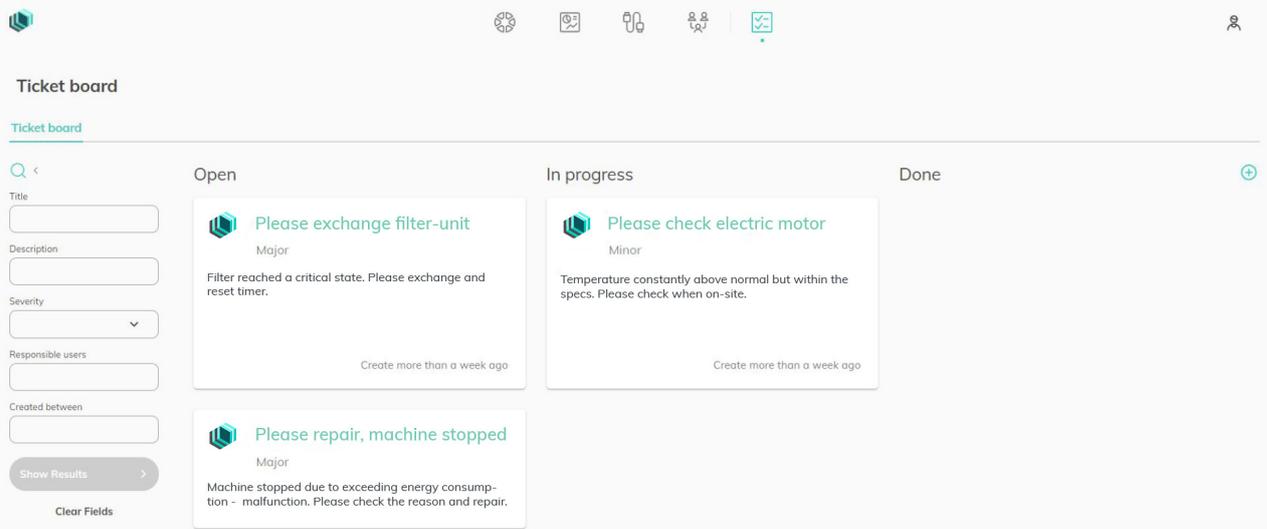


FIGURE: 8 View of the ticket board with tickets including attributes and their processing stages

7. Industrial Health Scoring

IN A NUTSHELL: The Industrial Health Scoring is a specific AI-powered dashboard tailor-made for industrial applications and processes. It shows the state of your entire operations at one glance and on different levels of aggregation. This enables Engineers and service personnel to easily detect anomalies and drill-down to the root cause as needed. This also supports an initial diagnosis of failures.

FURTHER INFORMATION: The IHS offers the following levels of aggregation: All sites overview, plant view, component view and sensor view. The overview of all your sites is shown as a “battery diagram” with an aggregated Health Score derived from all allocated plants. It is color-coded as follows:

- 95% +: green
- 90-95%: amber
- Below 90%: red

Additionally, all-plants will be displayed as gauges using the same color-coding. The health-score is derived on sensor-level based on our Machine Learning anomaly detection module. It takes into account the data history of each sensor and all sensors in a context and is statistically aggregated to higher levels (i.e. from sensor to component, from component to plant and from plant to overview). On sensor level, you can also view the data history of that sensor as a time-series diagram.

In order to gain access to IHS, you need to do the following: Please contact our sales engineer, who will guide you through the IHS building process with the following minimum requirements:

- A** Gap-free data history in graphicx.io of 2 month or more with a minimal measuring interval of 15 minutes. If you have strong seasonal exposure of your process (e.g. significant temperature differences between summer and winter), this period may be prolonged accordingly
- B** Selection of data points relevant to you (sensors, actuators, exogeneous factors, etc.)
- C** The structural context of these data points (i.e. which sensor belongs to which plant)
- D** Optional: The relative relevance of a sensor in the context of your entire operations



FIGURE: 9 View of the Industrial Health Scoring in graphicx.io



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